Essays on Individual and Institutional Willingness to Take Risks

Cumulative Dissertation

Submitted to the
Faculty of Business Administration
of the University of Hamburg

in partial fulfillment of the requirements for the degree of
Doctor rerum oeconomicarum

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February 13, 2019

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Date of Disputation: June 17th, 2019

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Chapter 1

General Introduction

1.1 Object of Study

Starting with the work of Jensen and Meckling (1976), the question how risk preferences of agents (i.e, managers) can be aligned with the risk appetite of principals (i.e., equity providers) has become an important question in economic research.

The welfare losses incurred by excessive risk taking in the financial industry before the financial crisis are hard to quantify in accordance with scientific and economic principles. Nevertheless, this event has once again drawn the attention of research and politics to one of the underlying reasons, the *principal agent dilemma*.

The common theme of this thesis, which consists of three essays, is individual decision making under risk and uncertainty.[1]

All essays address a major legal and economic problem: What kind of regulation is needed in order to neither provide incentives for excessive risk taking nor for absolute risk avoidance? I provide analytical and empirical evidence for both extremes and its effects on risk taking. In doing so, I focus on the risk preferences and choice behavior of managers working for two different kinds of institutions that, as major investors, both have significant influence on economic welfare: financial institutions and non-profit foundations.

In order to develop regulatory frameworks for risk taking in sensitive areas such as the financial industry, one has to understand the mechanisms of individual decision making under risk.

Neoclassical theory, i.e., Expected Utility Theory (EUT), suggests that the willingness to take risks is determined by an individual degree of risk aversion and probability-weighted potential outcomes (Von Neumann and Morgenstern (1947)). However, there is evidence that individuals tend to adapt their risk preferences to a (desirable) reference point. In this context, losses loom larger than equal-sized gains, which implies that agents will take more risk when they fall short of this kind of behavioral anchor and perceive less additional utility once they have exceeded their reference point. This behavioral pattern was first described by Allais (1953). Kahneman and Tversky (1979) and Tversky and Kahneman (1992) (KT) provide a model of reference-dependent preferences which can formalize this phenomenon: Prospect Theory (PT).

[1] *Risk* is characterized by a given set of potential, more or less preferred outcomes plus the availability of corresponding outcome probabilities. Whereas, situations in which a decision maker has an incomplete set of potential outcomes and/or no objectively estimable probabilities, can be described as *uncertainty* (Knight (1921)).

How to determine someone's reference point is still a key question in PT. For KT, the status quo is a candidate for the reference point. Motivated by the findings of Camerer et al. (1997) that the labor supply of New York Cab drivers is determined by an individual (daily) income target, Kőszegi and Rabin (2006) suggest that expectations can determine the reference point. Abeler et al. (2011) conduct a laboratory experiment and provide evidence in favor of this hypothesis. In my first essay (Chapter 2), I aim to transfer this finding from labor supply to risk taking. The result presented in this essay is important, because as far as there is no validated concept, reference-dependent models still have the drawback of an additional degree of freedom. This implies less predictive power than standard EUT-models. Chapter 3 studies whether regulatory constraints on executive compensation schemes in the aftermath of the financial crisis (i.e., bonus caps) have an effect on risk taking. In doing so, I transfer my results of Chapter 2 in order to examine the initial question: How can risk preferences of principals and agents be aligned?

The first two essays (Chapter 2 and 3) present empirical analyses of experiments. This method provides a maximum degree of control. Experiments also allow for causal interpretations since effects (i.e., treatments) can be assigned exogenously. Chapter 4 studies risk taking of German foundation managers by means of empirical and stochastic analyses. Whereas the possible failure of financial institutions and its economic costs due to excessive risk taking of managers is in the focus of public attention (e.g., Reinhart and Rogoff (2009)), German foundations and their influence on economic welfare have so far not been subject to similar investigations so far. As I will show, this sector is, similar to the financial industry, also highly regulated. Therefore, the underlying research question, in comparison with Chapter 3, is the same: What is the effect of legal constraints on individual risk taking?

Table 1.1 illustrates the topics of all three essays.

Table 1.1: Titles and Topics of Essays

Chapter	Title – Author(s)	Topic
2	*Risk Taking and Induced Reference Points* – Roger Gothmann and Markus Nöth	Identification of Mechanisms of Reference-Dependent Preferences under Risk
3	*Risk Taking and Compensation* – Roger Gothmann	Effects of the Remuneration Structure of Executives on Individual Willingness to Take Risks
4	*Asset Management of German Foundations* – Roger Gothmann	Asset Management under Regulatory Restrictions for German Non-Profit Foundations

Notes: List of essays according to §6 (2) Promotionsordnung 2010, for a detailed overview of personal contributions (§6 (3) Promotionsordnung 2010) see the General Appendix.

1.2 Overview and Summary of Chapters

This dissertation consists of three independent chapters. All chapters discuss individual risk taking in different areas and can be read independently of each other.

Expectations and the Willingness to Take Risks (Chapter 2)

In Chapter 2 we test whether expectations can influence individual willingness to take risks and to what extent. Reference-dependent preferences predict that individuals evaluate *changes* in income compared to a reference point whereas EUT takes the level of income as benchmark.

The theory of reference-dependent preferences (RDP) was initially established in economics by KT. However, the key question is still open: What determines the reference point? Without a sound theory, RDPs have an inherent additional degree of freedom. For their studies, Kahneman and Tversky (1979) work with the status quo. In a subordinate clause of their last section, KT suggest that expectations could also be a candidate for the reference point. Kőszegi and Rabin (2006) adopt this idea. By doing so, the authors are able to explain the Cab-Driver-Puzzle mentioned before.

The following example illustrates the difference between status quo and expectations:

A cash bonus of 50,000 euros at the end of the year is a gain in comparison to the status quo. However, it can be perceived as a loss if the expected bonus was 100,000 euros.

Abeler et al. (2011) are the first to investigate this hypothesis, using an experiment, and to find confirming evidence. Their main result is that individuals who expect to earn more than a control group, work, on average, more than this group. The authors argue that, with a reference point determined by expectations, subjects work more in order to avoid disappointment by *closing the gap* between expected and actual earnings, which is the definition of loss aversion as the fundamental mechanism of RDP.

In this chapter, we take up the issue raised by Abeler et al. (2011) that the mechanism how expectations affect reference point formation requires further research. In particular two strands of literature about reference point formation suggest different candidates: the highest outcome (e.g., Gul (1991)) or a weighted average (e.g., Quiggin (1982)).

To the best of our knowledge, we are the first to transfer the experimental design of Abeler et al. (2011) from the field of labor economics (i.e., the provision of effort) to the topic of risk taking. By means of an online experiment, we test the hypothesis that potential outcomes of different options are ranked in relation to the best (e.g., highest) outcome as suggested, for instance, by Gul (1991).

For this purpose, we use a well-established measure for individual risk preferences as suggested by Holt and Laury (2002) (HL-lotteries) in the first task of our experiment in order to measure mere risk preferences. Subjects have to choose between a low-risk lottery, Option A, and a high-risk lottery, Option B, in a series of ten decision tasks. For each task, the possible outcomes of the lotteries are fixed and identical. Only the probability weights change from task to task, starting with a weight of 0.1 on the higher outcomes of A (2.0) and B (3.85) and ending with a weight of 1 in the tenth stage. The lower outcomes of A and B are 1.6 and 0.1. Thus, a risk-neutral decision maker would start choosing Option A (low risk) for the first four stages and switch to Option B (high risk) in the fifth stage when the expected value for Option B is greater than the expected value for Option A from this stage on. In a second task, subjects have to play the HL-lotteries again. They receive the outcome of the chosen option only with 50 percent probability. With 50 percent probability they receive a fixed amount of 3.5. EUT, and RDP with the status quo as reference point would predict no different risk taking behavior.

In addition, we estimate different RDP-models by running Maximum-Likelihood-

Estimations on the data in order to answer the question: Is the highest outcome a possible reference point?

The main findings of our study are as follows: First, we find a significant effect between both tasks. Individuals switch one stage later from Option A to Option B when they have the additional chance to receive a higher outcome - the fixed amount. This means that, according to the scale suggested by Holt and Laury (2002), subjects switch from being slightly risk averse to being risk neutral. Second, our Maximum-Likelihood estimations provide evidence for the hypothesis that individuals rank potential outcomes in relation to the highest outcome in a risk taking framework.

Regarding the design of compensation schemes in the financial sector, our findings are relevant for the debate how to avoid providing incentives for excessive risk taking.

Risk Taking and Regulation (Chapter 3)

Chapter 3 focuses on the regulation of payment schemes in the financial sector. Managers of financial institutions had partially taken excessive risks before the financial crisis due to misdirected compensation schemes, which led to huge welfare losses (e.g., Bebchuk and Fried (2009)).

In this chapter, I study the effect of capped bonus payments for certain groups of financial managers (i.e., *identified staff*[2]) to a maximum of 200 percent of their fixed salary. This constraint was introduced by the European Union[3] in the aftermath of the financial crisis. I empirically analyze the effect of this event on the compensation structure of European banks. As I am able to show, these institutions increase the fixed salary of their managers. Chapter 3 focuses on this regulatory arbitrage. In line with this finding, I use an experiment to analyze this empirical shift in fixed and variable components of managerial remuneration.

In recent years, a growing body of literature has shown that an optimal CEO compensation should take behavioral aspects and in particular loss aversion into account (e.g., Dittmann et al. (2010)). Cole et al. (2015) show in a field experiment with commercial bank loan officers that monetary incentives such as performance-oriented payments can bias the assessment of credit risks. However, there is still limited knowledge about the

[2]Definition: Group of managers who have a profound influence on an institute's risk profile (Directive 2013/36/EU).

[3]Directive 2013/36/EU

influence of short-term variable bonus payments on individual willingness to take risks.

I conduct an online experiment in order to examine the effect of the ratio of short-term bonus payments to fixed salary. Individuals have to decide between a constantly low variance lottery (Option A) and a constantly high variance lottery (Option B) for each stage of a setup of 20 decisions tasks. The only variable parameter for all tasks is a fixed amount (*fixed salary*) which is the same for every stage of Option A and Option B and which increases from 6 euros to 25 euros in steps of one euro in order to study whether an increasing ratio of fixed versus variable compensation has an influence on risk taking. Both options have the same expected value for each stage. Option B has a considerable higher variance than Option A. Thus, risk (excessive) taking is defined as switching from Option A to Option B.

Here is what the data tells us: Given a certain amount of *total* compensation, a higher fixed salary can lead to increased (i.e., excessive) risk taking. This behavior can not be explained by EUT. RDP with a reference point in the highest potential outcome, as I show in Chapter 2, can provide an explanation: An increased fixed salary can induce a change of the ranks of potential outcomes. This change of ranks can make the potential outcomes of the higher variance lottery more desirable.

My main finding is that people tend to take on higher risks when the proportion of their fixed salary is higher. Aspects, such as reference dependent preferences should be taken into account. A solution to this problem could be a more heuristical approach by the legislator as suggested, for instance, by Admati and Hellwig (2014) or Neth et al. (2014), by *"fixing banker's pay"* which would not allow much leeway for regulatory arbitrage.

Asset Management of German Foundations (Chapter 4)

'*A man should always place his money, one-third into land, a third into merchandise and keep a third in hand*' (Babylonian Talmud[4])

In Chapter 4 of this thesis, I analyze investment decisions of German non-profit foundation managers who are faced with the following trade-off: the permanent preservation

[4]See, for instance, Mayer (1963).

of the foundation's pool of assets (in real terms) and the generation of sufficient returns in order to fulfill the foundation's goals. I address the following questions: What is the legal (i.e., regulatory) and financial framework for the asset management of German foundations? Given this institutional framework, what are suitable asset management strategies? Compared to an empirical benchmark, are there any welfare losses caused by the investment behavior of German foundation managers?

To the best of my knowledge, this study is the first that combines an analysis of German foundation law with a study of asset management strategies. By doing so, I extend the literature on asset management for German foundations which, so far, largely consists of the work of Schröder (2010).

Therefore, I define a legal framework based on the relevant regulatory restrictions of the German foundation law. By means of stochastic simulations, I specify and test different asset management strategies that comply with the legal framework. This part of my third essay is based on several studies of asset management strategies which provide evidence that highly sophisticated portfolio optimization strategies with a focus on short-term efficiency are inferior to simple (but robust) heuristics (e.g., DeMiguel et al. (2009), Jacobs et al. (2014)).[5]

For this purpose, I compare empirical asset allocations of German foundations, which mainly consist of 80 - 90 percent European bonds and 10 - 20 percent European stocks with (inter alia) GDP-weighted asset allocations as suggested by Jacobs et al. (2014) by means of Monte-Carlo-simulations. As a main result, I am able to show show that this heuristic can provide superior results: The probability of preserving the pool of assets in real terms increases significantly in contrast to decreasing risk measures. By doing so, I can also quantify welfare losses of empiric asset allocations of German foundations due to regulatory rules, that sanction a wide range of risk taking.

Regarding the regulation of German foundations, I provide insights in the correlation of regulatory framework and risk taking. Exaggerated *risk awareness* of German foundation managers, induced by a biased jurisdiction which solely sanctions downside risks, can lead to welfare losses. For this reason, I suggest to simplify the regulatory framework.

The trade-off mentioned above is currently captured by regulatory rules that require the preservation of assets. In addition, a foundation manager has to spend two-thirds of

[5] A prominent representative of these heuristics is the $\frac{1}{N}$-rule which had already been mentioned in the Talmud centuries ago.

current yields. Given these rules, one can explain empirical asset allocations that are on average dominated by highly rated government and corporate bonds. This contradicts the basic purpose of a (German) non-profit foundation: the support of the community by means of profits, earned by the foundation's assets. A simple law (i.e., heuristic), such as the 5-percent-rule in the US, which would require German foundations to spend a fixed rate of their funds per year might be able solve the trade-off between preservation and the requirement of generating earnings.

1.3 Summary

In Chapter 2 of my thesis, we are able to show that expectations can have a significant influence on individual risk taking. As pointed out at the beginning of this chapter, individual decisions on risk taking can have a (huge) impact on the economic welfare. Hence, regulatory authorities around the world try to restrict or control risk taking by means of an increasing number of laws.

In Chapter 3 and 4, I provide evidence that legal constraints can induce different behaviors: excessive risk taking and (absolute) risk avoidance. Both manifestations can lead to welfare losses which I can quantify for the asset management of German foundations (Chapter 4). It will be difficult to develop a regulatory framework that provides solutions for all these challenges. As discussed in Chapter 2 and 3, individual risk taking is a complex process with different determinants. As we are able to show, expectations are a main driver for individual willingness to take risk. However, whereas expectations can be controlled in a laboratory or online experiment, it is unfeasible to take a wide range of possible external influences in the field into account. One has to emphasize that the interaction in financial markets is not only characterized by risk, but also by uncertainty. A theory claiming to provide a perfect solution for such a complex and *chaotic* system can not valid in a worst-case scenario, as Makridakis and Taleb (2009) show. Therefore, economic research should not solely focus on institutions and models that perfectly match specific problems under certain assumptions. This approach was one of the catalysts for the last financial crisis (e.g., Neth et al. (2014)), when highly complex and concentrated risk models did not work any longer due to improbable events that had still occurred and whose effects could not be quantified correctly ex-ante.

In summary, both groups of decision makers that I analyze for my thesis (bank managers,

foundation managers) illustrate a major challenge (i.e., trade-off) for regulatory authorities because they are representative for both sides of the same coin. Legislation has to establish legal frameworks that do not provide incentives for risk taking in either extremes, i.e., excessive risk taking or exaggerated risk avoidance. In addition, there is evidence that expectations can determine individual risk taking. Given complex legal rules, these expectations can almost to be anticipated by the legislator.

For this reason, I compare highly sophisticated decision models with simple heuristics in the last chapter of my thesis. Heuristics are decision rules which have partially developed over centuries (Tversky and Kahneman (1974)) such as the $\frac{1}{N}$-rule as a simple diversification-method. My findings are in line with a current strand of literature, emphasizing that the complexity of a problem and the complexity of its solution must be not correlated.[6] In this sense, Admati and Hellwig (2014) suggest the application of simple, but restrictive heuristics (e.g., a universal equity-ratio for the regulation of the financial industry). One of their arguments is that, due to regulatory arbitrage, complex and specialized models required by the regulatory authorities can be undermined by more complex and more specialized risk models of the financial industry.

Thus, simple but robust heuristics can reduce a biased perception of risk, as in the case of German foundations, or regulatory arbitrage by the financial sector because they do, per se, not provide much room for interpretation.

[6]See Neth et al. (2014) for a comprehensive overview.

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Chapter 2

Risk Taking and Induced Reference Points

with Markus Nöth

2.1 Introduction

Managerial compensation has provoked an extensive and widely noted field of economic research. Politics and the public have been attracting notice to the structure of executive compensation schemes since the beginning of the financial crisis. The disclosure of bonus agreements at financial institions which had gone bankrupt (e.g., Lehman Brothers Holding Inc.) or which had to be prevented from falling into bankruptcy (e.g., The Bear Stearns Companies, Inc.) due to excessive risk taking by the management has induced comprehensive recesses by the financial market regulators. These measures are supported by several empirical studies, which find evidence for a correlation of managerial risk taking and variable compensation components (i.e., bonus payments) (e.g., Fahlenbrach et al. (2012), Fahlenbrach and Stulz (2011), Bebchuk and Fried (2009)). The main reason identified by the political debate in the European Union was the absolute and relative amount of variable compensation (i.e., bonus payments). Thus, the EU enacted a directive in 2013[1] in order to cap bonus payments to 100 percent[2] of yearly fixed compensation. We build our study on the findings of Gothmann (2015). The author suggests that this current regulatory framework might induce additional (i.e., higher) risk taking. The objective of our study is to identify the determinants of *compensation scheme induced risk taking* (CSIRT). Thus, our motivation is to localize the mechanisms (i.e., economic models) of CSIRT?

An obvoius starting point (i.e., benchmark) is Expected Utility Theory (EUT) Bernoulli (1738). After the axiomatic foundation of this econmoic model for choices under risk by Von Neumann and Morgenstern (1947), two fundamental alternative theories of this benchmark have come into the focus of economic and psychological research; the first being loss aversion Kahneman and Tversky (1979)[3] and second, rank dependence Quiggin (1982).[4] According to Harrison and Rutström (2008), both constructs are two of three main drivers for individual willingness to take risks within risk taking models so far. This theory includes rank dependence as well as loss aversion, concentrated and formalized in the relation of the salience of each possible outcome of a lottery. The third determinant is

[1] Directive 2013/36/EU

[2] Higher caps up to 200 percent have to be authorized by the general meeting.

[3] Prospect Theory Kahneman and Tversky (1979) combines a wide range of biases and psychological findings. Nonetheless loss aversion, on its own, is one of the corner stones of this EUT-Alternative.

[4] The aspect of rank dependence is also implemented in Cumulative Prospect Theory Tversky and Kahneman (1992).

the individual degree of risk aversion. Loss aversion and reference dependence are based on a level of aspiration, respectively a reference point.[5]

All alternative theories mentioned are based on a focal point (i.e., reference point), wich is a cornerstone of the most relevant EUT-alternatives. Brandstätter et al. (2006) argue that focusing on a reference point (e.g., aspiration level) can help to reduce the complexity of a decision task. Recent studies which investigate the influence of induced reference points have analyzed the RP-effect on individual effort (e.g., Abeler et al. (2011)). The advancement of our study is the transfer and modification of these methods in order to to gain insights into the impact of induced expectations on individual risk taking. We use this approach because members of the higher management usually reveal a relatively high level of effort. Thus, the critical factor which determines bonus payments is the individual willingness to take risks.

Abeler et al. (2011) highlight the fact that there is still no established economic theory for the determinants of the reference point. Thus, all models including a reference point so far have an additional degree of freedom so far. There is an ongoing debate that expectations or aspirations might affect the reference point. The following example has been created to illustrate the intuition of this concept and to connect CSIRT and reference point theory: Imagine a financial equity trader, A. In addition to her fixed salary she receives a variable bonus at the end of the year. This bonus solely depends on her realized annual return. At the end of June, A receives a piece of confidential information: with probability of 0.5, she will receive a bonus which is 30 percent higher than she can expect based upon to her cumulated midterm returns so far. Should this information affect A's willingness to take risks? On the one hand, it is intuitive that the possibility of a higher than expected bonus has a positive impact on A's utility. On the other hand, A is also aware of the fact that she can still *lose* this higher expected bonus with probability of 0.5 if she does not increase her risks (returns). In this case, A would increase her risk taking in order to avoid disappointment. Bell (1985) and Gul (1991) formalized such behavior, which is known as Disappointment Aversion.

The idea that expectations might influence individual willingness to take risks is already suggested in the original Prospect Theory Kahneman and Tversky (1979). The psychological intuiton behind this idea is discussed in Frederick and Loewenstein (1999).

[5]There is recent work of Bordalo et al. (2012),the so-called Salience Theory which explicitly does not postulate a reference point.

The authors show that a prisoner's well-being can be negatively impaired if he is suggested that there is a small chance of being released earlier than expected.
The question of how expectations directly affect individual choice behavior has come into the focus of economic research again with the works of Köszegi and Rabin (KR) (2006, 2007). KR take up the idea that recent beliefs about future events determine the reference point. KR's studies are motivated by the findings of Camerer et al. (1997), who investigated the labor supply of New Cab drivers. They explained the phenomena found in their data that some drivers worked less when average hourly wages were high, with reference dependent preferences and a reference point which is determined by expectations (see also KR (2006) and Crawford and Meng (2011) for a detailed discussion).

Another empirical study about how reference points affect individual behavior is Ockenfels et al. (2014). The authors show that for managers of a multinational company an expected 100% percentage bonus can serve as a natural reference point. Falling behind this point affects subsequent performance and satisfaction. According to the main hypothesis of KR, Abeler et al. (2011) show experimentally that individuals are willing to supply more effort if expectations about possible total earnings are high. The authors suspect that this effect is driven by a reference point determined by expectations. In this sense, subjects feel a loss by providing less effort and thus receiving a lower total compensation than they expected. In order to avoid this subjective loss, they provide an effort up to this threshold, their postulated reference point.

Thus, the aim of our study is to transfer the experiment design from labor supply into a risk taking framework. Risk taking is a much more complex process than the supply of labor. An individual will provide effort as long as the resulting additional utility per unit is greater than the additional opportunity costs (e.g., more or less time for family). A risk taker is faced with a trade-off of desirable and non-desirable consequences and their probability distribution. As we will discuss in the following sections there are different models of risk taking which can provide different predictions due to varying mechanisms.

Our paper is divided into two parts. In the first part, we conduct an online experiment to investigate whether expectations can affect individual willingness to take risks. Our elicitation method for risk preferences is the Multiple Price List suggested by (HL). In the second part, we estimate several models for choices under risk via Maximum Likelihood (ML) in order to better understand the mechanisms behind the revealed behavior in the

experiment. There is one main challenge for our study: how to control for expectations (reference point) within an experimental setup. For this purpose we use a mechanism suggested by Abeler et al. (2011). The authors control the expectations of their subjects by offering only two possible outcomes with a probability of 50 percent each. Thus, subjects can easily calculate what they can expect to receive. In order to vary expectations, Abeler et al. alter the fixed amount. Following this idea, we implement the HL-lotteries into a compounded lottery (modified HL-lotteries) which has two (direct) possible outcomes with equal probability: a fixed amount and the outcome of the standard HL-lotteries. Subjects also have to play the standard HL-lotteries as a control task and measure for mere risk preferences. We find that subjects reveal a significantly higher willingness to take risks in the modified HL-lotteries which cannot be explained by EUT.

As main contribution, we provide experimental evidence that expectations can influence individual risk taking. A possible explanation is that expectations affect the attractiveness of risky prospects and thus have an impact on how individuals distort probabilities. We estimate several models for decisions under risk via Maximum Likelihood methods and find that the disappointment aversion model of Gul (1991) in the notion of Grant et al. (2001) can explain such behavior best. The difference between these models is the level of aspiration. Gul uses the certainty equivalent, while Grant et al. suggest the highest outcome, which is more plausible to us for a plain lottery environment.

2.2 Design

The aim of our experiment was to elicit individual willingness for taking risks under controlled expectations. We chose a Multiple Price List (MPL), which was first used by Miller et al. (1969) for the elicitation of individual risk attitudes. There is an extensive discussion of established elicitation methods in Harrison and Rutström (2008). We used the design suggested by Holt and Laury (2002).[6] In the HL design, subjects had to choose between a low-risk lottery, Option A, and a high-risk lottery, Option B, in a series of 10 decision tasks as presented in the upper lottery branch of Figure 2.1. For each stage, the possible outcomes of the lotteries were fixed and identical. Only the probability weights changed from task to task, starting with a weight of 0.1 on the higher outcomes of A (2.0)

[6]Since the experiment was conducted in Germany, we converted the origin possible outcome 1:1 from Dollar to Euro.

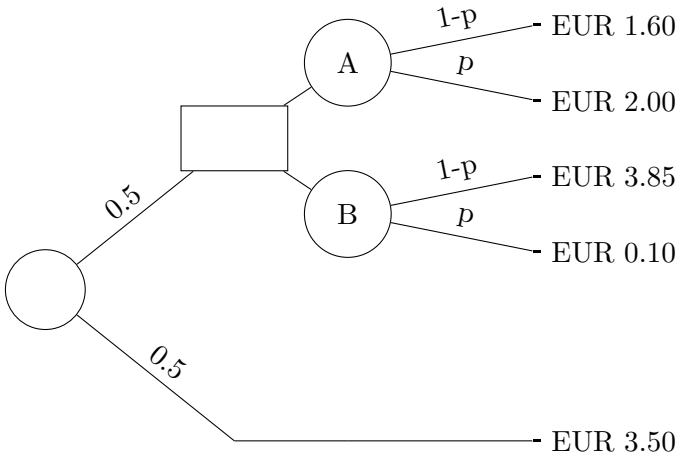
and B (3.85) and ending with 1 in the tenth stage (Table 2.1, Option A and Option B). A risk-neutral decision maker would start choosing Option A for the first four stages and switch to Option B in the fifth stage since the expected value for Option B is greater than the expected value for Option A from this stage on. Our experiment involved two main tasks. Prior to each task, subjects read the instructions and had to answer one control question which had to be answered correctly before the main task could be attended to. In the first task, subjects played modified HL-lotteries. These lotteries consisted of the HL-lotteries which we compounded with a certain gain (fixed amount) of €3.50 for each of the ten stages. Therefore, possible outcomes of this lottery were: a certain gain of €3.50 with fifty percent probability and the outcome of the HL-lotteries with the inverse probability of fifty percent. The only decision subjects had to make was to choose between Option A and Option B of the HL-lotteries for each of the ten stages. At the end of the experiment, the following chronological decisions were randomly chosen for payment: firstly, one of the ten stages was drawn and the result was simulated, secondly, the outcome of the lottery, fixed amount versus drawn lottery, was paid out. In the second main task subjects played the HL-lotteries without the fixed amount for each stage.[7] The payment for this task was determined similarly to the first task, except for the fact that there was no fixed amount.

As in Holt and Laury (2002), we define Option A as safe choice and Option B as risky alternative. By doing so, risk taking is defined as switching from Lottery A to Lottery B. Therefore, we can use the difference of chosen A-lotteries between both tasks as a measure for expectation-induced risk taking.

All subjects executed the first two main tasks in the same order starting with the modified HL-lotteries and followed by the standard HL-lotteries. According to EUT, a risk neutral decision-maker should choose 4 Options A followed by 6 Options B in both tasks. This is also the stage Holt and Laury base their classification of the degree of risk aversion on (see Table 2.2) (Holt and Laury (2002), p: 1649). Screenshots of the entire experiment are provided in Section A.1.2 of the Appendix.

[7] Thus, the second task was identical to the original HL-lotteries.

Figure 2.1: Modified HL-lotteries (MHL)



Notes: Subjects could only chose between Lottery A and Lottery B. At the end of the experiment, subjects either received the outcome of their chosen lottery (A or B) or the fixed amount with probability 0.5 each.

For both tasks and for each of the ten stages, we can now derive the rational expectations of our subjects by calculating the expected outcomes. Abeler et al. (2011) are the first who use, within a real-effort experiment, a simple compounded lottery to vary the expectations of their subjects (lottery-controlled-expectations). The payment of their subjects is the outcome of this lottery: with a probability of fifty percent, subjects receive a cumulated piece rate that they can earn for counting zeros out of tables with multitudinous numerals. The authors highlight the fact that the experimenter cannot know the actual expectations of his subjects within a lottery-controlled expectations design. However, their lottery has only two outcomes (cumulated earnings and fixed amount). Thus, expectations could well and easily be calculated.

In our experiment, we chose the fixed amount equal to €3.50 for two reasons: (1) it should not be within the range of possible outcomes of Lottery A in order to leave the ranking of the origin outcomes of Lottery A unaffected ($fixed\,amount > 2.0$) , and (2) it should be smaller than the highest potential outcome of Lottery B (< 3.85) due to the regulatory framework our experiment is based on (i.e., bonus cap of 100 percent of base salary). For neither of the tasks expected payoffs were provided. However, prior to each main, task subjects had to answer control questions in order to check for comprehension. We were aware of several problems this design could have induced. In particular, the fact

that we chose a within-design (all subjects took part in both tasks) could have induced an experimenter demand effect, in particular preferences for consistency Falk and Zimmermann (2011), especially as the both main tasks only differed in the fixed amount. This means subjects might felt induced to reveal a different preferences although an EUT-optimizer would had chosen the same amount of A and B options for both tasks. Therefore, we implemented a questionnaire as suggested in Cialdini et al. (1995) at the end of the experiment. Based on this questionnaire, we constructed a control variable which captures these kinds of preferences.

According to Huck and Weizsäcker (1999), the complexity of a lottery choice problem can lead subjects to deviate from maximizing expected values. The main findings of their experimental studies are: (1) subjects pay more attention to risk the less complex a lottery is, and (2) subjects reveal a higher willingness to deviate from maximizing expected values the greater the number of outcomes. As one can see in Figure 2.1 and Table 2.1, we presented the modified HL-lotteries in a manner that subjects would be aware of the fact that the fixed amount was equal for Lottery A and B and that their decision between A and B had no influence on the possibility of receiving the fixed amount.

Table 2.1: Modified HL-lotteries

safe option A			risky option B		
Fixed Amount	Low Variance Lottery p%	1-p%	Fixed Amount	High Variance Lottery p%	1-p%
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10
3.50	2.00	1.60	3.50	3.85	0.10

This table describes the modified HL-lotteries which were the first task of the experiment. Option A (the left-hand side of the respective MPL), denoted in CU. has a lower variance than Option B (the right-hand side of the respective MPL) for each stage. The probability p rises from 0.1 in the first stage to 1.00 in the tenth stage.

Table 2.2: Risk Aversion Classifications

Number of safe choices	Range of relative risk aversion for $U(x) = x^{1-r}/(1-r)$	Risk preference classification
0-1	$r < -0.95$	highly risk loving
2	$-0.95 < r < -0.49$	very risk loving
3	$-0.49 < r < -0.15$	risk loving
4	$-0.15 < r < 0.15$	risk neutral
5	$0.15 < r < 0.41$	slightly risk averse
6	$0.41 < r < 0.68$	risk averse
7	$0.68 < r < 0.97$	very risk averse
8	$0.97 < r < 1.37$	highly risk averse
9-10	$1.37 < r$	stay in bed

Notes: Classification of risk aversion according to Holt and Laury (2002), p: 1649

Table 2.2 depicts the classification of risk preferences given the utility function $U(x) = x^{1-r}/(1-r)$ suggested by HL.

2.2.1 Additional Measures

According to the literature personal traits as well as several demografic factors can be correlated with risk preferences.[8] For this reason we included a questionnaire in accordance to Caprara et al. (1993) for the eliciting of the BigFive Factor Model which includes the factors extraversion, agreeableness, conscientiousness, neuroticism, and openness. Nicholson et al. (2005) found a BigFive Pattern for risk propensity in their experimental study.[9] In addition, we collected information about personal characteristics such as age, gender, line of studies, and asked for a self-assessment of financial and statistical knowledge.[10] Financial literacy was measured by a questionnaire suggested by Lusardi and Mitchelli (2007) and Van Rooij et al. (2011) with a slight modification made by Nöth and Puhan (2009).

[8] See Dohmen et al. (2011) for an extensive summary.

[9] Evidence in their data suggests that high extraversion and openess emerge with a higher willingness to take risks.

[10] On a scale from 0 to 10.

2.2.2 Execution

We used ORSEE Greiner (2004) to recruit 157 subjects (71 females, 83 males) from the University of Hamburg without any restrictions. Individuals were aged between 19 and 37.[11] The experiment was computerized via LIMESURVEY[12] and took 30 minutes on average to complete. 15 subjects, randomly selected, earned €62.78 on average from all tasks.

2.3 Theories and Predictions

According to the common working models for choices under risk, Harrison and Rutström (2008) highlight that choices over lotteries are generally determined by one to three parameters: the degree of risk aversion, the degree of loss aversion and the degree of probability weighting. Therefore, models of decision under risk are only distinguished in the focusing of one or more of these parameters. We discuss several well-established models of decisions under risk in the following subsections. In the second part of Section 2.4, we estimate these models via Maximum Likelihood Methods on our data in order to reveal the mechanism and motivation behind expectation-induced risk taking.

The choice variable for every model we discuss is the stage in which subjects are indifferent between choosing Lottery A or Lottery B. This stage is represented by the probability p^* on the first outcomes of Lottery A $(2.0, 1.6, p)$ and Lottery B $(3.85, 0.1, p)$. Therefore, p is 1/10 for the first stage and 10/10 for the tenth stage. Thus, the higher the value for p, the higher the stage in which a subject decides to switch from Lottery A to Lottery B.

$$p^*1.6 + (1 - p^*)2.0 \leq p^*3.85 + (1 - p^*)0.1 \tag{2.1}$$

2.3.1 Expected Utility Theory

Our starting point is a risk-neutral Von-Neumann-Morgenstern rational decision maker who would start by choosing Lottery A and switch to Lottery B in the fifth stage for $p^* = 0.5$.

[11] The 90 percent percentile was 28 years. We excluded all subjects > 30 years for our statistical analysis (see section results).

[12] www.limesurvey.com

$$p^*1.6 + (1 - p^*)2.0 \leq p^*3.85 + (1 - p^*)0.1 \tag{2.2}$$

$$p^* \leq \frac{1.9}{3.35} < 0.6 \tag{2.3}$$

If we include risk aversion via a utility function $u(x)$ with constant relative risk aversion (CRRA), the switching point is determined by the degree of risk aversion r.

$$u(x) = \frac{x^{1-r}}{1-r} \tag{2.4}$$

$$EU_A(p^*) \leq EU_B(p^*) \tag{2.5}$$

$$p^*(r) \leq \frac{u(0.1) - u(1.6)}{u(2) - u(3.85) - u(1.6) + u(0.1)} \tag{2.6}$$

Based upon the classification of Holt and Laury (2002) (Table 2.2), a risk-averse decision maker would choose Lottery A five times or more. According to the independence axiom Von Neumann and Morgenstern (1947), the fixed amount of 3.5 should have no influence on his decision since it occurs with probability of 0.5 for both tasks: if $A \succeq B$, then $\frac{1}{2}3.5 + \frac{1}{2}A \succeq \frac{1}{2}3.5 + \frac{1}{2}B$. Thus, we convert the Allais-Paradoxon into a gradual form. Within the EUT-framework, different risk taking behavior between both lottery tasks of our setup (Holt Laury vs. modified Holt Laury) can only be explained with a change in the degree of risk aversion (r). Since the fixed amount lies within the range of possible lottery outcomes, EUT cannot provide an explanation for different choice-behavior independently from the form of the utility function.

Prediction EUT: An EUT-maximizer would choose the same number of A-lotteries for the standard and the modified HL-lotteries.

2.3.2 Expected Utility Alternatives

Alternatives to EUT number into double figures up to now (e.g., Starmer (2000), Fehr-Duda and Epper (2012)). Thus, the question is how to select a tractable number of models for our study. Fehr-Duda and Epper (2012) suggest deriving some working models for choices

under risk by three requirements: (1) basic properties such as completeness, transitivity, continuity, and monotonicity; (2) first-order risk aversion; and (3) probability distortion. The latter requirements are due to empirical validity. Thereby, the authors distill two main models: (1) rank-dependence models (e.g., Quiggin (1982), Tversky and Kahneman (1992)) and (2) disappointment aversion (Gul (1991)). We also take into account Salience Theory (ST) Bordalo et al. (2012), since this theory combines rank-dependence and a kind of disappointment aversion.

Rank Dependence Models

According to Fehr-Duda and Epper (2012), rank-dependence models can be divided into Cumulative Prospect Theory (CPT) (Tversky and Kahneman (1992)) and rank dependent utility (RDU) (Quiggin (1982)).

Cumulative Prospect Theory

Based on the assumption that the fixed amount works as a reference point, the loss in the sense of Kahneman and Tversky (1979) a decision maker perceives does not affect risk taking behavior, which she would reveal for the (standard) HL-lotteries.

$$U(x_i) = EV(x_i) + \begin{cases} EV(x_i) - rp;\ EV(x_i) - r > 0 \\ \lambda(EV(x_i) - rp); else \end{cases}, i = A, B \tag{2.7}$$

For any loss aversion parameter $\lambda \geq 0.48$[13], Option B provides a bigger loss (L_B)

$$L_{Bj} = (1-p)(3.85-3.5)+p\lambda(0.1-3.5) \geq L_{Aj} = (1-p)\lambda(2-3.5)+p\lambda(1.6-3.5)^{14} \tag{2.8}$$

than the loss a subject perceives from Option A (L_A) in the first four stages. Thus, a loss-averse decision maker would switch from Option A to Option B in the fifth stage or later.

CPT has the same implications as the rank dependence model utility (RDU) of Quiggin (1982) for the case that loss aversion is of no relevance. The second driver for choice

[13] A loss aversion parameter ≤ 1 implies loss seeking behavior.

[14] A decision maker who follows (origin) Prospect Theory would not take the fixed amount into account (as part of a compounded lottery) since common consequences are assumened to be canceled out in the editing phase.

behavior in the CPT framework is rank-dependent probability weighting as suggested by Quiggin (1982). Thus, the CPT model has the same implications as the RDU-model we will focus on in the following.

Rank Dependent Utility

The intuition behind RDU in the sense of Quiggin (1982) is that possible outcomes of a lottery are firstly ranked by the level of aspiration.[15][16] Afterwards, the probabilities are replaced through decision weights, which are defined as in Equation 2.11. There are two differences to standard probability weighting: (1) small probabilities are only overweighted if a low rank is attached to the corresponding outcome, (2) a violation of first-order stochastic dominance cannot occur, since decision weights are derived from the entire distribution of probabilities.[17]

$$V(P) = \sum_{i=1}^{n} \pi_i u(x_i) \tag{2.9}$$

$$\pi_i = \begin{cases} w(p_1) & \text{for } i = 1 \\ w(\sum_{k=1}^{i} p_k) - w(\sum_{k=1}^{i-1} p_k) & \text{for } 2 \leq i \leq n \end{cases} \tag{2.10}$$

There are numerous specifications of the probability weighting function (Harrison and Rutström (2008) for a detailed discussion). We chose the weighting function suggested by Karmarkar (1979) since this functional form ensures that there is no interdependence of the weighting parameter γ and the degree of risk aversion r. By doing this, we can differentiate between a shift in probability distortion and a variation in the degree of risk aversion.

$$w(p) = \frac{p^\gamma}{p^\gamma + (1-p)^\gamma} \tag{2.11}$$

[15] In this context, the *salience* of an outcome is often synonymically used. As we will discuss, there is a difference between salience in the sense of Bordalo et al. (2012) and salience in the meaning of: outstanding, unique, etc.

[16] Kőszegi and Rabin (2006) revisit RDU and extend this model with a so called *personal equilibrium*.

[17] This is the main innovation of Cumulative Prospect Therory (Tversky and Kahneman (1992)) in comparison to Prospect Theory (Kahneman and Tversky (1979)).

Disappointment Aversion

The basic idea of disappointment aversion (DA) (Bell (1985), Loomes and Sugden (1986) and Gul (1991)) is that a DA-maximizer perceives the potential outcomes of a lottery as either disappointing or aspired. Thus, all outcomes are evaluated in relation to a disappointment-threshold. Fehr-Duda and Epper (2012) show that DA-theory is a special of rank dependent theory with only two ranks for (1) aspired outcomes, and (2) disappointing outcomes. There are different notions of disappointment aversion (i.e., Grant et al. (2001) and Routledge and Zin (2010) for an overview). The main difference is the definition of the disappointment-threshold. Whereas Bell (1985) suggests the expected value as a candidate, Gul (1991) applies the certainty equivalent (CA). We employ the model of Grant and Kajii (1998). The authors suggest that disappointment/elation is perceived in relation to the best outcome of a lottery. Since we want to investigate the effect of achievable but unrealistic outcomes, we use this notion for further analyses.

$$V(P) = \int_x u(x) d[F_P(x)^\gamma] \tag{2.12}$$

F_P is a cumulative distribution function as in Equation 2.9. The additional utility of outcome x_i which occurs with probability p_i to the overall utility $V(P)$ of a lottery is

$$v(p_i) = [(p_i + q_i)^\gamma - q_i^\gamma] u(x_i), \tag{2.13}$$

where q_i is the probability that the lottery yields an outcome worse than x_i. As can be easily shown, a subject is disappoint-averse if (and only if) $\gamma < 1$. For the case $\gamma = 1$, the DA-model converts to EUT.

Salience Theory

Bordalo et al. (2012) suggest a model (ST - Salience Theory) for decisions under risk which is driven by the idea that probabilities are more distorted the more salient an outcome is. So far, this is common to the rank dependence models we discussed before. The main difference lies in the definition of a context-dependent salience (σ) for all possible outcomes x_i

$$\sigma(x_S^i, x_S^{-i}) = \frac{\mid x_S^i - x_S^{-i} \mid}{\mid x_S^i \mid + \mid x_S^{-i} \mid} \tag{2.14}$$

S is the state (context) for which an outcome is assessed. Applied to the standard HL-lotteries, a decision maker following ST would identify four states:

$$S_1(1.6, 3.85),\ S_2(1.6, 0.1),\ S_3(2.0, 3.85),\ S_4(2.0, 0.1).$$

The modified HL-lotteries provide eight states, due to the comparison of every lottery outcome with the fixed amount:

$$S_1(1.6, 3.85),\ S_2(1.6, 0.1),\ S_3(2.0, 3.85),\ S_4(2.0, 0.1)$$
$$S_5(3.5, 3.85),\ S_6(3.5, 0.1),\ S_7(3.5, 1.6),\ S_8(3.5, 2.0).$$

For our design, this means that each possible outcome of Lottery A is valued in the context of every possible outcome of Lottery B and vice versa. Bordalo et al. (2012) highlight the fact that contrary to origin PT, outcomes are not over- or underweighted if they are high or low. These outcomes are only overweighted if they are salient. ST would predict a decrease in risk taking. This effect is due to the fact that S_6 is the most salient state and subjects become more aware of the risk of Option B.

2.4 Results

According to Holt and Laury (2002), we define the A-lotteries for both main tasks as safe choices in contrast to the high variance B-lotteries. Thus, risk taking is defined as switching from Lottery A to Lottery B. We use the difference of chosen A-lotteries between both tasks as measure for expectation-induced risk taking.

2.4.1 Descriptive Results

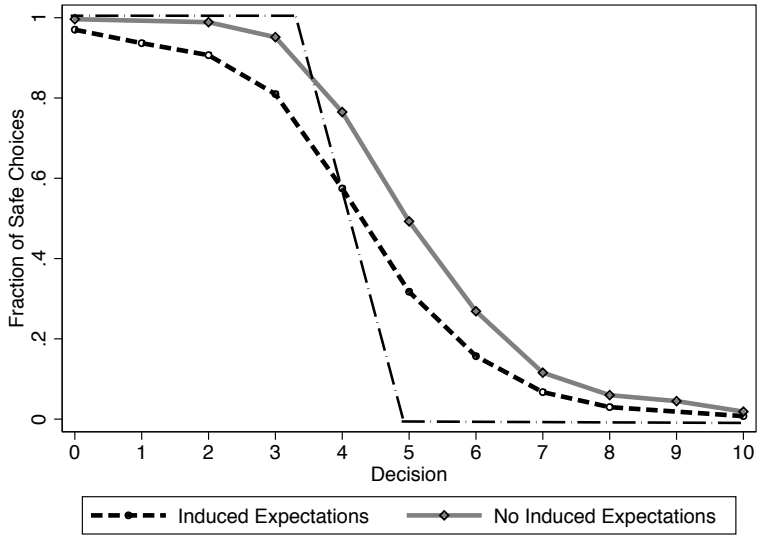
As a first step, we only pay attention to subjects who only switched once, from Option A to Option B. Thus, we exclude 23 subjects (a portion of 14.6 percent) from the further analysis since they switched back from Option B to Option A (multiple switchers).[18] As shown in Figure 2.1, risk taking is higher for the modified HL-lotteries (MHL) than for the HL-lotteries. The straight dash-dot-line represents an expected value maximizer (risk

[18]This phenomena is common for Multiple Price Lists. HL report a portion of 13.2 percent of multiple switchers.

neutrality). The cumulative proportion of chosen A-lotteries for the MHL-lotteries is greater than for the HL-lotteries for every number of safe choices. This difference in risk taking is significant using a Wilcoxon-signed-rank test of the null hypothesis that there is no intra-subject difference in the number of chosen safe choices between the standard and the modified HL-lotteries ($p < 0.01$).[19]

Result: *On average, subjects played one less A-lottery in the modified than in the standard HL-lotteries.*

Figure 2.1: Cumulated Fraction of Safe Choices — HL + MHL
all subjects



Notes: This figure illustrates the cumulative fraction of safe choices (A) for all subjects over all stages (1 - 10) for the HL and MHL-task. The third graph (straight line) represents a rational risk neutral decision-maker.

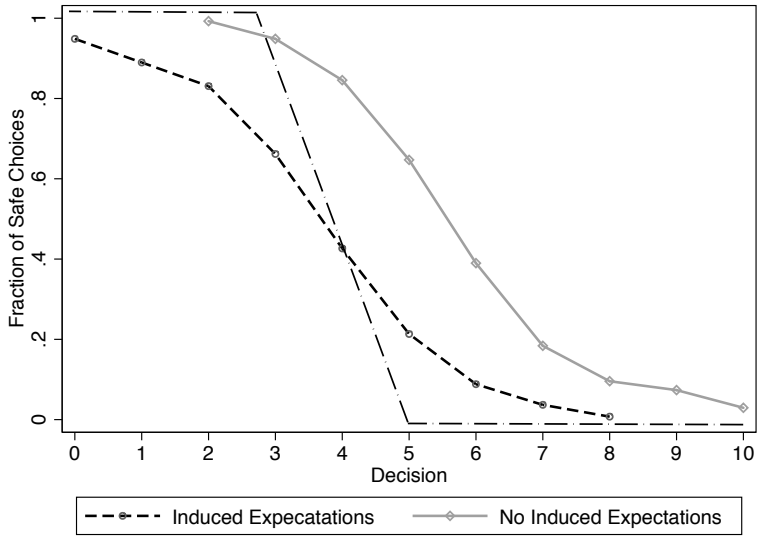
More than fifty percent of 134 subjects increased their risk taking by switching from Option A to Option B in the modified HL-lotteries, as compared to the standard HL-lotteries by at least one stage earlier. 53 subjects (40 percent) did not change their behavior and 13 subjects decreased their risk taking by switching to Option B in a later stage. Based on these results, we identify two types of decision makers: susceptible and non-susceptible for induced reference points.[20]

[19] We excluded multiple switchers from our main analysis as suggested by Holt and Laury (2002).

[20] The third group of 13 subjects who decreased their risk taking by switching to Option B later in the modified HL-lotteries is statistically too small for further analysis.

Figure 2.1 illustrates that on average, subjects switched in the fifth stage from the safe option to the risky one in the standard HL MPL. According to the risk aversion classification of Table 2.2, these subjects are *slightly risk averse* on average. The average switching point for the modified MPL is the fourth stage. According to Table 2.2, the same subjects reveal risk neutrality. The following example is designed to provide an intuition of this effect: a risk-neutral decision maker would be indifferent between a fixed amount (i.e., certainty equivalent) of $100,000$ and a lottery of $0.5; 50,000$ and $0.5; 150,000$. In accordance with Holt and Laury (2002), we use the following utility function: $U(x) = x^{1-r}/(1-r)$ to calculate the certainty equivalent and a risk aversion parameter of 0.28 as seen in Table 2.2. A slightly risk averse person would choose the lottery if the fixed amount was nearly $90,000$.

Figure 2.2: Cumulated Fraction of Safe Choices — HL+ MHL
RP-Susceptives



Notes: This figure illustrates the cumulative fraction of safe choices (Lottery A) for the RP-susceptive subjects over all stages (1 - 10) for the HL and MHL-task. The third graph represents a rational risk-neutral decision maker.

Next, we explore the mechanism behind expectation-induced risk taking. The focus on the group of subjects with an increased willingness to take risks (RP-susceptives) reveals that, on average, this group is risk-averse if playing the HL-lotteries and risk-neutral for the modified HL-lotteries as shown in Figure 2.2. Table 2.3 and Table 2.4 itemize the choice behavior of both main groups. NON-RP-susceptives are slightly risk averse for both tasks (median).

Table 2.3: Descriptive Results — RP-Susceptives

Task	N	Mean	SD	Min	0.25 Quant.	Median	0.75 Quant.	Max
Holt & Laury	68	5.71	1.75	2.00	5.00	6.00	7.00	10.00
Holt & Laury RP	68	3.60	1.84	0.00	3.00	4.00	5.00	8.00

Notes: 68 subjects, who chose less safe lotteries in the first task in contrast to the second task, were risk averse for the standard HL-lotteries und slightly risk loving for the modified lottery task.

Table 2.4: Descriptive Results — NON-RP-Susceptives

Task	N	Mean	SD	Min	0.25 Quant.	Median	0.75 Quant.	Max
Both Tasks	53	4.64	1.43	0.00	4.00	4.00	5.00	10.00

Notes: 53 subjects who chose the same amount of safe lotteries for both main tasks, were risk neutral on average.

As can be seen in Figure 2.2 and Table 2.3, RP-susceptives increased their risk taking by switching nearly two stages later from the safe choice A to the high-variance lottery B. The main descriptive result is that RP-susceptives are risk-averse for the HL-lotteries (Table 2.3: 5.71 safe choices on average), whereas NON-RP-susceptives tended to be risk-neutral for this task (Table 2.4: 4.64 safe choices on average).

The results of an ordered probit regression on the difference of chosen A-lotteries between both main tasks are presented in Section A.1.1 of the Appendix.

2.4.2 Model Estimation and Selection - Specifying the Reference Point

Abeler et al. (2011) highlight the fact that specifying the reference point of expectation-based models is an important direction for future research. One can argue that as long as there is no empirical supported reference point model, econometrical estimations will always be inherent to an additional degree of freedom.

So far, there are two main classes of models with different specifications of the reference point: the first class, disappointment aversion, assumes that the reference point is some level of aspiration (see Gul (1991) or Grant et al. (2001)). All possible outcomes of a lottery are evaluated in contrast to one desired outcome (i.e., the highest possible outcome, as

suggested by Grant et al. (2001)). In the second class, the reference point is the whole distribution of the ranks of possible outcomes (see Quiggin (1982) or Kőszegi and Rabin (2006) and Köszegi and Rabin (2007)). According to our experiment design, the fixed amount introduced in the second task should have two different functions, depending on the choice model: in DA, it directs attention to the highest possible outcome, which is 3.85 of the risky choice (Option B). In RDU, it changes the distribution of the ranks of possible outcomes. In order to understand the meachnism behind RP-induced risk taking, we estimate the parameters of our working models discussed in Section 3 via Maximum Likelihood Methods as suggested by Harrison et al. (2007). The utility (U_i), where $i = A, B$, for both Lotteries A and B, is defined as in Equations 2.9 and refe12Ṫhe difference (∇) for every lottery pair A and B is

$$\nabla U = U_A - U_B \tag{2.15}$$

per stage. Thus, a subject will choose Lottery A if $\nabla U > 0$.

We assume that subjects make some errors when comparing Lottery A and Lottery B, for example, in calculating expected values. Therefore, we add the Luce error specification (μ) suggested by Luce and Fishburn (1991) to our estimations, which is also suggested by Holt and Laury (2002).[21]

$$\nabla U_\mu = \frac{U_B^{1/\mu}}{U_A^{1/\mu} + U_B^{1/\mu}} \tag{2.16}$$

Thus, the log-likelihood-function for the assumption that the EUT-model is true is

$$lnL^{EUT}(r, \mu, y) = \sum_{i=1} [(ln((\nabla U_\mu/\mu) \mid y_i = 1) + (ln(1 - \Phi(\nabla U/\mu) \mid y_i = 0)], \tag{2.17}$$

with $\Phi()$ for the standard normal cumulative distribution function and y_i with $i = 0, 1$ as an indicator-variable for individual choices ($y_i = 1$ for the selection of Option A). If we assume that the rank-dependence-models (RD and DA) are true, we have to estimate the rank parameter (γ) in addition. The log-likelihood-function for the RD and DA-models

[21] See Harrison and Rutström (2008) for a survey of the advantages and disadvantages of several error specifications. The measure suggested by Luce and Fishburn (1991) has the advantage that ∇U_μ is already normalized for its application in the log-likelihood-function.

equals:

$$lnL^{RD,DA}(r,\gamma,\mu,y) = \sum_{i=1}[(ln(\Phi(\nabla U_\mu/\mu) \mid y_i = 1) + (ln(1-\Phi(\nabla U_\mu/\mu) \mid y_i = 0)]. \quad (2.18)$$

Expected Utility Theory (EUT) - Maximum Likelihood Estimation (MLE)

We start the MLE with the EUT-benchmark. It is obvious that the revealed difference in risk taking behavior must be captured by the degree of risk aversion r, the noise parameter μ, or both. The Maximum Likelihood estimates (Table 2.5) show that the estimates for the risk aversion parameter (r) are in the range for risk neutrality ($-0.15 < r < 0.15$) and slight risk aversion ($0.15 < r < 0.41$) (see Table 2.2). The most important result for the estimation of the EUT-model is that the noise parameter (μ) cannot explain induced risk taking for the modified HL-lotteries, since a decrease in the risk aversion parameter r (and a decrease in the noise parameter) captures this behavior. Thus, we have evidence that the increased willingness to take risks for the modified MPL is not due to confusion.

Table 2.5: Maximum Likelihood Estimates: Expected Utility (CRRA)

Parameter	Variable	Estimation	Std. Error	p-Value	log-likelihood
HL-lotteries					-386.6459
r	Constant	0.2808	0.0186	0.0000	
μ	Constant	0.1269	0.0063	0.0000	
MHL-lotteries					-470.5786
r	Constant	-0.0059	0.0019	0.0000	
μ	Constant	0.0229	0.0248	0.0000	

Weber et al. (2012) show that mere risk preferences (here r) are quite stable. Thus, following our hypothesis that expectations can determine the reference point and thereby also have a bearing on risk preferences, we estimate two reference point specifications (RDU and DA) as discussed before and perform a horse race between these two models.

Rank Dependent Utility (RDU) - Maximum Likelihood Estimation

According to the RDU-model (Equations 2.9-2.12) the focus of our RDU-estimation is on the weighting parameter γ. If γ was equal to 1, the RDU-model would have the same structure (i.e., consequences) as EUT. Equations 2.11 and 2.12 imply that the degree of rank dependence increases with a decreasing γ.
As one can see in Table 2.6, in the case of the standard HL-lotteries, the estimator for γ is close to 1 and has a standard error of (0.3547). The Wald-test on the hypothesis $H_0 : \gamma = 1$ (1.1783) shows that $\chi^2(1) = 0.25, p = 0.6152$.

Thus, we cannot reject the hypothesis that subjects follow EUT in the HL-task. The main result of our RDU-estimations is that for the case of the modified HL-lotteries, the hypothesis that subjects do not distort probabilities and rank possible outcomes cannot be rejected. The estimation of the distortion-parameter $\gamma = 0.7548$ is not equal to 1. A chi-squared-test on this hypothesis ($H_0 : \gamma = 1$) confirms the assumption $\chi^2(1) = 13.72, p = 0.0002$. Hence, there is evidence that the induced reference point can affect the attractiveness of lottery outcomes and that our subjects ranked possible lottery-outcomes in relation to the fixed amount.

Table 2.6: Maximum Likelihood Estimates: Rank Dependence (Quiggin 1982)

Parameter	Variable	Estimation	Std. Error	p-Value	log-likelihood
HL-lotteries					-386.06697
r	Constant	0.2921	0.04286	0.0000	
γ	Constant	1.1783	0.3547	0.0010	
μ	Constant	0.1396	0.0242	0.0000	
MHL-lotteries					-458.4372
r	Constant	-0.1679	0.0744	0.0240	
γ	Constant	0.7548	0.0662	0.0000	
μ	Constant	0.0631	0.0085	0.0000	

Disappointment Aversion (DA) - Maximum Likelihood Estimation

The reference point of a DA decision maker is not determined by the whole distribution as in RDU-theory. Fehr-Duda and Epper (2012) highlight the fact that DA means that there are only two ranks: above and below the reference point. According to Equation 2.14, a decision maker is disappointment averse if (and only if) $\gamma < 1$. For the case of $\gamma = 1$, the DA-model converts to EUT. In reference to our experiment design, we assume that the highest outcome, which is 3.85 of the risky choice (Option B), works as reference point. So, the fixed amount (3.5) has directed the subject's attention to this outcome.

Table 2.7 shows the results for both main tasks. If we test (Wald-test) the $H_0 : \gamma = 1$ for the modified lotteries, the result ist $\chi^2(1) = 126.87, p = 0.0000$; whereas we cannot reject this hypothesis for the standard HL-lotteries, as $\chi^2(1) = 2.38, p = 0.1225$. Our ML-estimations provide evidence that the fixed amount could have directed attention to the highest lottery outcome and could have induced a higher willingness to take risks due to disappointment aversion.

Model Selection

In this section, we try to provide evidence for the question how the reference point is specified. According to our model estimations, we have two candidates: the whole

Table 2.7: Maximum Likelihood Estimates: Disappointment Aversion

Parameter	Variable	Estimation	Std. Error	p-Value	log-likelihood
HL-lotteries					-384.9142
r	Constant	0.3117	0.0155	0.0000	
γ	Constant	1.9078	0.5878	0.0010	
μ	Constant	0.1147	0.0239	0.0000	
MHL-lotteries					-443.5302
r	Constant	0.5943	0.0052	0.0000	
γ	Constant	0.8122	0.0167	0.0000	
μ	Constant	0.0720	0.0043	0.0000	

Table 2.8: Model Selection HL-lotteries

Model	Degrees of Freedom (k)	AIC	BIC	Rank AIC	Rank BIC
EUT	2	777.29	783.08	2	1
RD	3	778.14	786.83	3	3
DA	3	775.83	784.52	1	2

distribution (RDU) or an aspiration level (i.e., the highest outcome) as suggested in DA. Thus, we start a horse race between our estimated working models.

One approach, given the log-likelihood of an estimated model, is the Akaike Information Criterion (AIC) (Akaike (1973) and Akaike (1974)) where k stands for the number of parameters (i.e., degrees of freedom).

$$AIC = -2ln(likelihood) + 2k \tag{2.19}$$

Since we compare models with different amounts of parameters, we prefer the Bayesian Information Criterion (BIC) because the BIC takes additional degrees of freedom more into account than the AIC.

$$BIC = -2ln(likelihood) + ln(N)k \tag{2.20}$$

Since N stands for the number of subjects, the penalty component for the BIC is more influential than the component of the AIC for more than eight observations ($N \geq 8$).

Table 2.8 and 2.9 content the results for both lottery-tasks. Given Equation 2.19 and 2.20 it is obvious that the smaller the AIC or BIC the more likely the model is (given the range of models).

Table 2.9: Model Selection MHL-lotteries

Model	Degrees of Freedom (k)	AIC	BIC	Rank AIC	Rank BIC
EUT	2	945.16	950.95	3	3
RD	3	922.87	931.57	2	2
DA	3	893.06	901.75	1	1

The most important result is that in the first task (modified HL-lotteries) the DA model has the lowest BIC while in the second task (standard HL-lotteries), it is the EUT-model with the lowest BIC. Given our set of models, these results provide evidence for:

1. EUT is still a reliable model to explain risk preferences for less complex choices.[22]
2. In a more complex decision task (MHL) with the chance of a high outcome (i.e., fixed amount), subjects define some level of aspiration.

2.4.3 Robustness Checks

Randomness

There is an intuitive assumption that the modified HL-lottieries provoke a more random choice behavior. We want to highlight the fact that for the Maximum Likelihood estimations of all three working models, we find a decrease (from the standard HL-lotteries in contrast to the modified lotteries) in the estimations of the noise parameter (μ).[23] This finding is in line with the hypothesis that reference points can simplify decision tasks by drawing attention to one aspect (outcome) of a complex decision task (e.g., Brandstätter et al. (2006)).

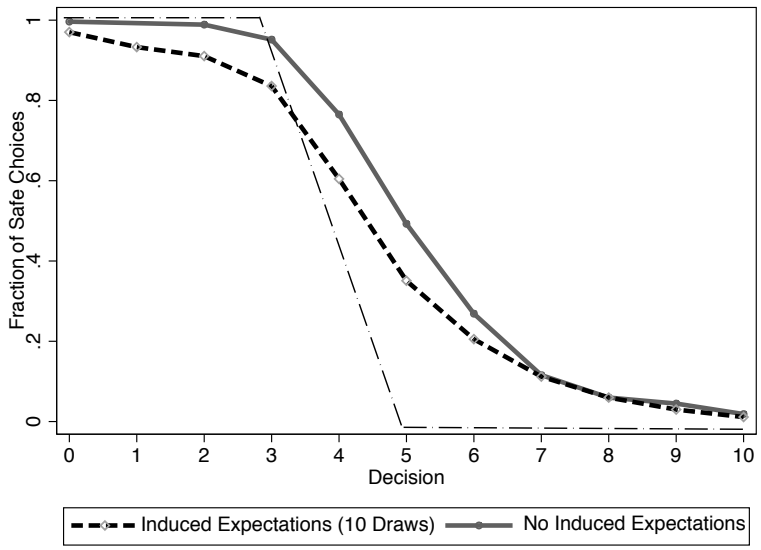
Compatibility and Ordering

According to the Rabin-Critique (Rabin (2000)), one might argue that the small stakes of our lotteries were not incentive compatible. Therefore, we implemented a control task which all subjects had to play after the two main tasks. This task was similar to the first task (modified HL-lotteries) with the only modification being that subjects received as payoff the result of ten draws with replacement of their chosen lotteries at the end

[22] This hypothesis might be supported by the fact that multiple price lists (e.g., HL) are frequently used for economic experiments and our subjects may have had some kind of experience.

[23] $\mu = 0$ implies that there is no evidence for structural errors made by our subjects (i.e., errors in calculating expected values)

Figure 2.3: Control Task — HL-lotteries with 10 Draws



of the experiment. We also used this task to control for an ordering effect. All subjects passed through the experiment in the following sequence: modified HL-lotteries (1 draw), standard HL-lotteries (1 draw), modified HL-lotteries (10 draws). If there was an ordering or learning effect, the results of the third (control) task would have significantly differed from the first task.

Our findings show that individual willingness to take risk for the control task rises significantly in contrast to the previous task (mere HL-lotteries). This difference in risk taking is significant using a Wilcoxon-signed-rank test of the null hypothesis that there is no intra-subject difference in the number of chosen safe choices between the standard HL-lotteries and the control task ($p < 0.01$). Thus, on average, subjects increased their risk taking for the first and third task in contrast to the mere HL-lotteries, the second task.

Result 1b: *On average, subjects played* 1 *less A-lotteries in the modified than in the standard HL-lotteries. Thus, subjects are willing to take more risk if they can expect to earn an amount that is beyond their (mere) risk preference.*

MPL and Multiple Switchers

We excluded 22 subjects for switching twice or more between A- and B-lotteries for our basic analyses. Our results stay robust if we reinclude these subjects for a Wilcoxon-signed-rank

test of the null hypothesis that there is no intra-subject difference in the number of played A-lotteries between the standard and the modified HL-lotteries.

2.5 Conclusion

We provide evidence that expectations can induce a reference point and risk taking. Subsequently, we localize the specifications of the reference point. Within a compensation framework we show that, given a relatively high salary, the highest possible outcome of a risky choice is a reasonable candidate for the reference point.

According to Gothmann (2015), who suggests that a cap on bonus payments can have external effects (e.g., increased risk taking), we can localize potential mechanisms of such a behavior. An important question for future research is whether our findings have implications for financial markets (i.e., asset prices).

Recent initiatives of European regulatory authorities are focused on compensation schemes (e.g., bonus cap) of credit and investment banks. With regard to our findings, one must ask whether such interventions take aspects as, for instance, reference dependent preferences and their impact on individual risk preferences into account.

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Chapter 3

Risk Taking and Compensation Schemes

3.1 Introduction

Aligning the interests of managers and owners of capital companies by means of monetary incentives (i.e., remuneration) is one of the major challenges in management. Recent insolvencies of (investment) banks and public subsidies for numerous financial institutions during the last financial crisis have drawn public attention to the structure of executive remuneration in the financial industry. Since financial institutions are highly leveraged compared to conventional industry, individual decisions (i.e., risk taking) of their managers have a considerable impact on economic welfare.

The objective of our study is to investigate the effect of recent regulatory measures in the aftermath of the financial crisis, such as bonus caps, on individual decision making (i.e., risk taking) by means of an experiment.

The influence of compensation schemes on excessive risk taking[1] and misperceptions of risk before the financial crisis must be separated from other aspects such as, for instance, a supportive regulatory framework for subprime mortgage loans in the US and other effects.[2]

Nevertheless, there is some empirical evidence for a correlation of executive remuneration practices and a biased perception of risk (e.g., Financial Stability Board (2009)). Bebchuk and Fried (2009) analyze the pre-crisis compensation contracts of executives from several investments banks. They find that bonus payments which were several times higher than the fixed salary were connected to short-term gains, without, in most cases, any rules that might allow banks to claw back bonus payments at least partially.

From an ex-post perspective it is obvious to conclude that such contracts can provide incentives for investments in projects with short-term gains but a long-term negative net present value.[3] Fahlenbrach et al. (2012) analyze the performance and risk (i.e., leverage) of banks during the financial crisis and find empirical evidence for this intuition. One effect of these discussions is that compensation schemes have come in the focus of regulatory authorities (Ferri and Goex (2013)).

The focus of our study is the impact of specific regulatory interventions in the aftermath of the financial crisis on compensation schemes in the financial industry. One of the

[1]For the purposes of our study we use the definition suggested by Lefebvre and Vieider (2014). The authors define *excessive risk taking* as the choice of an inferior lottery (in comparison to a lottery with a higher risk adjusted expected return).

[2]For instance Bouwman and Malmendier (2015) find evidence for an *institutional memory* of banks as determinant for risk taking.

[3]The concept of*Moral Hazard* predicts such a behavior for cases when risks can be trasferred to debt holders or the government.

cornerstones of European financial market regulation was the publication of a directive in 2013.[4] According to this directive, short-term bonus payment are capped to 100 percent of yearly fixed compensation for executives of credit and investment banks.[5] As a result a wide range of financial institutions has raised the fixed salaries of their managers according to a study of the EBA (2016).

Our research question is whether the relation of fixed and short-term variable bonus payments can have an effect on risk taking. For this purpose we conduct an experiment. Subjects have to choose between a high and a low variance lottery which is the same for twenty stages. The only variable parameter for all stages is a fixed amount (i.e., fixed salary) which is the same for every stage of Option A and Option B and which increases by steps of one euro in order to study whether an increasing ratio of fixed versus variable compensation has an influence on risk taking. A risk averse subject would choose the low variance for every stage, whereas only a risk loving subject would prefer the high variance lottery. According to neoclassical decision making theory a risk averse or risk loving subject would never switch from Option A to Option B or vice versa. We can show that 10 percent of our subjects start with choosing the high risk lottery in the first stage (i.e., low fixed salary) whereas 54 percent have switched to the high variance lottery in the last stage (i.e., the highest fixed salary).

Our study is motivated by the works of Ockenfels et al. (2014) and Cole et al. (2015). Both studies provide evidence that short-term bonus payments can have an effect on individual decision making (i.e., risk taking). Since the authors of both studies conduct field experiments we add additional value to this research question by investigating compensation schemes by means of a controlled online experiment.

In Section 3.2 we provide an overview of the institutional framework for executive compensation in the European Union (EU). Furthermore, we discuss current evidence on remuneration practices in recent years. An overview of relevant literature is provided in Section 3.3.

We discuss the theoretical framework of our analysis in Section 3.4 and explain the design of our online experiment in Section 3.5. A discussion of our results is provided in Section 3.6 and we complete our study with a conclusion in Section 3.7.

[4]Directive 2013/36/EU

[5]Higher caps up to 200 percent (upper bound) have to be authorized by the general meeting.

3.2 Institutional Overview

In this section, we discuss the legal foundations for executive compensation of financial institutions in the EU, which has received pronounced attention from the regulatory authorities since the beginning of the financial crisis.

Adding to that, we provide a summary of empirical remuneration practices of European financial institutions and discuss our findings in connection with the legal framework.

3.2.1 Legal Framework

A first comprehensive guideline for a reform and regulation of compensation schemes for credit banks was published in 2009 by the Financial Stability Board (2009).

The European Commission incorporated these ideas into Directive 2010/76/EU, which came into force on 1 January 2011. This directive provides, among other things, detailed guidelines for the remuneration policies of credit institutions and investment firms (here: financial institutions).

The Commission supplemented this regulatory frame by two additional directives in 2013 (2013/36/EU) (CRD IV) and 2014 (2014/604/EU). All three directives together were introduced in the belief that remuneration practices were considered to have been among the reasons that led decision makers of financial institutions to take excessive (short-term) risks which resulted in the financial crisis, according to a study of the European Banking Authority (EBA) (European Banking Authority (2014)).

We discuss two key measures of the legal framework described above. The first one is defined in article 92 (2) of CRD IV which requires financial institutions to identify staff (identified staff) who have, due to their professional activities, a material impact on the institution's risk exposure.

The identification criteria are a combination of quantitative and qualitative parameters. According to the Directive 2013/36/EU, article 94 (2) identified staff are generally part of the management body and/or have key functions or responsibilities over other identified staff. The quantitative criteria are mainly based on remuneration: earnings of more than 500,000 euros per year *or* 0.3 percent of staff with the highest remuneration.

The EBA will provide specific guidelines on remuneration policies for identified staff.[6]

[6]The authority of the EBA to issue guidelines for remuneration policies in the financial industry of the EU is defined in articles 74 and 75 of Directive 2013/36/EU.

These guidelines are effective starting 2017. With regard to the ratio between fixed and variable remuneration, the current requirements for all staff, mentioned below, will presumably remain.[7] [8]

The focus of our research is on a second measure for the regulation of financial institutions: article 94 (1) letter g) of CRD IV which constitutes a bonus cap (for all staff, especially including identified staff). According to this article, the ratio of variable to fixed remuneration shall not exceed 100 percent of the fixed component of total remuneration. Article 94 (1) letter g) (ii) allows for a higher cap of up to 200 percent which must be agreed by the shareholders.[9] Article 94 came into force on 1 January 2014.

Given this legal framework, we discuss the empirical effects of this rule on remuneration practices for risk takers (i.e., identified staff) in the following section.

3.2.2 Empirics

The focus of our study is individual risk taking in financial institutions under the European regulatory framework discussed above. Thus, we start this section with a short review of a study about risk taking of European banks before and during the financial crisis and provide empirical evidence about current remuneration practices.

Uhde (2015) analyzes compensation schemes of more than 60 banks from 16 European countries. The author finds evidence for an impact of variable compensation on bank risk for the period of 2000 to 2010. According to his analysis, the degree of influence on risk taking is correlated with the degree of financial distress, which can be described as *gambling for resurrection*.

According to a survey of the EBA nearly 34,060 employees of financial institutions within the EU were classified as identified staff, based on all qualitative and quantitative criteria (European Banking Authority (2014)). Due to adjusted selection criteria, provided through Regulatory Technical Standards of the EBA in 2014[10], this figure increased to 62,787 in 2014 (EBA (2016)). The ratio of identified staff to all staff was 2.34 percent in 2014.

[7] See number 190 of the Guidelines on Sound Remuneration Policies under Articles 74(3) and 75(2) of Directive 2013/36/EU and Disclosures under Article 450 of Regulation (EU) No 575/2013

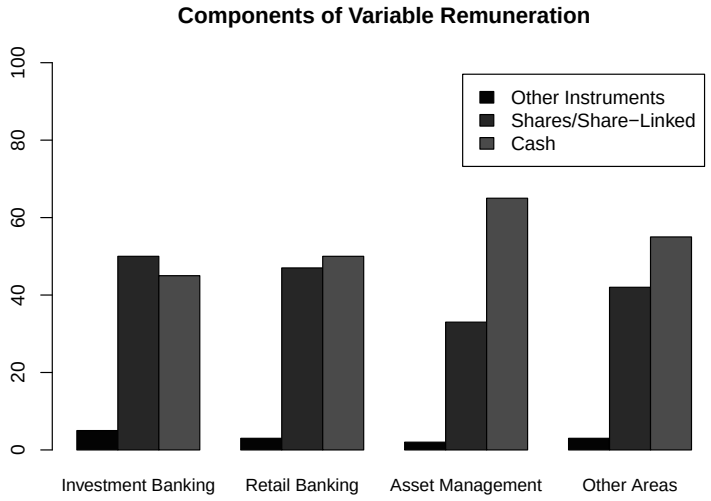
[8] Source: `https://www.eba.europa.eu/documents/10180/1314839/EBA-GL-2015-22+Guidelines+on+Sound+Remuneration+Policies.pdf`

[9] Member States are allowed to set a *lower* maximum percentage.

[10] Source: `https://www.eba.europa.eu/documents/10180/526386/EBA-RTS-2013-11+(On+identified+staff).pdf`

The composition of the variable remuneration for identified staff mainly depends on the business unit the employee works for. Figure 3.1 summarizes the distribution of variable remuneration components according to the business units: investment banking, retail banking, asset management, and other business areas for 2014. The focus of our analysis, short-term cash linked instruments, make up between 50 and 70 percent of variable compensation. These instruments are predominantly used in three of four bank units (EBA (2016)).

Figure 3.1: Variable Remuneration for Identified Staff 2014



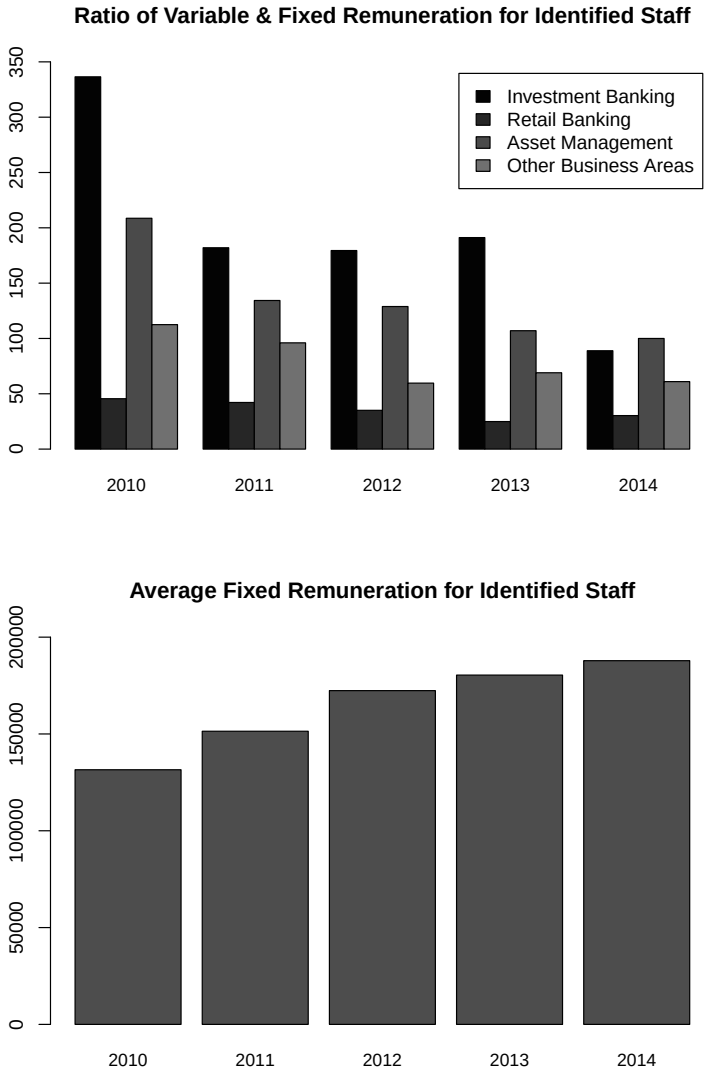
Notes: Data provided by EBA (2016)

The upper panel of Figure 3.2 shows a decrease in the ratio between variable and fixed remuneration from 2010 to 2014 for identified staff. The variable pay for employees[11] in the asset management or the investment banking sector in 2014 is only one fourth of what is was in 2010, which is due to the cap defined in Article 94 CRD IV. At the same time, *average* fixed remuneration rose from 130,000 euros to 190,000 euros (panel 2 of Figure 3.2).

The EBA highlights that the rise of fixed salaries from 2010 to 2014 is characterized by a high variance. In particular certain groups of identified staff could almost double their fixed salary.

[11]In the following we use *employee(s)* as synonym for *identified staff*.

Figure 3.2: Variable Cash Component and Ratio of Fixed and Variable Remuneration for Identified Staff (2010 - 2014)



Notes: Data aggregated from the EBA Reports "Benchmarking of Remuneration Practices at Union Level, 2014 and 2016 (European Banking Authority (2014), EBA (2016))

Given the regulatory framework, we investigate the effect of this fundamental change of structure of fixed and variable. There is evidence from the realm of behavioral economics that this shift of compensation architecture might have an influence on the risk taking of employees. The following section thus reviews the related literature.

3.3 Literature

There is a wide range of literature on the (optimal) structure of executive compensation. Neoclassical models usually state that it is the fundamental task of compensation schemes to align the interests of managers and shareholders due to diverging risk preferences. These models are based on the assumption that shareholders are risk neutral since they can diversify their assets, and managers are risk averse due to their cluster risks. This trade-off is the subject of a comprehensive strand of literature.[12]

Bebchuk and Fried (2009) provide evidence that connecting the interests of managers and shareholders to short-term incentives, for instance, cash bonus payments or stock options, might have been one of the catalysts for excessive risk taking before the financial crisis. The authors conclude that these conventional incentives and/or compensation structures failed in balancing both extremes: exaggerated risk avoidance and excessive risk taking.

Behavioral economics additionally takes judgment biases into account, such as loss aversion (e.g., Dittmann et al. (2010)) or overconfidence of CEOs (e.g., Malmendier and Tate (2005)) into account. Our study is motivated by Köszegi and Rabin (2007) who suggest for their (behavioral) model of *reference dependent risk attitudes* that expectations might determine the reference point (RP) and thus risk taking due to loss aversion as formalized in Prospect Theory (Kahneman and Tversky (1979)). There is empirical and experimental evidence for that hypothesis. Ockenfels et al. (2014) can show by means of a field experiment that expected bonus payments might be able to determine the RP. The authors analyze the compensation schemes of a large German corporation. They show that falling behind the average bonus payment (here: a bonus of 100 percent), which the authors define as natural reference point, can induce loss aversion which is measured by a drop in satisfaction and performance. Cole et al. (2015) analyze this effect on risk taking. The authors provide evidence by means of a field experiment that bank clerks take higher risks when they can expect to earn a higher cash bonus. Even experienced employees grant credits to borrowers they would have not done before.

Abeler et al. (2011) find experimental evidence for such behavior. By means of a simple lottery they can control the expectations of their subjects. The authors show that subjects who can expect to earn more with regard to their performance put in significantly

[12] See Prendergast (1999) and Prendergast (2000) for a basic overview.

more effort. Gothmann and Nöth (2015) can transfer these insights from the field of providing effort to risk taking by means of an experimental investigation and show that expectation-induced RPs can have an impact on individual willingness to take risks.

Based on the empirical findings of the EBA (2016) that European financial institutions have raised the fixed salary of their identified staff due to a regulatory cap of bonus payments we want to find out whether a high(er) fixed salary can work as an RP with effects on individual risk taking. This behavior can be predicted by reference dependent preferences as discussed in the following section.

3.4 Theoretical Predictions and Hypotheses

In this section, we examine the predictions of two different models: first, Expected Utility Theory (EUT) (Von Neumann and Morgenstern (1947)), which represents an entirely rational decision maker, and second, Disappointment Aversion (DA) (e.g., Gul (1991)).

This selection is based on Gothmann and Nöth (2015) who conduct a risk taking experiment with induced RP. The authors provide evidence that EUT and DA can explain individual decision making under controlled expectations.[13]

We start with the predictions of EUT. The expected outcomes (E) of both options are defined as follows:

$$E(Option\,A) = 0.5(fixed\,amount + 7) + 0.5(fixed\,amount + 9), \tag{3.1}$$

$$E(Option\,B) = 0.5(fixed\,amount + 1) + 0.5(fixed\,amount + 15). \tag{3.2}$$

An EUT decision maker will choose Option A if and only if

$$U(E(Option\,A)) - U(E(Option\,B)) > 0. \tag{3.3}$$

Additionally, we have to specify the form of the utility function $U(\cdot)$. For this purpose we exclude increasing (absolute and relative) risk aversion (IARA and IRRA). Several studies show that the average investor either reveals decreasing or constant absolute (relative) risk aversion (e.g., Friend and Blume (1975), Holt and Laury (2002)). Furthermore, IRRA is

[13]For an overview and selection criteria for suitable working models see Fehr-Duda and Epper (2012).

rarely observed in either field studies or economic experiments (Eisenführ et al. (2010)).

According to Harrison and Rutström (2008) the Power Utility Function (PUF) as shown in Equation 3.4 is an established workhorse for experimental investigations and represents constant relative risk aversion as well as decreasing absolute risk aversion (e.g., Harrison and Rutström (2008)). As one can see, for $r = 0$, PUF represents a risk neutral decision maker. These subjects would be indifferent for all stages. For all $r < 0$, the function becomes convex and implies a risk loving decision maker, who would choose Option B for all stages. A risk averse decision maker is represented for all $r > 0$, who would choose the low variance lottery (Option A) for all stages.

$$u(x) = \frac{x^{1-r}}{1-r}. \tag{3.4}$$

Furthermore, we base our predictions on a wide range of studies for estimated risk parameters r (e.g., Dohmen et al. (2011) or Harrison and Rutström (2008)). Harrison and Rutström (2008) summarize several calibration studies. The authors report that r is usually estimated within the interval $[0.25, 1.25]$, which implies risk aversion.

Table 3.1 provides the expected values for all stages. Adding to that, we calculate the absolute risk as the difference of the highest available outcome (fixed amount plus highest possible lottery outcome) and the lowest available outcome (fixed amount plus lowest possible outcome), defined absolute risk (AR). This clarifies that only a risk loving decision maker would choose Option B.

Table 3.1: Experiment: EUT - Predictions

This table provides the absolute risks (AR) and Expected Values for Option A and Option B for each stage.

Option A					Option B				
Fixed Amount	Lottery		EV	AR	Fixed Amount	Lottery		EV	AR
100%	50%	50%			100%	50%	50%		
6.00	7.00	9.00	14.00	-2.00	6.00	1.00	15.00	14.00	-14.00
7.00	7.00	9.00	15.00	-2.00	7.00	1.00	15.00	15.00	-14.00
8.00	7.00	9.00	16.00	-2.00	8.00	1.00	15.00	16.00	-14.00
9.00	7.00	9.00	17.00	-2.00	9.00	1.00	15.00	17.00	-14.00
10.00	7.00	9.00	18.00	-2.00	10.00	1.00	15.00	18.00	-14.00
11.00	7.00	9.00	19.00	-2.00	11.00	1.00	15.00	19.00	-14.00
12.00	7.00	9.00	20.00	-2.00	12.00	1.00	15.00	20.00	-14.00
13.00	7.00	9.00	21.00	-2.00	13.00	1.00	15.00	21.00	-14.00
14.00	7.00	9.00	22.00	-2.00	14.00	1.00	15.00	22.00	-14.00
15.00	7.00	9.00	23.00	-2.00	15.00	1.00	15.00	23.00	-14.00
16.00	7.00	9.00	24.00	-2.00	16.00	1.00	15.00	24.00	-14.00
17.00	7.00	9.00	25.00	-2.00	17.00	1.00	15.00	25.00	-14.00
18.00	7.00	9.00	26.00	-2.00	18.00	1.00	15.00	26.00	-14.00
19.00	7.00	9.00	27.00	-2.00	19.00	1.00	15.00	27.00	-14.00
20.00	7.00	9.00	28.00	-2.00	20.00	1.00	15.00	28.00	-14.00
21.00	7.00	9.00	29.00	-2.00	21.00	1.00	15.00	29.00	-14.00
22.00	7.00	9.00	30.00	-2.00	22.00	1.00	15.00	30.00	-14.00
23.00	7.00	9.00	31.00	-2.00	23.00	1.00	15.00	31.00	-14.00
24.00	7.00	9.00	32.00	-2.00	24.00	1.00	15.00	32.00	-14.00
25.00	7.00	9.00	33.00	-2.00	25.00	1.00	15.00	33.00	-14.00

In line with these considerations, an EUT decision maker will not switch from Option A to Option B or vice versa, for all kinds of risk preferences (risk aversion, risk neutrality or risk loving). Since risk neutral EUT decision makers receive no additional utility from *switching*, they choose only only one option (A or B).

According to the general assumption about risk averse individuals, we postulate the following hypothesis.

Hypothesis: *An EUT decision maker will not switch.*

According to the findings of Gothmann and Nöth (2015), DA might explain risk taking due to expectation induced RP. According to Fehr-Duda and Epper (2012) there is a wide range of DA-models. Thus, we base our predictions on the intuition of DA (i.e., rank dependence). DA-averse decision maker have a level of aspiration (i.e., RP). With regard to this RP they value (i.e., ranks) all other possible outcomes (e.g., Bell (1985) or Gul

(1991)) as shown in Table 3.2.

Of the two options subjects choose from, Option B contains the highest possible outcome (15) from the first stage to the eighth stage. From the tenth stage on, the fixed amount represents the highest outcome for both options.

While the fixed amount is rising from stage to stage, the disutility for a DA decision maker by not choosing Option B would rise too. Due to diminishing sensitivity, the loss, possibly caused by the second outcome of Option B ($1 - FA$), is *weighted* less than the loss caused by Option A ($7 - FA$ or $9 - FA$). In this case, DA decision makers would prefer Option B to Option A due to a wider spread (i.e., higher risk).

Given that the fixed amount works as an RP, a DA-averse decision maker would perceive additional utility (i.e., less disutility) per stage from choosing Option B. This implies a switch from Option A to Option B at some point, which is in direct violation of the EUT benchmark defined above.

Table 3.2: Ranking of Possible Outcomes According to Disappointment Aversion

Stage	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
1	1 (Option B)	**6 (FA)**	7 (Option A)	9 (Option A)	15 (Option B)
2	1 (Option B)	**(7 (FA)** = 7 (Option A))		9 (Option A)	15 (Option B)
3	1 (Option B)	7 (Option A)	**8 (FA)**	9 (Option A)	15 (Option B)
2	1 (Option B)	7 (Option A)	(**9 (FA)**= 9 (Option A)		15 (Option B)
4	1 (Option B)	7 (Option A)	9 (Option A)	**10 (FA)**	15 (Option B)
5	1 (Option B)	7 (Option A)	9 (Option A)	**11 (FA)**	15 (Option B)
6	1 (Option B)	7 (Option A)	9 (Option A)	**12 (FA)**	15 (Option B)
7	1 (Option B)	7 (Option A)	9 (Option A)	**13 (FA)**	15 (Option B)
8	1 (Option B)	7 (Option A)	9 (Option A)	**14 (FA)**	15 (Option B)
9	1 (Option B)	7 (Option A)	9 (Option A)	**15(FA)** = 15 (Option B)	
10	1 (Option B)	7 (Option A)	9 (Option A)	15 (Option B)	**16 (FA)**
		.....			
		.....			
		.....			
		.....			
18	1 (Option B)	7 (Option A)	9 (Option A)	15 (Option B)	**23 (FA)**
19	1 (Option B)	7 (Option A)	9 (Option A)	15 (Option B)	**24 (FA)**
20	1 (Option B)	7 (Option A)	9 (Option A)	15 (Option B)	**25 (FA)**

Notes: Ranking of possible outcomes according to a DA-averse decision maker.

3.5 Experimental Design

The objective of our experimental study is to investigate the influence of the ratio of fixed salaries and short-term variable payments (i.e., cash bonus payments) on risk taking. According to current regulatory interventions and empirical findings as discussed in the section before, we want to find out whether increasing fixed salaries and bonus caps can have an impact on individual risk taking.

There is an ongoing discussion about how to determine risk preferences in laboratory

experiments.[14] Lönnqvist et al. (2015) compare two methods: the Holt and Laury (2002) lottery-choice task (HL-lotteries) and a multi-item questionnaire suggested by Dohmen et al. (2011). The authors find evidence for a test-re-test stability of the questionnaire. Charness et al. (2013) provide a comprehensive survey of the literature and suggest a more differentiated view on both methods. They conclude that Multiple Price Lists (MPL) (i.e., HL-lotteries) are still the standard for quantifying the risk taking effect. Since this is the purpose of our study, we use the MPL-approach instead of a questionnaire.

The complete documentation of our experimental setup is provided in Section A.2 of the Appendix. Prior to each main task, subjects had to read the instructions and had to answer a control question correctly before being admitted to the respective task.

For the first main task subjects had to decide between a constantly low variance lottery (Option A) and a constantly high variance lottery (Option B) for each stage of a setup of 20 decisions tasks. The choices are illustrated in Table 3.3. The only variable parameter for all tasks was a fixed amount which was the same for every stage of Option A and Option B and which increased from 6 euros to 25 euros in steps of 1 euro in order to find out whether an increasing ratio of fixed versus variable compensation influences risk taking.

Both options had the same expected value for each stage. Option B had a considerable higher variance than Option A. Thus, we defined risk taking as switching from Option A to Option B.

At the end of the experiment, the following chronological decisions were randomly chosen for payment. First, one of the 20 stages was randomly drawn and the corresponding fixed amount was paid out. Additionally, the result of the corresponding (chosen) lottery (Option A or Option B) was determined by a random mechanism and paid out as well.

As can be seen, the expected value for both remuneration schemes (Option A and Option B) is the same for each stage.

[14] See Harrison and Rutström (2008) for a survey.

Table 3.3: Experiment: Multiple Price List

This table describes the MPL for the first treatment. Option A (the left-hand side of the respective MPL) denoted in CU has the same expected value as Option B (the right-hand side of the respective MPL) for each stage.

Option A			Option B		
Fixed Amount	Low Variance Lottery		Fixed Amount	High Variance Lottery	
100%	50%	50%	100%	50%	50%
6.00	7.00	9.00	6.00	1.00	15.00
7.00	7.00	9.00	7.00	1.00	15.00
8.00	7.00	9.00	8.00	1.00	15.00
9.00	7.00	9.00	9.00	1.00	15.00
10.00	7.00	9.00	10.00	1.00	15.00
11.00	7.00	9.00	11.00	1.00	15.00
12.00	7.00	9.00	12.00	1.00	15.00
13.00	7.00	9.00	13.00	1.00	15.00
14.00	7.00	9.00	14.00	1.00	15.00
15.00	7.00	9.00	15.00	1.00	15.00
16.00	7.00	9.00	16.00	1.00	15.00
17.00	7.00	9.00	17.00	1.00	15.00
18.00	7.00	9.00	18.00	1.00	15.00
19.00	7.00	9.00	19.00	1.00	15.00
20.00	7.00	9.00	20.00	1.00	15.00
21.00	7.00	9.00	21.00	1.00	15.00
22.00	7.00	9.00	22.00	1.00	15.00
23.00	7.00	9.00	23.00	1.00	15.00
24.00	7.00	9.00	24.00	1.00	15.00
25.00	7.00	9.00	25.00	1.00	15.00

Notes: The main task of our experiment is a combination of a Multiple Price List as suggested by Holt and Laury (2002) and a simple 50:50 lottery, suggested by Abeler et al. (2011) in order to control for expectations.

The second main task was a HL-lottery (Holt and Laury (2002)), illustrated in Table 3.4, in order to measure the degree of *mere* risk aversion. This task is consistent with the first main task because subjects had to choose between a low variance lottery, shown in the first two columns of Table 3.4 and a high variance lottery, depicted in the two columns on the right. At the end of the experiment one of the ten stages was randomly drawn, simulated and paid out.

Table 3.4: HL Lotteries

p	Low Variance Lottery		High Variance Lottery	
	p%	1-p%	p%	1-p%
0.1	2.00	1.60	3.85	0.10
0.2	2.00	1.60	3.85	0.10
0.3	2.00	1.60	3.85	0.10
0.4	2.00	1.60	3.85	0.10
0.5	2.00	1.60	3.85	0.10
0.6	2.00	1.60	3.85	0.10
0.7	2.00	1.60	3.85	0.10
0.8	2.00	1.60	3.85	0.10
0.9	2.00	1.60	3.85	0.10
1	2.00	1.60	3.85	0.10

Notes: This table describes the HL-lotteries, the second main task of the experiment.

According to the literature personal traits as well as several demographic factors can be correlated with risk preferences.[15] Therefore we included a questionnaire for the BigFive Factor Model in order to control for factors like extraversion, agreeableness, conscientiousness, neuroticism, and openness as suggested by Caprara et al. (1993). Additionally, we collected information about personal characteristics such as gender, age, studies, and provided a self-assessment for financial and statistical knowledge. Financial literacy was captured by a questionnaire suggested by Nöth and Puhan (2009).

[15] See Dohmen et al. (2011) for an extensive summary.

The experiment was conducted via LIMESURVEY[16] and took on average 25 minutes to complete. 32 out of our pool of 161 subjects were randomly selected and earned 27.56 euros on average from all tasks.

3.6 Results

In this section, we present and discuss the results of our experiment and put them into the context of the regulatory framework for executive remuneration in European financial institutions.

3.6.1 Descriptive Results

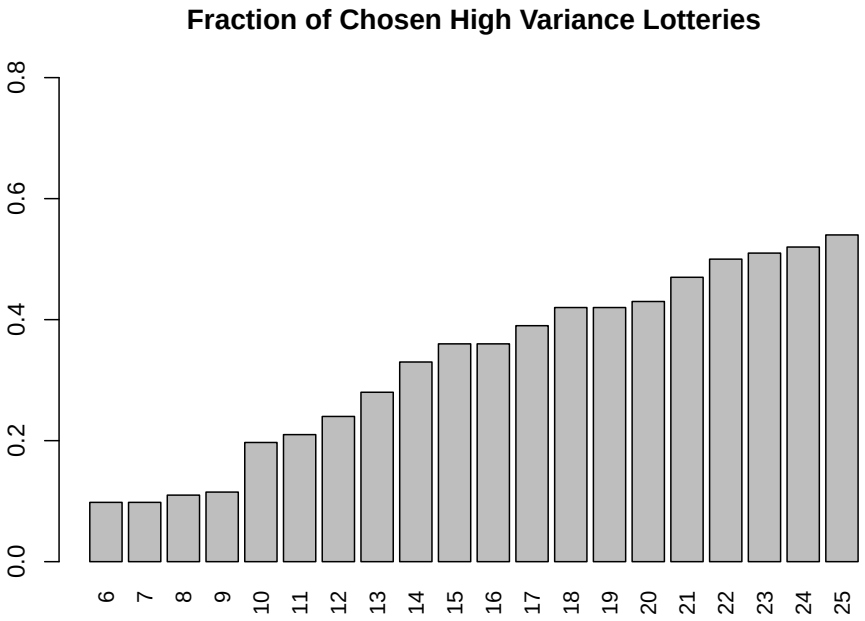
Figure 3.3 illustrates the fraction of chosen high variance lotteries (Option B) per stage (i.e., level of fixed salary). The ratio of subjects who choose Option B for the first two stages is ten percent. This ratio rises (continuously) up to 54 percent in the last stage. The proportion of subjects who switch from Option A to Option B per stage is quite constant and lies between one and three percent. We removed 18 subjects out of 161 who switched at least twice. We discuss their influence on the results in the following section.

There is a slump for a fixed salary of ten units. Nearly ten percent of our subjects switch from Option A to Option B. As one can see in Table 3.2, this is the stage when the fixed salary is higher than the highest possible outcome of Option A for the first time. A DA averse decision maker with an RP determined by the fixed amount would receive additional value because Option A only provides losses in the sense of the DA theory from this stage on.

We perform a probit regression on the probability of choosing Option B and find no significant influence of empirical factors (e.g., age or gender), all kinds of self-assessments (statistical knowlegde, BIG5, risk preferences) and measures such as financial literacy or preferences for consistency. This finding is in line with Gothmann and Nöth (2015).

[16] www.limesurvey.com

Figure 3.3: Results: DA-Induced Risk Taking

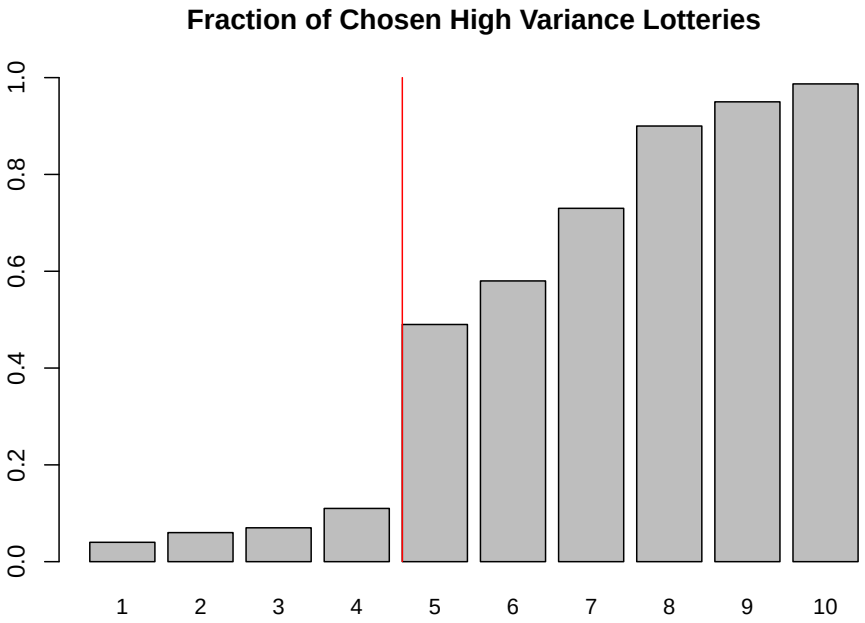


Notes: This figure illustrates the fraction of chosen high variance lotteries (Option B) per fixed salary.

This result contradicts EUT and the general assumption that individuals are risk averse on average. Since we conducted a HL-lottery in order to control for risk preferences as second main task of the experiment we can compare both results. Figure 3.4 illustrates the fraction of chosen high variance lotteries per stage. Again, we removed 14 subjects who switched at least twice (e.g., from Option A to Option B and back, see the following section for a discussion).

A risk neutral decision maker should switch from Option A to Option B in the fifth stage which is marked by the vertical line in stage five.

Figure 3.4: Results: Mere Risk Preferences



Notes: This figure illustrates the number of chosen high variance lotteries of the HL risk measure.

HL suggest a classification with regard to the degree of risk aversion based on the number of chosen high variance lotteries as depicted in Table 3.5. This would imply that our subjects are risk averse on average.[17]

[17]Gothmann and Nöth (2015) conduct several mere and modified HL-lotteries. The authors report similar results for their HL-lottery task.

Table 3.5: Degree of Risk Aversion

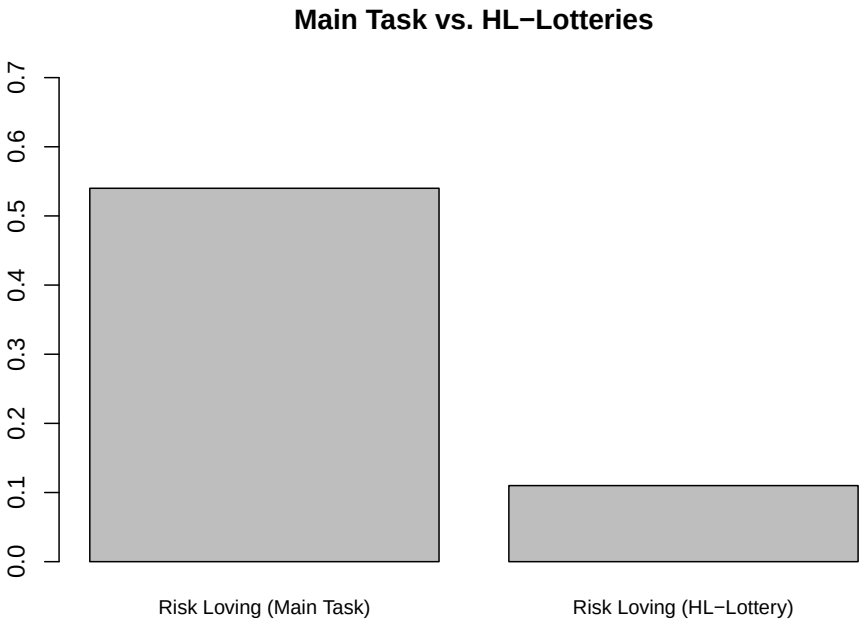
Number of Risky Choices	Degree of Risk Aversion
9 -10	highly risk loving
8	very risk loving
7	risk loving
6	risk neutral
5	slightly risk averse
4	risk averse
3	very risk averse
2	highly risk averse
0-1	stay in bed

Notes: Classification of risk aversion according to Holt and Laury (2002), p: 1649

According to this classification, we compare the distribution of risk lovers for both tasks: HL-lotteries and remuneration (main) task. Figure 3.5 depicts the results of both lotteries. The left bar (Risk Loving (Main Task)) represents the fraction of subjects who choose the high variance lottery of Option B for any stage. The right bar depicts the fraction of subjects who revealed risk loving preferences.

We identify 11 percent risk lovers for the HL-task and 54 percent for the main task. This finding is in line with Cole et al. (2015), who find that this behavior does not solely depend on mere risk preferences. The authors conduct an experiment and can induce their subjects to take risks by means of performance-based compensation schemes.

Figure 3.5: Results: DA-Induced Risk Taking vs. Mere Risk Taking



Notes: The left bar represents the fraction of risk taker for the remuneration task. The following three bars show the fraction of risk neutral and risk loving subjects, identified in the HL-task.

3.6.2 Robustness Checks

We were able to identify 18 out of 161 subjects who switched from Option A to Option B and back for the main task. Additionally, there were 8 subjects who started with choosing Option B and switched back to Option A. Since the main result is based on absolute figures, i.e., the fraction of subjects who take risk, and not on difference between treatments or tasks, our results remain robust if we exclude them.

The p-value for the Wilcoxon sign-test on the hypothesis that mere risk preferences have an impact on remuneration induced risk taking rises slightly to $p = 0.0894$.

3.7 Conclusion

Recent regulatory interventions in remuneration practices of European credit and investment banks are intended to provide less incentives for excessive risk taking than before the last financial crisis.

Our study focuses on a directive of the EU that requires credit and investments banks to cap variable compensation to 100 percent of the fixed salary (2013/36/EU, article 94). Based on studies of the EBA, we provide evidence that this rule led to a significant increase of fixed salaries on average.

Motivated by insights provided by Cole et al. (2015) that performance (i.e., risk) based compensation schemes can induce a biased perception of risks and thus excessive risk taking, we are interested in the question of whether this change in the structure of remuneration schemes has an impact on individual risk taking.

We conduct a risk taking experiment and show that more than half (54 percent) of our subjects reveal EUT-inconsistent choice behavior. By gradually increasing the fixed component of their total compensation, subjects switch from choosing a low variance lottery to a high variance lottery. Our results indicate that regulatory initiatives such as a bonus cap might induce bank managers to take on more risks instead of less.

Agreeing with Admati and Hellwig (2014), we recommend further research on the question whether simple rules (i.e., heuristics) can provide more robustness and less incentives for regulatory arbitrage such as the proposal of Bebchuk (2009) who suggests to fix bankers' pay.

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Chapter 4

Asset Management of German Foundations

4.1 Introduction

According to the Bundesverband Deutscher Stiftungen (2015), there were more than 21,300 foundations (BGB companies) in Germany at the end of 2015, whereof 95 percent exclusively and directly pursue non-profit and/or charitable objectives (here: non-profit) in the sense of §52 Abs. 1 S. 1 Abgabenordnung (AO). This norm stiulates that a foundation pursues non-profit objectives if and only if its activities are aimed at supporting the public on a material, mental or ethical level in an altruistic, exclusive and immediate way.[1]

Half of these foundations had been founded in the last 14 years (Wigand et al. (2015)). In total, they manage assets of more than 100 billion euros (Bundesverband Deutscher Stiftungen (2015)). Their expenditures amounted to 17 billion euros in 2014[2], whereof 5 billion euros resulted from current yields by their asset management activities (Bundesverband Deutscher Stiftungen (2014b)).[3]

Given how plentiful the investment activities of German foundations are, we focus on two questions. First, how should German foundations diversify their assets? Second, does German foundation law imply investment behaviors of foundation managers that can lead to welfare losses?

In Section 4.5, using stochastic simulations, we empirically estimate the welfare losses of German foundations based on data ranging from 2003 to 2012.

Our study is motivated by Hüttemann and Schön (2007). The authors highlight that the German legal literature predominantly defines asset management for foundations as an instrument for risk avoidance with a focus on safe and steady incomes.[4]

The focus of our considerations lies on small and mid-sized foundations (assets under management $< 10,000,000$ euros). We opt for this group because it is representative for nearly 95 percent of all foundations registered in Germany and represents up to 70 percent of the overall assets of all foundations (i.e., 70 billion euros). Furthermore, this group does usually not operate with a professional in-house asset management (Bundesverband

[1]For a history of German foundation law see Schauhoff (2010) who states the term 'gemeinnützig' was first mentioned at the end of the 18th century in the Preußisches Allgemeines Landrecht. According to that the management and the application of individual property was legally privileged as far as it was applied to promote the 'gemeinschaftlichen Besten der Gesellschaft'.

[2]These expenditures equate nearly six percent of the budget expenditures of the Federal Republic of Germany in 2014 (296,5 billion euros according to the Haushaltsgesetz 2014)

[3]One should mention that the cumulative property of all German foundations mentioned above is mainly based on book values. Thus, the relation of the cumulative property and total spendings from current yields is actually lower than five percent.

[4]See also Seifart et al. (2013) and Reuter (2012).

Deutscher Stiftungen (2014a)).

Our research question is closely linked to a persistent key obstacle that is widely discussed in scientific and practical studies: what is the optimal asset allocation?[5]

Such an optimal allocation must serve the following purposes: the sustainable preservation of assets and the generation of adequate current income in order to carry out the foundation's predefined goals. The main (practical) problem for the German non-profit sector is the still existing uncertainty about the questions which asset classes and asset allocations are covered by the German foundation law and what the guidelines of an efficient asset management strategy have to be derived from these norms (e.g., Hüttemann and Schön (2007) or Schröder (2010)).

Therefore, we start with the definition of a legal and financial framework for German foundations in the first two sections of this study. We do so by evaluating the current legal literature as well as court rulings in Section 4.2 and derive and discuss possible legal restrictions as one part of our legal and financial framework.

In Section 4.3, we discuss asset management strategies suggested by the literature. The main focus of this part of the framework lies on easy to implement and robust asset allocation strategies as suggested, for instance, by Jacobs et al. (2014) or Duchin and Levy (2009). The authors compare robust and easily implementable asset management strategies with different Markowitz-otimized portfolios and conclude that these sophisticated optimizations have no significant advantage compared to simple heuristics, such as $\frac{1}{N}$-strategies. These studies are part of a current body of literature which find analytical and empirical evidence that a wide range of simple decision rules can provide more robust returns than complex optimization models.[6]

To the best of our knowledge, there are no studies which combine legal and financial research in order to define an integrated framework for the asset management of German non-profit foundations. Schröder (2010) upon touches this area by proposing suitable asset classes for German foundations but lacks a concise strategy for their portfolio optimization.

The starting point of such an investigation should be an appropriate and specific measure for risk. We base our study on the corresponding considerations of Schröder (2010). Taking these suggested measures into account (risk-adjustment) we can show that a focus

[5]In this study we assume a foundation which tries to achieve its purpose(s) through autonomously generating capital gains from the foundation capital. Thus, we do not take additional capital flows such as external donations or endowment contributions into account.

[6]See DeMiguel et al. (2009) for a comprehensive overview.

on short-term and downside volatility can lead to inefficient asset allocations, which can be empirically observed. Once we have derived the legal and financial framework, we compare different empirical asset allocations with the suggested strategies (i.e., heuristics) by means of Monte Carlo simulations in Section 4.5.

We find that empirical asset allocation policies can be dominated by simple heuristics with regard to all risk measures. Thus, we provide evidence that empirical asset allocations can generate welfare losses of 40 to 90 percent of their (actual) returns due to asset management strategies with a focus on exaggerated risk avoidance.

4.2 Institutional (Legal) Framework

In this chapter, we discuss and derive a legal framework for the asset management of German non-profit foundations. We start with a description of the German foundation law, consisting of federal legislation plus the 16 separate laws on foundations of the German federal states. Since laws are usually subject to interpretation, we then provide an overview of relevant court rulings and their potential consequences.

4.2.1 German Foundation Law

Foundations are statutory corporations (§80 Abs. 1 Buergerliches Gesetzbuch (BGB)). In this section, we discuss relevant legal restrictions for the asset management of German foundations.[7]

Beside the distinction between federal law and that of the federal states, one can distinguish between civil and public foundation law. The civil legal framework is defined by §§80-88 BGB and §93 AktG. Within this range, the 16 federal state laws can further specify this framework.[8] The public law is defined in §§51-68 Abgabenordnung (AO). A differentiation between public and civil law is relevant because it implies different regulatory

[7]At this point one should mention, that the founder is authorized to determine the guidelines for the asset allocation within the foundation's statute. An example is the Alfred Toepfer Stiftung F.V.S. in Hamburg. In its statute, article 6 establishes that funds are to be invested into real estate and landed property in Europe. It is recommended to waive such requirements within the foundation statutes, because subsequent modifications are hardly possible since they would violate the founders intention in principle. Thus, guidelines for the asset management should be outsourced into investment policies. Particular attention should be paid to the fact that capital markets are subject to financial innovations. Thus, investment guidelines should be flexible enough to leave scope of action.

[8]In the case of contradictory federal and federal state regulations there is the principle that federal law takes precedence over state law according to article 31 of the constitution (Grundgesetz).

authorities, which will be discussed in the following three sections.

Germany's civil and public law for foundations provides two important guidelines for the asset management of German foundations. While the *civil* law is focused on the question to what extent a foundation manager has to maintain the original endowment, the public law incorporates restrictions on the use of current income (e.g., dividends interest payments) and the redistribution of funds between different asset classes.

Federal Civil Law (BGB)

The majority of the federal civil foundation law is laid down in §§80-88 BGB, which is supplemented by §93 AktG. According to §80 Abs. 2 S. 1 BGB a foundation is given legal endorsement if and only if the foundation is able to fulfill its goals in a sustainable manner.[9]

Schauhoff (2010) concludes that §80 BGB does not provide concrete recommendations for actions regarding the asset management of foundations. At the same time Hüttemann and Schön (2007) interpret this norm as the specification for the preservation of the endowment. The authors substantiate this main principle by emphasizing that the endowment must be invested efficiently and safely. Falk (2011) adds to this interpretation and argues that a foundation requires steady earnings in order to satisfy the intention of the founder, respectively of §80 Abs. 2 S. 1 BGB. Thus, one can summarize that §80 Abs. 2 S. 1 BGB constitutes two regulatory major principles of German foundation law: (1) the sustainable preservation of the endowment and (2) the generation of revenues in order to permanently fulfill the foundation's purposes.[10]

Theuffel-Werkhahn and Siebert (2013) define the restrictions for an asset manager negatively. Following their interpretation, the endowment must not completely invested in one type of assets only – neither in single stocks nor in saving accounts. Both strategies would violate the principles of precaution and economic efficiency which the authors derive from §80 Abs. 2 S. 1 BGB.

According to §93 Abs. 1 AktG, the so-called 'business judgment rule' has to be applied for managers of non-profit foundations as well. Organs (i.e., asset managers) of a foundation cannot be made liable for losses incurred if the have carefully considered all necessary

[9] §80 Abs. 2 S. 2 BGB defines an institution whose endowment can be used up (non-perpetual trust). The consumption of the endowment must be ensured for at least 10 years.

[10] The wording of §80 BGB is provided in Section A.3.1 of the Appendix.

information. Thus, according to §93 Abs. 1 AktG investments in a basket of single stocks selected by the foundation manager could violate the business judgment rule if the manager does not thoroughly analyze all available information about every single corporation that is being invested in. According to §93 Abs. 1 AktG one might argue that an investment in a basket of single assets (i.e., single stocks or single bonds) instead of broader based indices is subject to comprehensive documentation requirements.

Considering these interpretations of the federal civil law, one can summarize that extreme asset allocations would violate §80 Abs. 2 S. 1 BGB. Examples for extreme allocations could be investments which generate no revenues (e.g., precious metals) or would be speculative (e.g., single stock(s)).

Federal State Civil Law (Landesstiftungsgesetze)

The explicit statutory requirements regarding the principle of preservation of assets are stipulated in the foundation laws of the sixteen German federal states. These rules can be divided into four degrees of preservation as summarized in Table 4.1.

These degrees of preservation range from: 'the assets shall be kept undiminished on a permanent basis'[11] which obviously requires the preservation of assets in real terms, to 'the assets of the foundation must be maintained unimpaired if possible'[12], which provides a wide scope of action for the foundation's management. The majority of the federal state foundation laws contain the following wording: "the assets must be contained or contained unimpaired", which both can be interpreted as the preservation of assets in nominal terms (e.g., Reuter (2012)). Nevertheless, there is an ongoing and still open debate in the literature on the question whether one can interpret the term 'unimpaired' as 'in real terms' or 'in nominal terms' (e.g., Hüttemann (2014)).

According to this debate, one can find indications for the legislator's intentions when analyzing the introductory laws of the foundation laws of Hamburg and Sachsen-Anhalt. Both regulations suggest maintaining the foundation's assets in real terms.[13]

The legal literature (e.g., Hüttemann and Schön (2007)) directly derives from these principles that the assets of the foundation must be sufficiently diversified. We will

[11] §4 Abs. 3 foundation law Saxonia (August 7, 2004)

[12] e.g., §4 Abs. 2 foundation law Hamburg (December 14, 2005)

[13] The sample statute which is provided by the foundation supervisory authority in Hamburg even explicitly contains this requirement (see §3 Abs. 3 sample statute Hamburg (http://www.hamburg.de/justizbehoerde/stiftungen/4125446/downloads/)).

analyze and complement this abstract legal interpretation from a financial point of view in Section 4.3 since this strand of literature does not provide any concrete guidelines for asset management. The focus of the following financial investigation, therefore, is the question: how should a foundation diversify its assets?[14]

Table 4.1: Preservation Principles of the German Federal States

Scope of the Principle of Endowment Preservation	Federal State
The assets of the foundation must be maintained.	Baden-Württemberg, Sachsen-Anhalt, Schleswig-Holstein, Thüringen
The assets of the foundation must be maintained in an unimpaired way.	Bayern, Berlin, Bremen, Hessen, Niedersachsen, Nordrhein-Westfalen, Saarland
The assets of the foundation must be maintained in an unimpaired way if possible.	Hamburg, Rheinland-Pfalz
The assets shall be kept undiminished on a permanent basis.	Sachsen
No guidelines	Brandenburg, Mecklenburg-Vorpommern

Notes: This table is based on an evaluation of the Landesstiftungsgesetze of all German federal states. A German translation of the original passages can be found in Section A.3.2 of the Appendix. The relevant articles are provided in Section A.3.3.

[14]The RAG-foundation which is one of the largest foundations in Germany has a slightly diversified portfolio of assets. The foundation maintained assets of more than 18 billion euros at the end of 2014. With an interest of 67.9 percent the foundation is the largest stockholder of the Evonik group (ISIN DE000EVNK013), which corresponds with nearly 45 percent of the foundations endowment.

Most federal state foundation laws include additional principles for the organization of foundations asset management. These statements do not provide any clarifications for the operational asset management since they primarily clarify that the foundation's assets must be managed *economically* (Schröder (2010)).

Public Law (Fiscal Code)

According to §5 (1) number 9 KStG, non-profit foundations are exempt from taxes on income as far as they comply with the requirements of §§51-68 AO.[15]

The Fiscal Code contains no explicit guidelines about the question whether a foundation can lose the privilege of tax exemption in the case of a reduction of the original endowment. The prevailing view in the literature is that a decline of the original endowment caused by the asset management will generally not lead to foundations having their tax exemption revoked (e.g., Theuffel-Werkhahn and Siebert (2013), Falk (2011)).

The authors summarize that as far as the foundation operates a taxable economic business, losses of this section (i.e., commercial sphere) may not be compensated by funds of the non-material sphere.[16] The German Fiscal Code[17] provides explicit provisions regarding the management and the use of the property of the foundation.

First, we investigate the principle of the commitment of assets laid down in §55 (1) number 1 and number 4 AO. Therefore, funds of the foundation may only be used for purposes laid down in the statutes. Nevertheless, a foundation can only plow back profits in a restrictive manner. §55 (1) number 5 AO has a concrete and direct effect on the operational asset management. According to that central rule, the current income of a foundation has to be spent within the following year of the fund's inflow, exclusively usable for the foundation's purposes only (obligation of expenditure).[18] This also includes donations. Excluded from this principle is regular income from investments (i.e., interests, dividends). Not more than one third of the income from investments can be used to set aside as a free reserve (§62 (1) number 3 AO), i.e. for the preservation of the foundation endowment (in real terms). Additionally, gains realized from shifts can be placed in a restructuring reserve (Note 27 of the Fiscal Code Application Decree[19] regarding §55 AO).

Table 4.2 summarizes the legal options to transfer funds from one sphere of the foundation to another. This is relevant for the original endowment, reserves and current income. Free reserves and restructuring reserves are legislative vehicles to transfer current

[15]The tax exemption for revenues does not capture Value Added Tax, since there is no statutory provision for non-profit institutions by the Value Added Tax Act.

[16]The non-material sphere is the section of the foundation which is essential for the fulfillment of the foundation purpose. The (taxable) commercial sphere has a unique purpose: generating revenues for the non-material sphere (§14 AO).

[17]In German: Abgabenordnung (AO)

[18]This implies an obligatory use of funds within a maximum of two years (if the inflow occurred on January 1st)

[19]In German: Anwendungserlass zur Abgabenordnung (AEAO)

Table 4.2: Legal Classification of Foundation Assets

Possible Financial Reserves		
	The Principle of :	
Preservation	Locked Reserves applies for:	Obligation of Expenditure
original endowment	free reserves	current revenues
	⇔	
additional endowment[21]	free reserves	donations
	⇔	
appropriated reserves	restructuring reserves	appropriated reserves

Notes: This table shows the classification of foundations reserves in their entirety as it is defined in the German Fiscal Code (AO). By means of transfers or dissolution of reserves, funds can be transferred through all three possible legislative spheres (endowment, reserves and current revenues).

income to the endowment and vice versa. We will take this into account for the stochastic simulations of our asset management strategies discussed in Section 4.3.6.

Additional flexibility for newly established foundations is provided by §62 (4) AO. According to that rule, a foundation is authorized to transfer all of its revenues to the endowment fund in the year of its founding and additionally in the following three legal years.[20]

4.2.2 Current Jurisdiction

Particularly the question to what extent foundation managers can be held liable for losses might have a significant effect on their willingness to take risks. Thus, we discuss the relevant jurisdiction in order to define an operational framework. Hüttemann and Schön (2007) analyze three court decisions of the Bundesfinanzhof (BFH).[22] [23] [24] We extend this survey with current rulings of the previous years.

According to Hüttemann and Schön (2007), it can generally be assumed that the BFH, as well as the Bundesgerichtshof (BGH), do not take a decline in the assets of a foundation

[20]Since we do not distinguish between newly established and longer existing foundations for purposes of our study, we do not take this rule into account. Furthermore, §62 (4) AO obviously does not alleviate the problem of the preservation of assets by the admission to increase the original endowment.

[21]The principle of preservation does not apply for additional endowments if the founder has explicitly excluded his/her additional endowment from this principle.

[22]BFH v. 2.10.1968 I R 40/68 BFHE 93, S.522 ff.

[23]BFH v. 13.11.1996 I R 152/93 BStBl II 1998, S. 711 ff.

[24]FG Münster v. 10.12.2001 9 K 2537/98 K (juris)

as an occasion to state a breach of public foundation law. However, there are cases when a foundation manager can be held responsible for losses of the asset management. We identify two elements of these cases by evaluating the relevant court decisions, summarized in Table 4.3. The first one, in line with the findings of Hüttemann and Schön (2007), is a compensation of losses which were generated by the commercial sphere with funds of the non-material sphere. A commercial sphere can be established by investments which require an active management (Reuter (2012)). This could be the case, for instance, for direct investments in real estate due to the need of property and facility management (active management).

The other fundamental principle, one can derive from the latest jurisdiction, is that foundation managers cannot be held liable for losses caused by their asset management strategy if the have administered a sufficiently diversified portfolio of suitable assets. Thus, we will analyze this principle in the second part of our investigation (financial framework), taking as a starting point recent research on diversification strategies.

Table 4.3: German Court Decisions Regarding the Asset Management of German Foundations

Court	Guiding Principle(s)	Implications for Asset Management
BFH (13.11.1996 IR 152/93)	A loss which was generated out of the non-material sphere is not allowed to be compensated by funds of the non-material sphere.	Certain asset classes such as private equity are usually assessed as commercial activies by the German fiscal authorities (Reuter (2012)). These investments usually start with losses in the first periods[25], so that this investment class is not suitable as a single investment and should be pooled.
BGH (22.03.2011 XI ZR 33/10)	A derivative (i.e., interest rate swap) by itself is a bet.	The BGH highlights that a bank adviser has to document whether a swap does match with the risk profile of a town council. The customer must be informed that such an asset is a *bet*. The classification of a mere swap as speculation by the BGH might induce that a derivative *by itself*[26] is not an appropriate asset for a foundation.
OLG Oldenburg (8.11.2013 6 U 50/13)	A foundation manager is liable to make compensations for a loss induced by a higher than allowed stock exposure and a long period of losses without any adjustments[27]	The court assessed a breach of duty concerning a higher than permitted stock exposure. In addition, this decision implies that the foundation's assets must be diversified sufficiently.
BGH (20.11.2014 III ZR 509/14)	This verdict confirms OLG Oldenburg (08.11.2013 6 U 50/13)[28]	
FG Münster (11.12.2014 3 K 323/12 Erb)	A portfolio which includes 70 percent loans, granted to corporations which can not exhibit an investment grade, implies a contravention	The court recognizes that a low interest level requires a higher willingness to take risks in order to generate earnings for the mission of the foundation. However, 70 percent granted loans is defined as a cluster risk which is too high.
OLG Frankfurt (28.01.2015 1 U 32/13)	1. Foreign currency leveraged closed property funds[29] are not suitable for a German foundation	The court did not separate the closed property funds from the foreign currency loan. Thus, one can imply that *at least* foreign currency loans are a violation of the foundation law.
	2. Bonds with a fixed rate of interest[30] are safe investments and suitable for a German foundation in order to preserve the property.	A foundation portfolio of 100 percent (investments grade) bonds is not a violation of the foundation law.

4.2.3 Summary of Relevant Legal Restrictions

Based on current legal norms and court decisions, the main restrictions for the asset management of German foundations can be summarized as follows: Asset classes which can involve commercial activities such as closed real estate funds or direct investments in private equity are not suitable assets since they can cause losses which are not allowed to be compensated by the funds of the non-material sphere. Furthermore, assets which imply a bet, such as swaps or stocks of virtually insolvent companies (i.e., penny stocks) do not align with the purposes of German foundations.

Extreme asset allocations can represent an infringement of the principle of preservation. This could be, for instance, a portfolio with 100 percent commodities or 100 percent liquidity whereas foundation portfolios including 100 percent bonds or 100 percent stocks seem to be authorized under the German foundation law. Nevertheless, a foundation manager can be held liable for losses due to a poorly diversified asset allocation. Thus, the presentation and discussion of suitable diversification approaches is subject of the following section (financial framework).

4.3 Financial Framework

In this section, we discuss suitable asset management strategies for German foundations, given the legal framework we defined for the institutional (legal) framework before.

As derived in the preceding sections, there is one legal principle which has already been confirmed by German courts: a foundation manager cannot be held responsible for losses if the foundations assets are sufficiently diversified. Therefore, it is the objective of this part of our study to discuss suitable diversification strategies.

By means of stochastic simulations we compare empirical asset management strategies with strategies suggested by the (recent) literature. This analysis will provide us with information for our second research question: can the actual (empirical) investment behavior of German foundation managers lead to welfare losses? We start with an analysis

[26] So-called J-curve effect

[27] The assets of the foundation had fallen from 8.84 m euros in 2001 to 2.55 m euros in 2008. The manager was sentenced to reimburse 1.128 m euros.

[28] The BGH increased the claim for reimbursement by about 330,000 euros.

[29] In this case a German bank had suggested to invest into a closed property funds. This investment was financed by a loan in CHF due to the fact that the interest level in Switzerland was lower than in Germany.

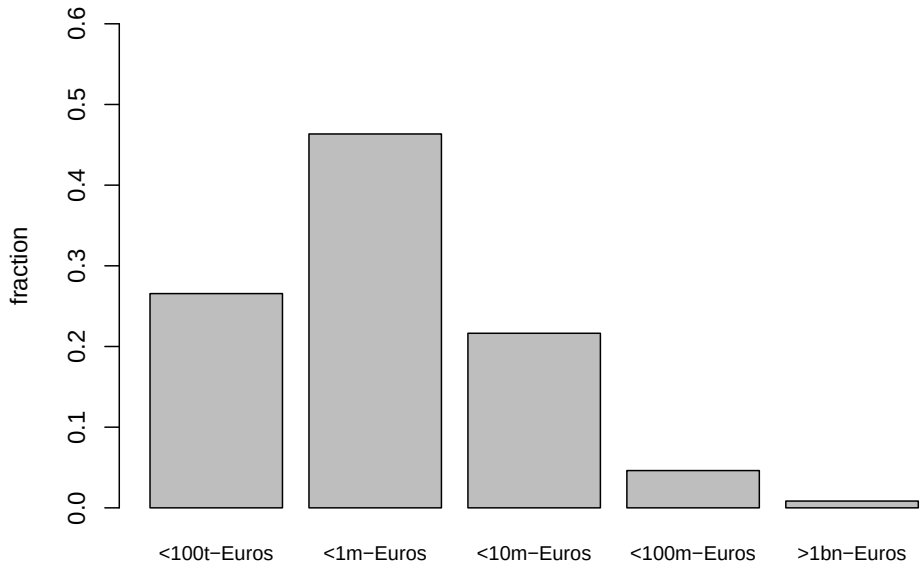
[30] One can imply that the court refers to investment grade bonds.

of empirical studies about the investment behavior of German foundations.

4.3.1 Empirics

In order to define an empirical benchmark for our stochastical simulations, we start by analyzing the empirical asset management strategies of German foundations. We narrow our focus further down to German foundations with assets under management of less than 10 million euros. According to the Bundesverband Deutscher Stiftungen (2014c) this class is representative for nearly 95 percent of all registered German foundations, as can be seen in Figure 4.1. These foundations have in common that they usually do not have a professional in-house asset management.[31] Thus, they are not subject to any requirements to publish financial statements. Representative information about their asset allocations and methods of portfolio management are rare.

Figure 4.1: German Foundation Properties in Classes



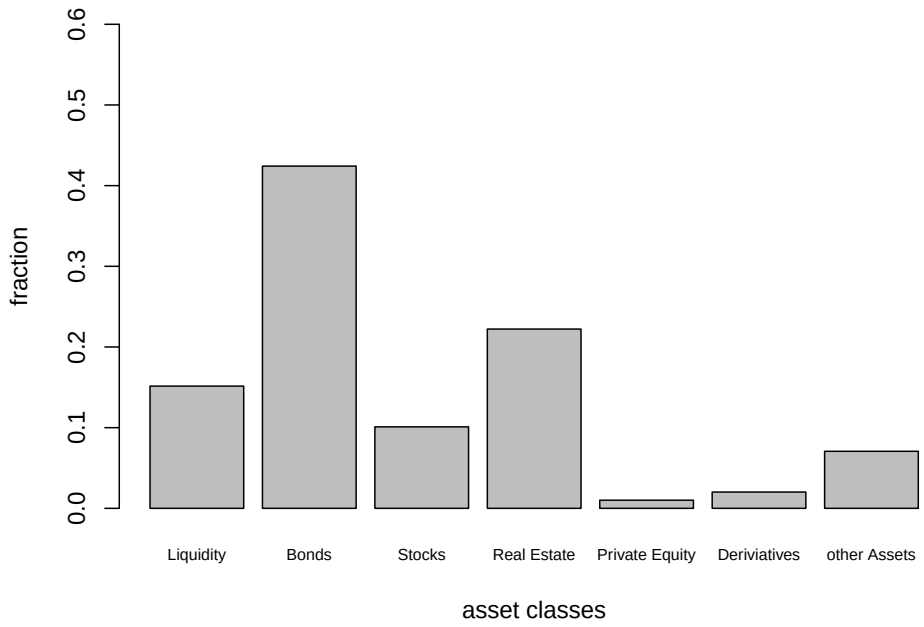
Notes: This survey is primarily based on book values (BVDS (2014).

[31] Imagine a foundation with 10 million euros under management. If this foundation realized an annual return of 4 percent before costs it would have only 400,000 euros to distribute for charitable objectives and administration (i.e., personnel) costs.

Representative Surveys - Asset Allocations

We use three representative surveys regarding the asset allocations of small and medium German foundations:[32] Heissmann (2004), Heissmann (2005) and Bundesverband Deutscher Stiftungen (2010). Figures 4.2 and 4.3 show the asset allocation of non-profit German foundations in 2005 and in 2009. Moreover, the survey of the Bundesverband Deutscher Stiftungen (2010) provides some additional information about the average return in 2007, 2008 and 2009 which was 4.07 percent (2007), 3.49 percent (2008), and 3.48 (2009) percent.

Figure 4.2: Distribution of Asset Classes 2005
Heissmann (2005)

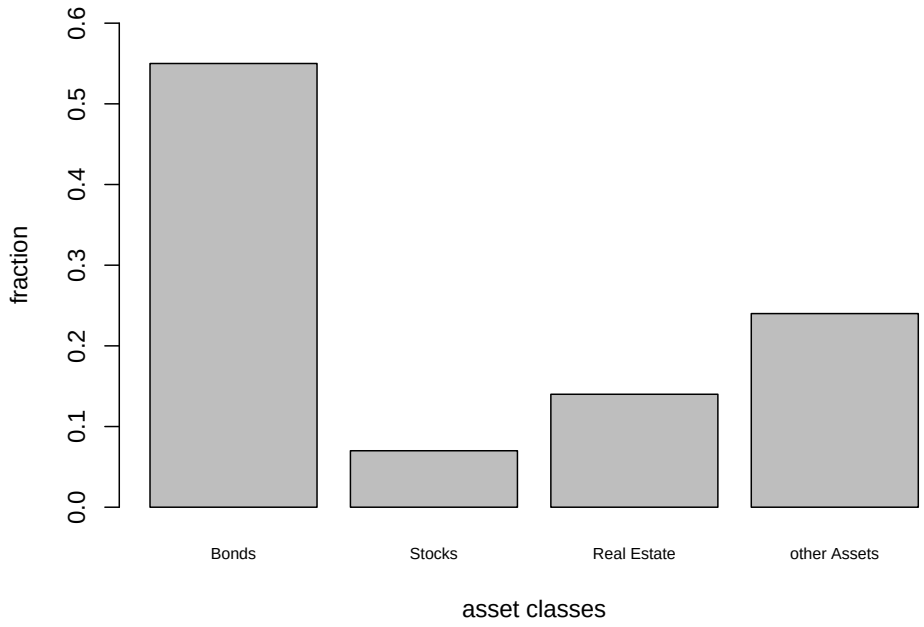


Notes: Other assets includes, for instance, hedge funds

Both figures illustrate an exposure to equities of eight to ten percent on average. Bonds and bank deposits account for the majority of the assets (60 - 80 percent). This pattern, which both studies show, is stable over a four-year period between 2005 and 2009.

[32] A study of Then et al. (2012) investigates the investment behavior of the biggest 30 German foundations that are not subject of our analysis as mentioned in the introduction.

Figure 4.3: Distribution of Asset Classes 2009
BVDS (2010)



Notes: Other assets includes liquidity, private equity, hedge funds and derivatives

How do German Mutual Funds for Foundations Diversify?

There are more than 39 open-end and exchange traded funds for German foundations according to a study of Haake (2013). Thus, one could analyze their investment strategies in order to receive a proxy for the investment behavior of German foundations. However, these funds represent only 4.3 billion euros under management. The largest fund, Deka Stiftungen Balance[33], has 1.4 billion euros under management.[34] According to the key investor information the fund's management has to comply with the following guidelines: an equity ratio up to a maximum of 30 percent and an investment focus on assets listed in Euro.[35]

[33]ISIN *DE*0005896864
[34]The total issue surcharge is 2 percent and has running costs of 1.17 percent in 2014.
[35]Source: https://www.deka.de/privatkunden/fondsprofil?id=DE0005896864

Empirical Implications and Benchmark

We have shown in the previous sections that German foundations on average mainly invest in fixed incomes (i.e., government bonds). Schindler (2003) summarizes this behavior as follows: a foundation manager can be held liable for losses only. In this context, Dimmock (2012) finds evidence that university endowments with higher background risk invest more in fixed income. Background risk is defined as the volatility of the foundation's non-financial income (e.g., donations). Moreover, assets listed in Euro are preferred.

We use the findings of the previous sections to derive our empirical benchmark. Due to the heterogeneity of German foundations, a single asset allocation does not seem to be appropriate and representative. Thus, our benchmark portfolios consist of an equity ratio from 0 to 15 percent stocks and 85 to 100 percent bonds, both asset classes noted in Euro.

4.3.2 Literature – Asset Management for (German) Foundations

As we presented in detail before, in order to preserve the assets of the foundation, a manager has to hold a sufficiently diversified portfolio. Our first research question implies this, i.e., how should German foundations diversify, given the legal restrictions we derive for the financial framework?

The literature on the question of how foundations should allocate their assets is dominated by a US-centric perspective. However, the legal restrictions US and German foundations have to adhere to differ significantly. A main difference is the obligation of American foundations to spend five percent of their endowment per year. Another difference is the restriction regarding potential asset classes. Whereas American foundations are allowed to invest in nearly all asset classes, i.e., private equity, German foundations are far more restricted in this respect.

The relevant literature on asset management can be divided into two strands. The first one was established by Merton (1993). The author suggests the implementation of three portfolios to preserve the foundation's endowment in real terms: a market portfolio, a risk-free interest rate portfolio, and a hedge portfolio. The function of the hedge portfolio is to compensate for an inflation-caused increase of spendings for foundation goals. Rudolf and Ziemba (2004) suggest complementing these portfolios by a liabilities hedge portfolio in order to additionally hedge the foundations costs (e.g., administration costs). In this context, Merton (1993) as well as Rudolf and Ziemba (2004) recommend investing in assets

that are negatively correlated with the liabilities, respectively expenditures.

As the small foundations we focus on are usually unable to manage rather complex hedge portfolios, this strand of literature is of limited use for our analysis. Thus, we choose another approach that is based on a second strand of literature, which compares static and dynamic value protection strategies.

Dybvig (1999) and Bajeux-Besnainou and Ogunc (2006) show analytically that a Constant Proportion Portfolio Insurance (CPPI) as suggested by Black and Jones (1987) can theoretically outperform static strategies such as a protective put. This is in line with Benninga and Blume (1985), who find evidence that static protection models (e.g., put strategies) can be only utility maximizing in incomplete markets (e.g., the prohibition of an investment in risk-free asset classes).

Under the restrictions of German foundation law, Schröder (2010) provides evidence by means of stochastic simulations that CPPI-strategies cannot add additional value to the results of simple buy and hold strategies.

Annaert et al. (2009) show analytically that CPPI can only add additional value under very restrictive assumptions such as unconstrained borrowing, which a German foundation is legally not allowed to comply with.

The major problem is determined by the design of such strategies and it is summarized, for instance, by Choie and Seff (1989). Given a level of preservation (i.e., protection) of the endowment, funds are shifted from a stock market portfolio (risky assets) to a riskless portfolio should the value of the foundation portfolio fall short of the protection level due to an increase of stock market volatility. Given the endless investment horizon of a foundation, a fee-based protection method such as CPPI which smoothes out (short-term) volatilities might be inappropriate for a German foundation. This assumption is in line with Black and Perold (1992).[36]

For this reason, we solely focus on mere static approaches.

To the best of our knowledge there are no comprehensive studies about the question of how German foundations should diversify their assets. In one of the rare contributions to this topic, Schröder (2010) compares different static allocation methods (buy and hold) between European and global stock and bond indices and finds no superior strategy.

[36]A modification of CPPI is the TIPP model (Estep and Kritzman (1988). In contrast to CPPI the protection level in the TIPP model rises as the portfolio return increases. This additionally increases the risk, that the funds of the foundation are shifted into the risk-free asset without ever having the possibility of participating in a recovery of the stock market.

In order to identify suitable allocation policies for German foundations, we continue with the definition of portfolio selection criteria in the following section.

4.3.3 Performance and Risk Measures - Foundation Utility Optimization

The aim of the following sections is to identify diversification strategies that are suitable for German non-profit foundations based on the literature discussed before. Thus, we need selection criteria that reflect, among other aspects, the legal restrictions we derive in section 4.2.

The primary legal criterion is the preservation of assets. This means that foundation managers face an asymmetric risk as they can only be held liable for losses of the endowment. In contrast, managers of mutual funds could also be called to account for a loss of profit regarding their benchmarks.

Fishburn (1977) suggests for these purposes the so-called Lower Partial Moments, which capture downside risks (i.e., the fall in value of the original endowment). As selection criteria we choose the Lower Partial Moments of degree zero (LPM_0), degree one (LPM_1), and degree two (LPM_2), that are defined as follows:

$$LPM_0 = E[(z - r)^0], \tag{4.1}$$

$$LPM_1 = E[(z - r)^1], \textit{ and} \tag{4.2}$$

$$LPM_2 = E[(z - r)^2], \tag{4.3}$$

with E as the expectations operator and r as observed (i.e., simulated) return and z as target return. In cases where the foundations endowment must be preserved in real terms, z must be greater than or equal to the rate of inflation. Equation 4.1 defines the lower partial moment of degree zero (LPM_0). This measure captures the frequency with which a specific diversification strategy *cannot* reach the target return (i.e., inflation rate). LMP_1 (Equation 4.2) quantifies the corresponding expected shortfall. The lower partial moment of degree two (Equation 4.3) is a measure for the volatility below the target return. We

use all three lower partial moments as risk measures and potential selection criteria.

A risk averse decision maker (i.e., foundation manager) would choose an asset management strategy which provides her with the highest return per unit risk. Thus, for conventional Markowitz optimization, the Sharpe Ratio (SR) (Sharpe (1966)) is usually applied. The SR is a risk-adjusted performance measure that captures excess return per unit risk and is defined as follows:

$$SR = \frac{r - z}{\sigma}, \tag{4.4}$$

where σ is the standard deviation of the expected return r. Since volatility above the target return z is not defined as risk for our purposes, we use a modification of the SR, suggested by Sortino and Price (1994), the Sortino ratio (SoR), which is defined as in Equation 4.5:

$$SoR = \frac{r - z}{\sqrt{LPM_2(z)}}. \tag{4.5}$$

The excess return is adjusted by the standard deviation below the target return.[37] The last selection criteria we use are the average current yield (CY) (e.g., dividends, coupons) and the absolute growth ($Growth$)[38] of the foundation's assets, so that the optimization problem for a German non-profit foundation is as follows:

$$\textbf{Minimize } LPM_0,\ LPM_1,\ LPM_2,$$
$$\text{and } \textbf{Maximize } SoR,\ CY,\ Growth.$$

4.3.4 Potential Asset Classes

We complete the definition of a financial framework for German foundations with the discussion of potential asset classes. Due to the scope of our research question, we do not focus on liquidity management as well. Thus, liquidity is not an autonomous asset class for our purposes.[39]

The German foundation law provides no clear guidelines which asset classes a foundation manager is permitted to invest in. However, we have shown that investments which imply

[37] As can easily be seen, this is defined as the square root of the lower partial moment of degree two (LPM_2).

[38] We assume a starting point of 100 euros for the purpose of the simulations.

[39] For a study about the asset-liability management see Bajeux-Besnainou and Ogunc (2006).

commercial activities could be fraught with risks due to the legal prohibition of loss compensation between the commercial and the non-material sphere. Therefore, we exclude direct investments which could establish a commercial sphere.

As starting point we take asset classes Jacobs et al. (2014) recommend for (German) private investors as shown in Table 4.4. With regard to the investment horizon, private investors and foundations are not very different. Both institutions have a longer investment horizon than institutional investors. Therefore, they do not have to focus on short-term market movements. In contrast to stocks, Jacobs et al. (2014) argue that the currency risk of bond portfolios needs to be controlled. That is why the authors restrict their analysis to Euro-denominated bonds. Since our focus is on easy-to-implement asset management strategies we follow their suggestion. The benchmark for each asset class is presented in the third column.[40][41]

Table 4.4: Asset Classes Suggested for Private Investors

Asset Class	Region	Benchmark
Stocks		
	Emerging Markets	MSCI Emerging Markets
	Eurozone	EURO STOXX
	North America	MSCI North America
	Pacific	MSCI Pacific
Bonds	Eurozone	iBoxx Euro Overall
Commodities	—	S&P GSCI Commodity TR

Notes: Asset classes and benchmarks suggested for private investors by Jacobs et al. (2014). The authors recommend an allocation of 60 percent stocks (worldwide), 25 percent bonds (noted in Euro), and 15 percent commodities.
There is no regional classification for commodities.

[40]The iBoxx Euro Overall is a capitalization-weighted index which contains government bonds and corporate bonds from the Eurozone listed in Euro (source: http://www.markit.com/Product/IBoxx).

[41]The Euro Stoxx Index is a subset of the STOXX Europe 600 Index with large-, mid- and small-size companies of 12 Eurozone countries (source: http://www.stoxx.com/index-details?symbol=SXXGT).

For a discussion of the fundamental suitability of the asset classes mentioned in Table 4.4 for the purposes of US or German foundations see Thaler and Williamson (1994) and Schröder (2010). Commodities are not taken into account in these studies. We take this class into consideration because Jacobs et al. (2014) find a slightly negative correlation with bonds and equity. We find this effect with bonds as well. Figure 4.4 shows the Pearson correlation coefficient for the asset classes discussed above for our estimation period (2003 - 2012).

From an ex-ante perspective, stocks are suitable for the diversification strategy of a foundation for two reasons. First, they provide direct participation in the productive capital which could thereby be a hedge against inflation. Second, dividends are current yields that a foundation manager can immediately apply for statutory purposes.[42]

As our focus is on small and medium foundations, we do not consider direct real estate investments. Such an investment could constitute a cluster risk. Schätz and Sebastian (2009) and Sebastian et al. (2012) analyze to what extent Real Estate Investment Trusts (REITs) could be a substitute for real estate. The authors show that especially for the long run (i.e., periods longer than 30 years) REITs exhibit a higher correlation with real estate than with stocks. For our estimation period we cannot find this effect in the data. This is in line with the studies of Sebastian et al. (2012). For this reason, we exclude REITs.

One might argue that open-ended real estate funds could be a substitute for direct real estate investments, too. We do not take these funds into account for their persistent problems with their own liquidity management (e.g., Fecht and Wedow (2014)).

We also do not incorporate private equity since German foundations are restricted to indirect investments in private equity. A direct investment could imply commercial operations which are generally not authorized by the German fiscal authorities. For hedge funds we could find no equivalent indices that satisfy the selection criteria suggested by Jacobs et al. (2014). Additionally, in their analysis the authors conclude that the diversification effect of alternative assets (i.e., hedge funds, private equity) is limited.

In view of the above we use the asset classes and corresponding indices as shown in Table 4.5 for our stochastic simulations.

[42]See Wachter (2013) for an overview about the volatility of dividends.

Table 4.5: Overview: Time Series, 2003 –2012

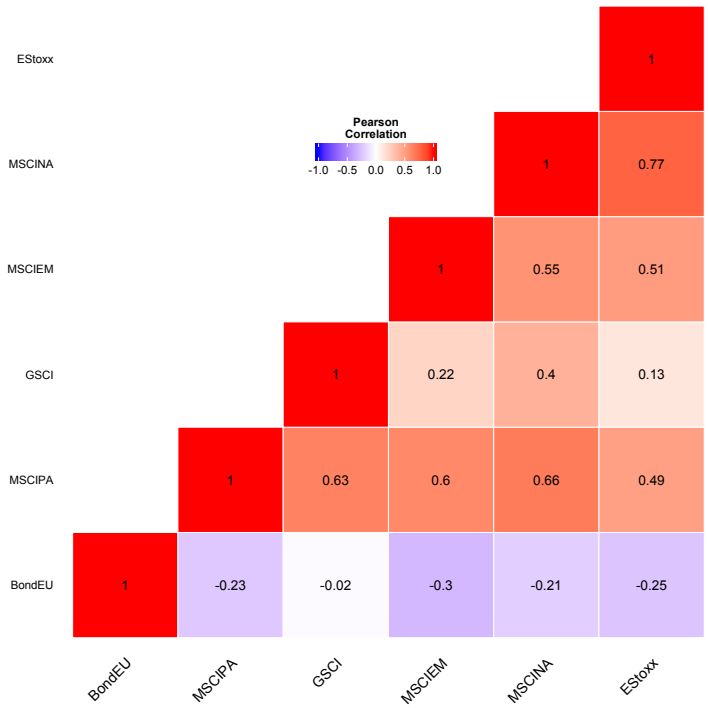
Asset Class/Region	Benchmark/Index	Characteristics
Stocks		
Emerging markets	MSCI Emerging Markets	Price and Total Return Index
Europe	EURO STOXX	Price and Total Return Index
North America	MSCI North America	Price and Total Return Index
Pacific	MSCI Pacific	Price and Total Return Index
Bonds		
Europe	iBoxx Euro Overall	Price and Total Return Index
Other asset classes		
Commodities	S&P GSCI Commodity TR	Total Return Index

Table 4.6: Descriptive Statistics for Asset Classes to be Considered (Estimation Period: 2003–2012).

Asset class/ Region	Interests-/Dividend-Payments	Price Return	Total Return	Standard Deviation
Stocks: regional indices				
Emerging Markets	2.70%	9.67%	12.37%	20.35%
Europe	3.22%	0.50%	3.72%	22.08%
North America	2.00%	1.80%	3.80%	21.30%
Pacific	2.29%	1.33%	3.62%	20.26%
Bonds: Regional Indices				
Europe	4.14%	0.46%	4.60%	3.23%
Commodities	-	-	0.61%	24.26%

Notes: Dividend- and interest-payments are measured by subtracting the return of the price index from the return of the total return index.

Figure 4.4: Pearson Correlation of Relevant Assets



Notes: Pearson correlation coefficients for relevant asset classes

4.3.5 Target Return and Interest Rates

The central parameter for our quantitative analysis is the target return. This parameter is related to the question whether German foundations have to preserve their assets in real or in nominal terms. The academic debate has come to the conclusion that a foundation is obliged to aspire a perservation in real terms to avoid a lingering erosion of the profitability and thus a reduced capability of sponsoring charitable objectives in a sustainable manner (e.g., Reuter (2012)). Figure 4.5 shows the inflation rate for our estimation period in relation to the risk-free interest rates.

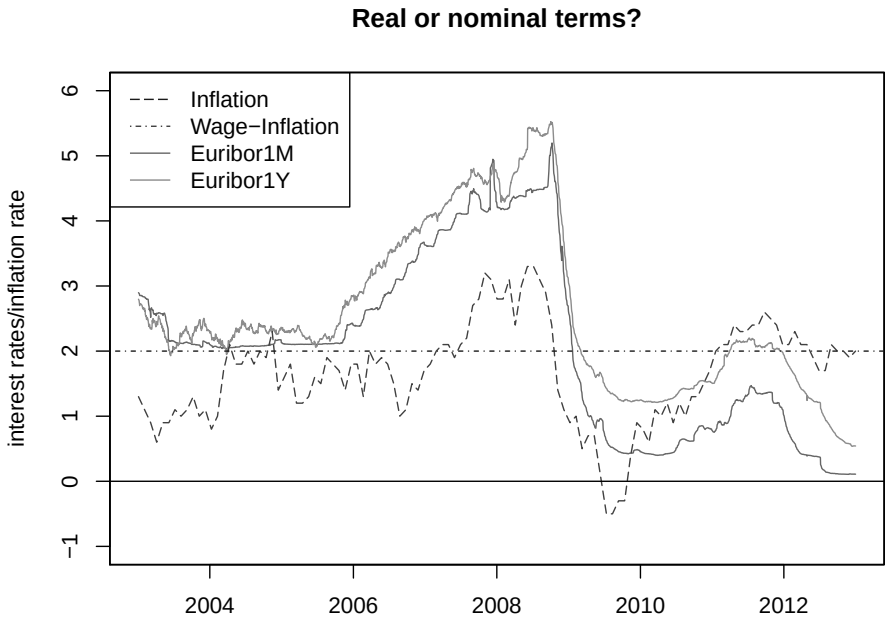
As can be seen in the graph, the German inflation rate is quite volatile and ranges between zero and three percent within the estimation period (2003 - 2012). However, we choose a fixed rate of two percent as target return. We do this because expenditures of German foundations are mainly determined by personnel expenses.[43] For that reason we do not take the price increase of a representative basket of commodities into account but

[43] According to the Bundesverband Deutscher Stiftungen 56.6 percent of German foundations purposes which are mainly driven by personnal costs (Bundesverband Deutscher Stiftungen (2014a)): 28.8 percent social purposes, 15.4 percent eduction, 12.4 percent science.

the increase of personnel expenses in Germany. According to the Hans Boeckler Stiftung, German wage agreements add up to 2.08 percent per year over all branches from 2003 to 2012 (Boeckler (2013)).

Figure 4.5 also illustrates the interest-rate-inflation scenario the data for our Monte Carlo simulations are estimated from.

Figure 4.5: Interest Rates, Price and Wage Inflation – 2003 - 2012



Notes: Short-term and medium-term interests are plotted against the average wage inflation rate and the inflation of German consumer prices.

4.3.6 Diversification Strategies

Carstensen (2003) (also Carstensen (1996)) shows, that mere money market strategies cannot provide a preservation of assets. Thus, we do not take these strategies into account, nor do we use them as benchmarks.[44]

With regard to the question of optimal asset allocation (i.e., diversification), there is extensive literature on the comparison of sophisticated Markowitz optimization methods with simple heuristics.

[44]This is unnecessary due to the construction of our risk and performance measures which include by definition the real interest rate as benchmark.

Several studies provide evidence, that simple decision rules like, for instance, $\frac{1}{N}$ can provide superior and/or more robust results than a wide range of mean-variance (Markowitz) models (e.g., Duchin and Levy (2009), DeMiguel et al. (2009), Tu and Zhou (2011) or Jacobs et al. (2014)).[45]

In contrast, Kritzman et al. (2010) find evidence that optimized allocations can outperform equally-weighted portfolios. The authors argue that several studies showing the opposite used samples that were too small. This criticism can be rejected by the work of Jacobs et al. (2014), since the authors use market data from 1973 onwards. Furthermore, they compare more than 500 heuristics with a wide range of Markowitz-models and come to the conclusion that a stock market portfolio with the respective Gross Domestic Products as weights for the stock market regions: Europe, Northern America, Emerging Markets and Pacific can beat all Markowitz models.

Markowitz-optimized portfolio weights are sensitive to changes in the input parameters that can be analytically derived (e.g., Poddig and Unger (2012)). According to Unger (2015), this could have been one reason for the failure of these portfolios in the financial crisis when events such as a breakdown of an investment bank tumbled previous correlations and therefore the input parameters of existing risk models.[46] As an outcome of the financial crisis, the author highlights that by now, there are up to 17 definitions of robustness regarding the sensitivity problem in the literature by.

For our purposes we focus on two: worst-case robustness and structural robustness (Poddig and Unger (2012)). Worst-case robustness means that, for instance, in the case of a market slump, the chosen diversification strategy will provide better results than other possible strategies. Structural robustness stands for an insensitivity to the input parameters (e.g., Unger (2015)). It is obvious that there is a trade-off and no single solution for this problem. Nevertheless, we will take these considerations into account when comparing different diversification strategies. Diversification heuristics as discussed in section 4.3.2 are at least structurally robust by their nature (i.e., $\frac{1}{N}$ or GDP-weighted).

Table 4.7 provides an overview of all diversification approaches (i.e., heuristics) we take into account. A more detailed discussion of these models is given in the following sections.

[45] Another strand of literature is concernced with the fundamental problem of the statistical misinterpretation of results (e.g.,Ioannidis (2005) and Harvey et al. (2015).

[46] See Reinhart and Rogoff (2009) for a historical and financial analysis of the financial crisis.

Table 4.7: Diversification Approaches

	A: Markowitz-Based Optimization
1	Minimum Variance Approach with Short Sales Constraints
	B: Heuristic Models
2	Euro-Bonds with weights of 0 - 100 percent and GDP-weighted stock portfolio (0-100 percent)
3	Euro-Bonds with weights of 0 - 100 percent and $\frac{1}{N}$-weighted stock portfolio (0-100 percent)
4	models 3 and 4 with a fraction of commodities instead of stocks (0 - 100) percent)

Notes: This table summarizes the diversification methods we take into account for the stochastic simulations. Weights will be adjusted in steps of five percent.

Markowitz-based Approaches

Given the sensitivity problem discussed before, we focus on the Minimum-Variance (MV) portfolio as the only representative for Markowitz-optimized portfolios. There is a strand of literature which provides evidence that risk based optimized portfolios are worst-case and structurally more robust than return-based approaches such as the Mean-Variance framework (e.g., Allen (2010) and Lee (2011)).

Heuristics

For our purposes, the $\frac{1}{N}$ allocation of the equity component (e.g., Duchin and Levy (2009)) is the first diversification heuristic which has been extensively investigated. In the context of this study, a $\frac{1}{N}$ allocation means that each geographic equity region (Europe, Northern America, Emerging Markets, and the Pacific) is weighted equally (i.e., $\frac{1}{4}$). However, Jacobs et al. (2014) find evidence that their suggested GDP-weighted approach provides slightly better results. Thus, we take both heuristics into account. In the sense of worst-case robustness, a $\frac{1}{N}$ diversified portfolio might be more robust than a GDP-weighted one due to an equal dependence on every stock region.[47]

[47]However, we are also aware of the fact the stock markets worldwide are by now highly correlated.

Rebalancing

Given a static allocation approach one has to decide how often the original asset weights have to be rebalanced. According to Dichtl and Wambach (2014) neither too frequent rebalancing nor infrequent rebalancing strategies are efficient due to a trade-off between transaction costs and the advantage of the original asset allocation. The authors find evidence that an adjustment to the initial weights once a year is an appropriate approach. The same is suggested by Jacobs et al. (2014).

4.4 Quantitative Analysis

In this section, we discuss the technical aspects of our analysis and subsequently present the results. The aim of our study is to test diversification strategies which we derived in section 4.3.6 by means of stochastic simulations and the comparison with a range of empirical benchmark portfolios. Subsequently, we want to find out whether there are welfare losses due to inefficient diversification approaches, using a range of representative empirical benchmarks.

4.4.1 Simulation Method and Design

We analyze and compare the diversification strategies suggested in section 4.3.6 by running Monte Carlo simulations. These simulations generate continuously compounded portfolio returns ($d(lnS)$), on the basis of a Geometric Brownian motion (Hull (2011)) which is identical to the process Black and Scholes (1973) use for their option pricing model.

$$d(lnS) = (\mu - \frac{\sigma^2}{2})dt + \sigma dz \tag{4.6}$$

Since we use different assets for each diversification strategy that are more or less correlated, we have to incorporate these correlations. We do this by a Cholesky-transformation of the correlation matrix.[48]

We are aware of the fact that Monte Carlo simulations are based on the assumption of idealized asset markets. This means that structural phenomena such as "fat tails" and autocorrelations are not incorporated into this model.[49]. In particular, by estimating the

[48]See, for example Poddig (2000) for a detailed discussion of this method.
[49]See Detemple et al. (2003) for a detailled discussion.

input parameters from historical data (expected returns, volatilities, and corresponding correlations of the asset classes), the choice of the estimation period has a substantial influence on the results of the simulations. Nevertheless, Monte Carlo simulations are still an appropriate means for the simulation of asset prices (e.g., Detemple et al. (2003)). The mentioned weaknesses are reduced by the choice of a suitable estimation period (basic scenario) and by a large set of robustness checks. In most studies, these robustness checks include the separation of the basic scenario into subscenarios which makes it possible to investigate the influence of specific events on the results.

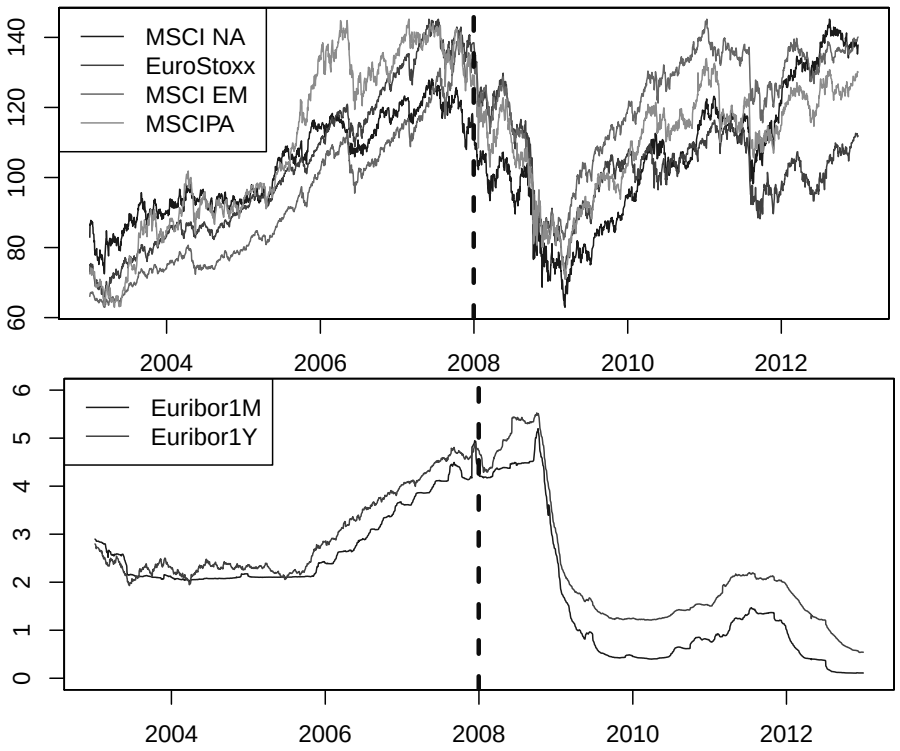
We estimate the input parameters for our basic scenario from 1 January 2003 to 31 December 2012. As can be seen in the upper graph of Figure 4.6 this period includes two significant price drops in the stock market. The first market slump coincides with the announcement of the insolvency of Lehman Brothers Holding Inc. in 2008 which marked the first escalation of the financial crisis. The second decline in 2011 took place after a potential exit of Greece from the Eurozone had been announced. Furthermore we exclude years before 2003 for two reasons. First, the period of 2001 - 2002 is mainly characterized by an additional market slump: the meltdown of the so-called New Economy. Second, before the introduction of the Euro, European investors were faced with extensive currency risks. We also do not consider years after 2012 because since then, particularly bond yields are being being distorted by quantitative easing of the European Central Bank and the Federal Reserve Bank from that time on (e.g., Lerven (2016)).

According to the aim of our study to find diversification strategies for a sustainable preservation of assets, the chosen period provides a sufficient number of events to test the analytically derived strategies.

Without anticipating the results of the quantitative analysis, one can see from the lower graph of Figure 4.6 that this period has two events we will use as a robustness check. One can see two trends in the interest rate level; a pronounced increase until the end of 2007 and a decrease from the beginning of 2008. Thus, we test the suggested diversification strategies for three market scenarios: a basic scenario with two market slumps and two subscenarios with an increasing and a decreasing level of interest rates. We do not extend the robustness checks to the end of 2015 in order to investigate the influence of a historical low interest rate level for the reasons mentioned above and because this period is too short (three years) to get stable results.

We run 15,000 iterations for each (sub)scenario and diversification strategy.[50] We rebalance the weights of every asset class once a year as discussed in Section 4.3.6 and assume rebalancing costs of ten basis points as suggested by the literature (e.g., Dichtl and Drobetz (2011)).

Figure 4.6: Basic (2003 - 2012) - and Subscenarios (2002 - 2007 and 2008 - 2012)



Notes: Subscenarios: 2003 - 2007 and 2007 - 2012

4.4.2 Markowitz Optimization - Minimum Variance

The analytically derived weights for the Markowitz efficient portfolio with the lowest variance (MV portfolio) are presented in Table 4.8. Theses weights are in the range of the empirical allocations (85-100 percent bonds, 0-15 stocks). One might argue that this is due to the asymmetrical incentives the foundation law provides. The priority on the preservation might induce the avoidance of risk, which is basically represented by volatility.

[50] According to the literature (e.g.,Pagan (1996), one should get stable results for at least 10,000 iterations.

Table 4.8: Weights of the Minimum Variance Portfolio

iboxx	Euro Stoxx	MSCINA	MSCIEM	MSCIPA	ReitsG	GSCI
0.9	0.04	0.02	0.03	0.01	0	0

4.4.3 Heuristics

The designs of the heuristic approaches are virtually self-explanatory. For all models we start with an allocation of 100 percent Euro bonds which we replace by stocks or other assets (e.g., commodities) in steps of five percent. If we include commodities, we replace stocks by steps of five percent.

4.5 Simulation Results

In this section, we present and discuss the results of the Monte Carlo simulations of the suggested diversification strategies. We begin with the presentation of the results for the basic scenario including all suggested diversification strategies in section 4.5.1 and conclude this section with robustness checks in section 4.5.9. We present and discuss results for a one-year- and a five-year-window as suggested by Schröder (2010).[51]

4.5.1 Basic Scenario

For the basic scenario, we estimated the input parameters from 2003 to 2012. This period includes two equity market slumps and a distinct rise as well as a strong decrease in the interest rate level.

4.5.2 Benchmark Portfolio(s)

The results for the benchmark portfolios with a range of 100 percent to 85 percent Euro bonds are provided in Table 4.9. The left column contains the proportion of bonds of the whole portfolio. *Growth* is the absolute gain of the original endowment which is standardized to 100 euros. The third column contains the (average) current revenues (e.g., dividends) per year.

[51] German tax authorities evaluate the financial status of foundations on an annual basis - whereas a five-year-window is commonly used to asses asset manage strategies in the literature.

The probability of the assets being preserved after five years is 45 percent ($1 - LPM_0$) for a portfolio with 100 percent Euro bonds whereas the probability rises about three percent to 48 percent for a portfolio which additionally includes 15 percent Euro stocks. On a five-year investment horizon, the 90 percent bonds portfolios dominate all other benchmarks. Thus, it is noteworthy to point out that even a foundation manager whose utility function is solely determined by the measures for risk (i.e., LPM_0, LPM_1 and LPM_2) should include a fraction of at least 10 percent of stocks.

Table 4.9: Results of the Benchmark-Portfolio (after one and five years)

Bonds(in %)	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
Results after one year						
100	1.60	2.79	0.55	1.60	2.67	-0.14
95	1.73	2.76	0.54	1.41	2.39	-0.11
90	1.83	2.73	0.53	1.41	2.42	-0.06
85	1.97	2.70	0.52	1.57	2.69	-0.01
Results after five years						
100	8.26	2.99	0.62	4.54	7.02	-0.31
95	8.86	2.97	0.59	3.89	6.16	-0.25
90	9.46	2.95	0.57	3.69	6.02	-0.16
85	10.06	2.93	0.53	3.90	6.52	-0.05

4.5.3 Minimum Variance Portfolio

The results of the MV-portfolio are presented in Table 4.10. This allocation only differs from the corresponding (90 percent bonds) benchmark portfolio in that the stock component is globally diversified. The effect is a domination for all performance and risk measures of the MV portfolio in contrast to the corresponding benchmark with 90 percent bonds.

Table 4.10: Results of the MV-Portfolio (after one and five years)

Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
results after one year					
2.17	2.65	0.48	1.08	1.97	0.09
results after five years					
11.25	2.90	0.48	2.48	4.56	0.15

4.5.4 Heuristics - Euro Investments

Figure 4.7 provides the results for exclusive Euro-portfolios for a five-year investment horizon and it illustrates the trade-off between risk and performance measures.[52] These allocations include Euro bonds which are represented by the iboxx Euro Overall as suggested by Jacobs et al. (2014) and stocks which are represented by the Euro Stoxx. We start with an allocation of 100 percent bonds which we replace by stocks in steps of five percent.

The probability for a preservation of assets in real terms measured by $1 - LMP_0$ varies between 39 percent for an equity ratio of zero percent and 50 percent for ratios between 35 and 65 percent. The main result of these simulations is that a foundation manager who wants to maintain her assets in reals terms would hold at least 10 percent stocks and probably not more than 20 percent. Thus, for exclusive Euro-investments the benchmark portfolios can be an efficient allocation.

4.5.5 Heuristics - GDP-Weighted Stocks

The effect of a global diversification of the stock component with GDP-weighted region-specific indices as suggested by Jacobs et al. (2014) is provided in Figure 4.8 and Table 4.12. The probability for the preservation of assets is highest (69 percent[53]) for equity ratios of 50 to 70 percent.

4.5.6 Heuristics - Equally-Weighted Stocks

The results for the portfolios with a $\frac{1}{N}$-weighted stock component are slightly inferior to the GDP-weighted heuristic. These findings provided in Table 4.13 are in line with the simulation results of Jacobs et al. (2014). Nevertheless, Figure 4.9 illustrates that this heuristic exhibits the same pattern as the GDP-approach. Adding worldwide diversified (i.e., GDP- or $\frac{1}{N}$-weighted) stocks to a 100 percent Euro bond portfolio leads to a decrease of LPM_0 up to an allocation of 70 percent bonds and 30 percent stocks. From this level on, (potential) additional growth of the foundations assets are accompanied by an increase in the downside risk measures.

[52] From this point we provide the long-term (5 years) results.
[53] This implies a $LPM_0 = 0.3136$.

Figure 4.7: Results Euro-Investments (five years)

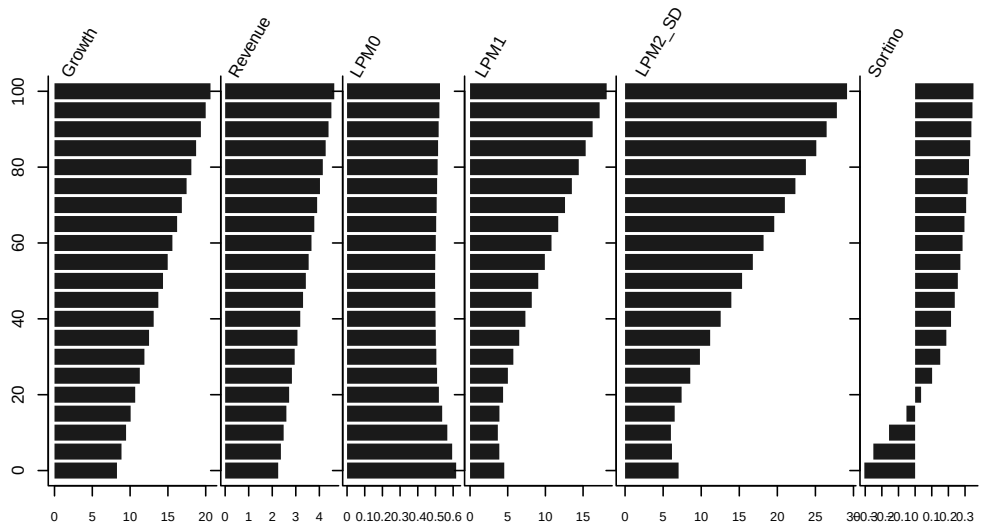


Table 4.11: Results Euro Investments (five years)

Bonds (in %)	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
100	8.32	2.98	0.61	4.52	7.01	-0.30
95	8.86	2.97	0.59	3.88	6.16	-0.25
90	9.46	2.96	0.57	3.69	6.02	-0.15
85	10.07	2.93	0.54	3.90	6.52	-0.05
80	10.67	2.91	0.52	4.38	7.42	0.04
75	11.28	2.89	0.51	5.02	8.56	0.10
70	11.89	2.87	0.51	5.74	9.83	0.15
65	12.50	2.84	0.50	6.53	11.18	0.19
60	13.11	2.83	0.50	7.35	12.55	0.21
55	13.73	2.80	0.50	8.19	13.96	0.24
50	14.35	2.78	0.50	9.05	15.37	0.26
45	14.98	2.76	0.50	9.92	16.78	0.27
40	15.59	2.73	0.50	10.81	18.19	0.29
35	16.21	2.70	0.50	11.70	19.59	0.30
30	16.84	2.69	0.51	12.60	20.99	0.31
25	17.47	2.66	0.51	13.51	22.37	0.32
20	18.10	2.63	0.51	14.42	23.75	0.32
15	18.73	2.61	0.51	15.34	25.12	0.33
10	19.36	2.59	0.52	16.27	26.47	0.34
5	20.00	2.56	0.52	17.19	27.82	0.34
0	20.63	2.53	0.53	18.13	29.16	0.35

Figure 4.8: Results GDP-Weighted Stocks Components (five years)

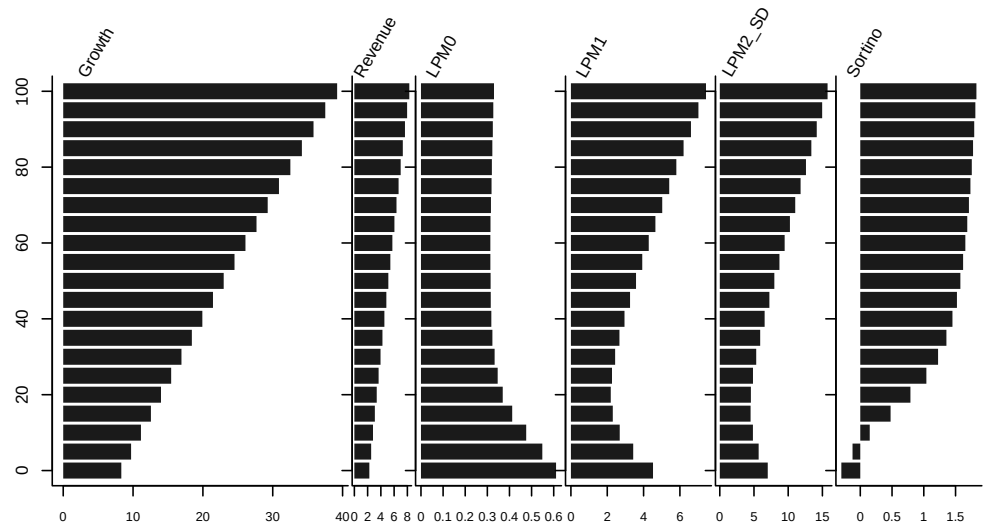


Table 4.12: Results GDP-Weighted Stock Components (five years)

Bonds (in %)	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
100	8.32	2.98	0.61	4.52	7.01	-0.30
95	9.72	2.96	0.55	3.43	5.68	-0.12
90	11.33	2.93	0.48	2.69	4.84	0.14
85	12.56	2.90	0.41	2.30	4.60	0.48
80	14.00	2.87	0.37	2.19	4.54	0.79
75	15.46	2.84	0.35	2.26	4.85	1.04
70	16.93	2.80	0.33	2.43	5.32	1.22
65	18.42	2.77	0.32	2.67	5.90	1.36
60	19.92	2.74	0.32	2.95	6.55	1.45
55	21.44	2.70	0.32	3.25	7.25	1.52
50	22.98	2.67	0.31	3.58	7.98	1.58
45	24.53	2.63	0.31	3.93	8.72	1.62
40	26.09	2.59	0.31	4.28	9.48	1.65
35	27.68	2.55	0.31	4.65	10.25	1.68
30	29.28	2.51	0.31	5.03	11.03	1.71
25	30.89	2.47	0.32	5.41	11.81	1.73
20	32.52	2.43	0.32	5.80	12.60	1.76
15	34.17	2.38	0.32	6.20	13.38	1.78
10	35.82	2.34	0.32	6.61	14.18	1.79
5	37.52	2.29	0.33	7.02	14.96	1.81
0	39.32	2.24	0.33	7.43	15.76	1.82

Figure 4.9: Results $\frac{1}{N}$-Weighted Stocks Components (five years)

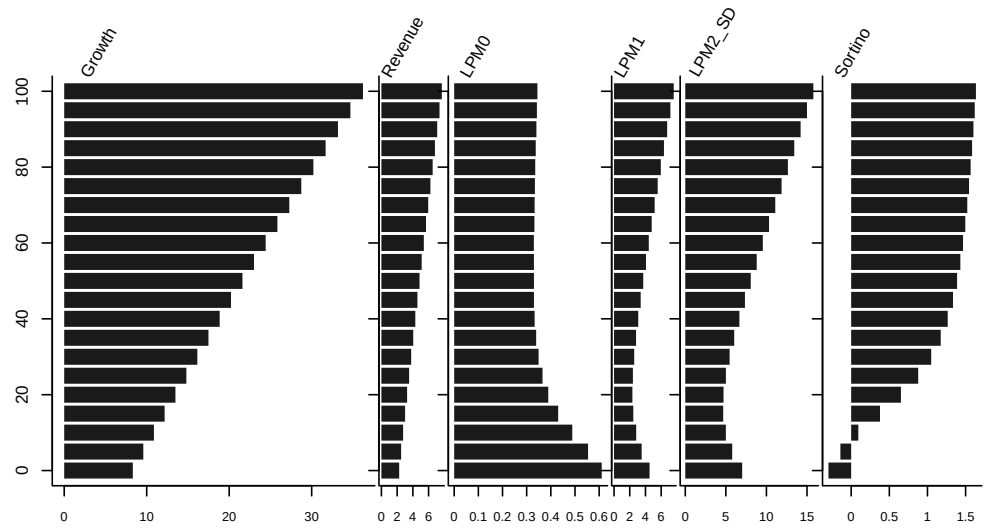


Table 4.13: Results $\frac{1}{N}$-Weighted Stock Components (five years)

Bonds (in %)	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
100	8.32	2.98	0.61	4.52	7.01	-0.30
95	9.59	2.96	0.55	3.51	5.78	-0.14
90	10.88	2.92	0.49	2.81	5.00	0.09
85	12.17	2.89	0.43	2.45	4.67	0.37
80	13.48	2.86	0.39	2.34	4.71	0.65
75	14.81	2.82	0.37	2.40	5.01	0.88
70	16.13	2.79	0.35	2.57	5.46	1.05
65	17.48	2.75	0.34	2.80	6.01	1.17
60	18.84	2.72	0.33	3.08	6.67	1.27
55	20.22	2.68	0.33	3.39	7.35	1.33
50	21.61	2.64	0.33	3.71	8.07	1.39
45	23.01	2.60	0.33	4.06	8.81	1.43
40	24.43	2.56	0.33	4.42	9.56	1.46
35	25.84	2.52	0.33	4.79	10.31	1.49
30	27.28	2.48	0.33	5.16	11.09	1.52
25	28.74	2.43	0.33	5.55	11.86	1.55
20	30.22	2.39	0.34	5.94	12.64	1.56
15	31.68	2.35	0.34	6.35	13.42	1.58
10	33.18	2.30	0.34	6.79	14.21	1.61
5	34.69	2.25	0.34	7.17	14.99	1.62
0	36.21	2.20	0.34	7.59	15.78	1.63

4.5.7 Commodities

Table 4.14 summarizes the simulation results for different commodity ratios: 5, 10, and 15 percent.[54] For reasons of clarity, we provide the results for all three ratios in steps of 10 percent. We can find the following effects: the inclusion of commodities into a foundation's portfolio can lead to decreasing returns, increasing volatility and decreasing current yields. Thus, based on these results, commodities cannot add value to the asset management of German foundations.

Table 4.14: Results GDP-Weighted Stocks and Commodities (five years)

Bonds (in %)	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
5 Percent Commodities						
90	10.22	2.82	0.52	3.21	5.49	-0.03
80	13.04	2.76	0.40	3.21	5.65	0.57
70	16.16	2.70	0.34	2.42	5.35	1.04
60	19.47	2.73	0.33	2.55	6.49	1.36
50	22.34	2.56	0.32	2.96	7.85	1.52
40	25.58	2.48	0.32	3.56	9.33	1.63
30	28.83	2.38	0.32	4.45	10.85	1.69
20	32.48	2.31	0.33	4.96	12.43	1.73
10	35.46	2.22	0.33	5.72	13.93	1.85
10 Percent Commodities						
90	9.22	2.71	0.57	4.31	6.86	-0.17
80	12.23	2.65	0.45	3.51	5.91	0.38
70	15.13	2.58	0.38	2.96	5.99	0.82
60	18.18	2.51	0.35	3.12	6.78	1.14
50	21.11	2.43	0.33	3.71	8.01	1.35
40	24.48	2.36	0.32	4.33	9.40	1.49
30	27.73	2.27	0.32	5.02	10.87	1.59
20	31.06	2.18	0.33	5.75	12.45	1.67
10	34.45	2.09	0.33	6.51	13.92	1.72
15 Percent Commodities						
90	9.22	2.71	0.57	4.31	6.86	-0.17
80	11.14	2.53	0.50	4.05	7.04	0.10
70	14.10	2.47	0.41	3.54	6.97	0.54
60	17.13	2.39	0.37	3.63	7.40	0.91
50	20.23	2.32	0.35	4.01	8.44	1.16
40	23.39	2.24	0.34	4.56	9.70	1.33
30	26.62	2.15	0.33	5.20	11.08	1.46
20	29.92	2.06	0.33	5.88	12.53	1.55
10	33.29	1.97	0.33	6.62	14.01	1.63

[54] 15 percent is the proportion Jacobs et al. (2014) recommend for private investors.

4.5.8 Welfare Losses

In this section, we summarize the results for the basic scenario in order to analyze whether the empirical investment behavior of German foundations can lead to welfare losses.

Since the funds of a foundation have to be used for purposes of public interest, welfare losses occur with regard to a specific asset allocation if there is another allocation which has the same or lower risk but can provide higher returns at the same time.

The GDP-heuristic dominates the Euro investments, including the benchmark portfolios, for every corresponding allocation with regard to all performance and risk measures.

For these reasons, we define a risk equivalent (RE) that is represented by the globally diversified portfolio RE (Global) which provides the same or less risk with regard to all downside risk measures (LM_0, LM_1, LM_2) as the corresponding Euro portfolio.

According to the utility function of the foundation manager, we have localized welfare losses due to two possible kinds of individual choice behavior. A foundation manager whose focus is on the downside volatility (LPM_2) would choose the 90 percent bond portfolio in the case of exclusive Euro investments and she would choose the 80 percent bond portfolio in the case of a globally diversified and GDP-weighted stock component. A foundation manager who uses the probability for a preservation of assets (LPM_0) as selection criteria to solve the trade-off between risk and performance measures would choose not more than 35 percent stocks in the case of mere Euro investments and not more than 50 percent stocks in the case of the GDP-heuristic. Table 4.15 summarizes the effects of this choice behavior.

Given both potential choice behaviors, the welfare loss is determined by the difference between the absolute growth of the Euro portfolio and the growth of the globally diversified portfolio (lower boundary) and the RE (upper boundary). As Table 4.15 shows, the welfare loss for a foundation manager with a focus on the preservation of assets is twice as high as for a manager who wants to minimize downside risks. Table 4.15 illustrates and quantifies the external effects (i.e., welfare losses) of a regulatory framework that provides incentives for risk avoidance.

Empirical asset allocations (e.g., 90 percent Euro bonds portfolios) can generate welfare losses from 40 to 90 percent[55] of their (actual) returns due to asset management strategies with a focus on exaggerated risk avoidance.

[55]In addition, it must be considered that the average revenue of the representative benchmark portfolio

Table 4.15: Choice Behavior and Welfare Losses

	Bonds	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
Focus on Downside Volatility (LPM_2)							
Euro	90	9.46	2.96	0.57	3.69	6.02	-0.15
Global	80	14.00	2.87	0.37	2.19	4.54	0.79
RE(Global)	65	18.42	2.77	0.32	2.67	5.90	1.36
Welfare loss		[4.54, 8.96]					
Focus on Preservation of Assets (LPM_0)							
Euro	65	12.50	2.84	0.50	6.53	11.18	0.19
Global	50	22.98	2.67	0.31	3.58	7.98	1.58
RE(Global)	30	29.28	2.51	0.31	5.03	11.03	1.71
Welfare loss		[10.48, 16.78]					

Potential welfare losses (LPM_2): $4.54 = 14 - 9.46$, $8.96 = 18.42 - 9.46$; (LPM_0): $10.48 = 22.98 - 12.50$, $16.78 = 29.28 - 12.50$

In summary, Table 4.15 shows that, given the risks German foundations actually take (on average), there is a huge welfare loss due to biased perception of these risks. The following example illustrates this problem: a German foundation is founded with an endowment of 1 million euros. Given the empirical allocation of 90 percent Euro bonds and 10 percent Euro stocks, this foundation would exhibit an absolute growth of 94,600 euros after five years whereas an allocation which provides the same (or lower) risk measures due to a globally diversified stock portfolio would lead to an absolute growth of 184,200 euros.

If we assume a spending rate of three percent per year, this choice behavior would lead to a *loss* in a foundation's expenditures for charitable purposes of approx. 5,500 euros for year five. With respect to the small and mid-sized German foundations that we focus on with assets under management of nearly 70 billion euros, this loss would amount to nearly **385** million euros.

is slightly higher than the revenues of *efficient* allocations.

4.5.9 Results - Subscenarios

In this section, we provide the results of the robustness checks for the five year horizon. We run Monte Carlo simulations for two subscenarios: a period (i.e., subscenario) with a rise in the level of interest rates and a subscenario with a decrease in interest rates. In section 4.5.1, we have shown that foundation managers who do not only aim at growing their assets should invest a large proportion of their funds in bonds. Thus, both subscenarios can be seen as a check for (worst-case) robustness.

Benchmark Portfolio(s)

The simulation results for both subscenarios, provided in Table 4.16, are nearly inverse. For the first subscenario, a period with a persistently rising interest rate level, the probability for the assets of being preserved is virtually zero for the first three benchmark portfolios.[56] By contrast, the portfolios with 100 percent or 95 percent Euro bonds would have preserved the original funds with probability of 100 percent for the second subscenario, a period with a rapidly decreasing interest rate level.

Table 4.16: Results of the Benchmark-Portfolio (after five years)

Growth Bonds(in %)	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
2003 - 2007					
100	-14.41	2.50	1.00	24.81	25.38	-0.98
95	-9.92	2.55	1.00	20.33	20.98	-0.97
90	-5.25	2.61	0.99	15.66	16.64	-0.94
85	-0.38	2.66	0.94	10.97	12.66	-0.85
2008 - 2012					
100	28.73	3.36	0.03	0.12	0.87	21.01
95	25.03	3.27	0.05	0.19	1.07	13.69
90	21.42	3.19	0.14	0.61	2.14	5.14
85	17.89	3.11	0.29	1.87	4.37	1.71

[56] There is anecdotal evidence that some German foundations put their funds into long-term bonds (e.g.,15 or 20 years) in order to generate current income over the recent past. Such a duration would strengthen the effect of rising interest rates.

Minimum Variance Portfolio

The results of the MV-portfolio for both subscenarios are provided in Table 4.17. Since the allocation of the MV-Portfolio is quite similar to the benchmark portfolio with 90 percent Euro bonds, the results resemble each other. Nevertheless, with regard to all risk and performance measures the MV-portfolio seems to exhibit a slightly higher worst-case robustness with regard to all performance and risk measures than the corresponding benchmark portfolio due to a diversified stock component.

Table 4.17: Results of the MV-Portfolio (after five years)

Assets	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
2003 - 2007					
95.65	2.63	0.97	14.99	15.89	-0.91
2008 - 2012					
123.39	3.21	0.11	0.59	2.24	5.32

Euro Investments and GDP-Weighted Stocks

Table 4.19 and Table 4.18 provide the results for the subscenarios of exclusive Euro-Investments and portfolios with GDP-weighted stocks.

A focus on the downside variance LPM_2 would lead to extreme allocations: 100 percent stocks for 2003 - 2007 and 95 to 100 percent bonds for 2008 - 2012. Whereas, a focus on the LPM_0 would lead to an allocation of 80 percent bonds and 20 percent globally diversified stocks for both scenarios.

Table 4.18: Results of Euro-Investments (after five years)

Bonds(in %)	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
			2003 - 2007			
100	-14.41	2.50	1.00	24.81	25.38	-0.98
95	-9.92	2.55	1.00	20.33	20.98	-0.97
90	-5.25	2.61	0.99	15.66	16.64	-0.94
85	-0.38	2.66	0.94	10.97	12.66	-0.85
80	4.69	2.71	0.76	6.99	9.42	0.61
75	9.96	2.76	0.55	4.27	7.10	-0.06
70	15.44	2.81	0.36	2.66	5.55	0.91
65	21.13	2.85	0.24	1.75	4.52	2.37
60	27.05	2.90	0.17	1.22	3.83	4.34
55	33.20	2.94	0.12	0.90	3.37	6.76
50	39.58	2.98	0.09	0.71	3.05	9.56
45	46.21	3.02	0.07	0.58	2.83	12.67
40	53.09	3.05	0.06	0.49	2.66	16.04
35	60.22	3.09	0.05	0.43	2.54	19.60
30	67.62	3.12	0.04	0.38	2.46	23.30
25	75.29	3.14	0.04	0.35	2.39	27.10
20	83.24	3.17	0.03	0.32	2.35	30.95
15	91.47	3.19	0.03	0.30	2.33	34.83
10	100.00	3.20	0.03	0.28	2.31	38.73
5	108.82	3.22	0.02	0.27	2.31	42.62
0	117.96	3.22	0.02	0.26	2.31	46.50
			2008 - 2012			
100	28.73	3.36	0.03	0.12	0.87	21.01
95	25.03	3.27	0.05	0.19	1.07	13.69
90	21.42	3.19	0.14	0.61	2.14	5.14
85	17.89	3.11	0.29	1.87	4.37	1.71
80	14.43	3.03	0.43	4.03	7.53	0.53
75	11.07	2.96	0.54	6.82	11.20	0.06
70	7.78	2.89	0.61	9.90	15.02	-0.17
65	4.57	2.81	0.65	13.09	18.94	-0.31
60	1.44	2.74	0.69	16.32	22.77	-0.39
55	-1.61	2.67	0.71	19.51	26.52	-0.45
50	-4.59	2.60	0.73	22.68	30.16	-0.50
45	-7.50	2.53	0.75	25.80	33.69	-0.53
40	-10.34	2.46	0.77	28.86	37.10	-0.56
35	-13.11	2.40	0.78	31.84	40.39	-0.58
30	-15.80	2.34	0.79	34.79	43.57	-0.60
20	-18.43	2.27	0.80	37.66	46.65	-0.61
15	- 21.00	2.21	0.81	40.46	49.60	-0.63
10	-23.50	2.16	0.82	43.20	52.45	-0.65
5	-28.30	2.04	0.83	48.46	57.85	-0.67
0	-30.61	1.99	0.84	51.00	60.41	-0.68

Table 4.19: Results of GDP-heuristic (after five years)

Bonds(in %)	Assets	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
			2003 - 2007			
100	-14.41	2.50	1.00	24.81	25.38	-0.98
95	-9.73	2.54	1.00	20.14	20.91	-0.96
90	-4.95	2.58	0.99	15.37	16.42	-0.94
85	0.03	2.62	0.94	10.57	12.18	-0.85
80	5.23	2.66	0.76	6.36	8.62	-0.61
75	10.64	2.69	0.51	3.50	6.02	0.04
70	16.27	2.73	0.31	1.90	4.30	1.36
65	22.12	2.76	0.19	1.08	3.20	3.67
60	28.21	2.78	0.11	0.65	2.50	7.13
55	34.54	2.80	0.07	0.43	2.04	11.81
50	41.13	2.83	0.05	0.30	1.74	17.64
45	47.97	2.84	0.04	0.22	1.54	24.42
40	55.05	2.86	0.03	0.17	1.40	31.91
35	62.42	2.86	0.02	0.14	1.30	39.89
30	70.07	2.86	0.02	0.11	1.24	48.28
25	78.01	2.87	0.01	0.10	1.18	57.04
20	86.23	2.86	0.01	0.09	1.15	66.08
15	94.76	2.85	0.01	0.09	1.11	75.38
10	105.60	2.83	0.01	0.08	1.10	84.86
5	112.75	2.81	0.01	0.07	1.08	94.46
0	122.23	2.78	0.01	0.07	1.07	104.13
			2008 - 2012			
100	28.73	3.36	0.03	0.12	0.87	21.01
95	27.77	3.28	0.03	0.10	0.76	22.71
90	26.97	3.21	0.04	0.16	0.98	16.82
85	26.17	3.14	0.08	0.35	1.60	9.83
80	25.38	3.08	0.14	0.81	2.71	5.52
75	24.60	3.01	0.21	1.54	4.25	3.33
70	23.81	2.95	0.27	2.54	6.08	2.20
65	23.03	2.88	0.32	3.72	8.09	2.56
60	22.25	2.81	0.36	5.04	10.20	1.16
55	21.47	2.75	0.40	6.44	12.35	0.89
50	20.69	2.69	0.43	7.94	14.53	0.70
45	19.93	2.63	0.46	9.42	16.71	0.57
40	19.15	2.56	0.48	10.97	18.88	0.46
35	18.38	2.50	0.50	12.52	21.02	0.39
30	17.61	2.43	0.52	14.10	23.15	0.31
25	16.84	2.47	0.53	15.69	25.25	0.25
20	16.01	2.31	0.55	17.27	27.32	0.21
15	15.31	2.26	0.56	18.87	29.36	0.17
10	14.55	2.20	0.57	20.45	31.37	0.13
5	13.79	2.14	0.58	22.04	33.34	0.10
0	13.03	2.08	0.59	23.63	35.29	0.07

Welfare Loss - Scenarios

In summary, Table 4.20 provides the calculated welfare losses for both subscenarios. In comparison with the results of the basic period (Table 4.15), a foundation manager with a focus on downside volatility would prefer extreme allocations (i.e., 0 or 95 to 100 percent Euro bonds). A manager who prefers the preservation of assets would choose 80 to 90 percent Euro bonds. This behavior is due to the outperformance of stocks in 2003 - 2007 (in relation to bonds) and the outperformance of bonds in 2008 - 2012 (in relation to stocks). However, welfare losses due to an inefficiently diversified stock component are lower than for the basic scenario but still occur (except for a downside-volatility-averse manager in the second subscenario (2008-2012)). We can show that even for extreme scenarios a higher and GDP-weighted stock component can provide additional utility and reduce welfare losses caused by exclusive Euro-investments.

Table 4.20: Choice Behavior and Welfare Losses

	Bonds	Growth	CY	LMP_0	LMP_1	LPM_2	Sortino Ratio
Focus on Downside Volatility (LPM_2)							
			2003 - 2007				
Euro	0	117.96	3.22	0.02	0.26	2.31	46.50
Global	0	122.23	2.78	0.01	0.07	1.07	104.13
RE(Global)	0	122.23	2.78	0.01	0.07	1.07	104.13
Welfare loss		4.27					
			2008 - 2012				
Euro	100	28.73	3.36	0.03	0.12	0.87	21.01
Global	95	27.77	3.28	0.03	0.10	0.76	22.71
RE(Global)	100	28.73	3.36	0.03	0.12	0.87	21.01
Welfare loss		-					
Focus on Preservation of Assets (LPM_0)							
			2003 - 2007				
Euro	90	9.46	2.96	0.57	3.69	6.02	-0.15
Global	80	14.00	2.87	0.37	2.19	4.54	0.79
RE(Global)	65	18.42	2.77	0.32	2.67	5.90	1.36
Welfare loss		[4.54, 8.96]					
			2008 - 2012				
Euro	90	9.46	2.96	0.57	3.69	6.02	-0.15
Global	80	14.00	2.87	0.37	2.19	4.54	0.79
RE(Global)	65	18.42	2.77	0.32	2.67	5.90	1.36
Welfare loss		[4.54, 8.96]					

4.6 Conclusion

Our study has two objectives. First of all, we define a legal and financial framework for the asset management of German foundations in order to derive efficient asset management strategies within this framework. Based on a summary of the legal literature and current jurisprudence we can show that asset managers of German foundations cannot be held liable for losses if they had sufficiently diversified the respective foundation's assets before.

We therefore compare different approaches and test their suitability for the purposes of German non-profit foundations by means of stochastic simulations. We find that foundation portfolios should at least consist of bonds and globally diversified stocks. With regard to the weights of the stocks we find evidence that a (worldwide) GPD-weighting as suggested by Jacobs et al. (2014) provides superior results compared to exclusive Euro investments or even worldwide equally weighted stocks.

Second, we can show that the empirical investment behavior of German foundations with a focus on Euro investments leads to welfare losses. Given the objectives of a foundation manager, these losses arise if a chosen asset allocation is dominated by another allocation which provides a higher return for the same (or even lower) risk measures at the same time. For stochastically simulated asset markets, we show that this can be the case for a portfolio with a globally diversified stock component in contrast to exclusive Euro investments. By comparing the empirical investment behavior of German foundations with our stochastically simulated results we can quantify these welfare losses. Small and mid-sized German foundations which altogether manage assets of 70 billion euros could provide up to 77 million euros of additional spending for charitable purposes per year if they were to hold a higher (i.e., ten percent) worldwide diversified stock component. Such a portfolio would provide the same or even lower risk measures.

This problem could be caused by a biased understanding of risk and a focus on short-term volatility risk measures instead. Therefore, we suggest the implementation regulatory incentives such as the five percent rule in the USA. A foundation which has to spend a certain amount (e.g., five percent) of its endowment per year could be *nudged* to take risks in a more efficient way than a foundation whose manager can only be held liable for losses.

Furthermore, such a rule would provide a clear regulatory framework with less room for interpretation and regulatory arbitrage, as suggested by Admati and Hellwig (2014) for the banking industry.

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Appendix A

Appendices

A.1 Appendix – Induced Expectations and Risk Taking

A.1.1 Regression Results

Table 5: Results of an Ordered-Probit Regression on the Difference of safe Choices between HL- und MHL-lotteries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
age	-0.125***	-0.131***	-0.125***	-0.127***	-0.121***	-0.121***	-0.133***
	(-4.00)	(-4.17)	(-3.95)	(-4.01)	(-3.78)	(-3.78)	(-3.71)
PortfolioMutualFunds		0.474**	0.698***	0.697***	0.728***	0.728***	0.735**
		(1.99)	(2.62)	(2.61)	(2.72)	(2.72)	(2.31)
PortfolioStocks			-0.501*	-0.561**	-0.596**	-0.596**	-0.839**
			(-1.92)	(-2.13)	(-2.25)	(-2.25)	(-2.54)
LowFinlit				-0.383*	-0.396*	-0.396*	-0.464*
				(-1.87)	(-1.93)	(-1.93)	(-1.93)
Big5_Extraversion					-0.203*	-0.203*	-0.264**
					(-1.73)	(-1.73)	(-1.99)
Preference for Consistency							0.288*
							(1.62)
Control for Gender	No	No	No	No	No	No	Yes
Control for further Financial Products	No	No	No	No	No	No	Yes
Control for Line of studies	No	No	No	No	No	No	Yes
Control for further BIG5 Factors	No	No	No	No	No	No	Yes
Control for Risk Preferences	No	No	No	No	No	No	Yes
N	134	134	134	134	134	134	134
Pseud R^2	0.03	0.04	0.05	0.06	0.06	0.07	0.11

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.1.2 Appendix – Induced Expectations and Risk Taking (Experiment Documentation)

Experimental Design: Page 1

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Umfrage

Lehrstuhl für Bankbetriebslehre
und Behavioral Finance

Willkommen zur aktuellen Umfrage für Teilnehmer der Experimentalliste ORSEE!

Vielen Dank, dass Sie sich die Zeit für diese Umfrage nehmen. Die Mittel dafür werden durch den *Verein zur Förderung der wissenschaftlichen Aus- und Fortbildung im Bereich der Finanzwirtschaft e.V.* zur Verfügung gestellt.

Bitte lesen Sie sich die im weiteren Verlauf dargestellten Anweisungen genau durch, bevor Sie Ihre Entscheidungen treffen. **Es geht bei dieser Umfrage nicht um "richtige" oder "falsche" Entscheidungen** sondern nur um die Erfassung individueller Präferenzen.

Diese Befragung wird maximal 30 Minuten dauern. Ein Fortschrittsbalken wird auf jeder der folgenden Seiten angezeigt.

14 Teilnehmer werden nach Abschluss dieser Befragung (spätestens am 21. März 2011) zufällig ausgewählt und erhalten entsprechend den jeweiligen Hinweisen auf den folgenden Seiten ihre jeweiligen Entscheidungen (in bar) vergütet.

Diese Umfrage enthält 68 Fragen.

Weiter >>

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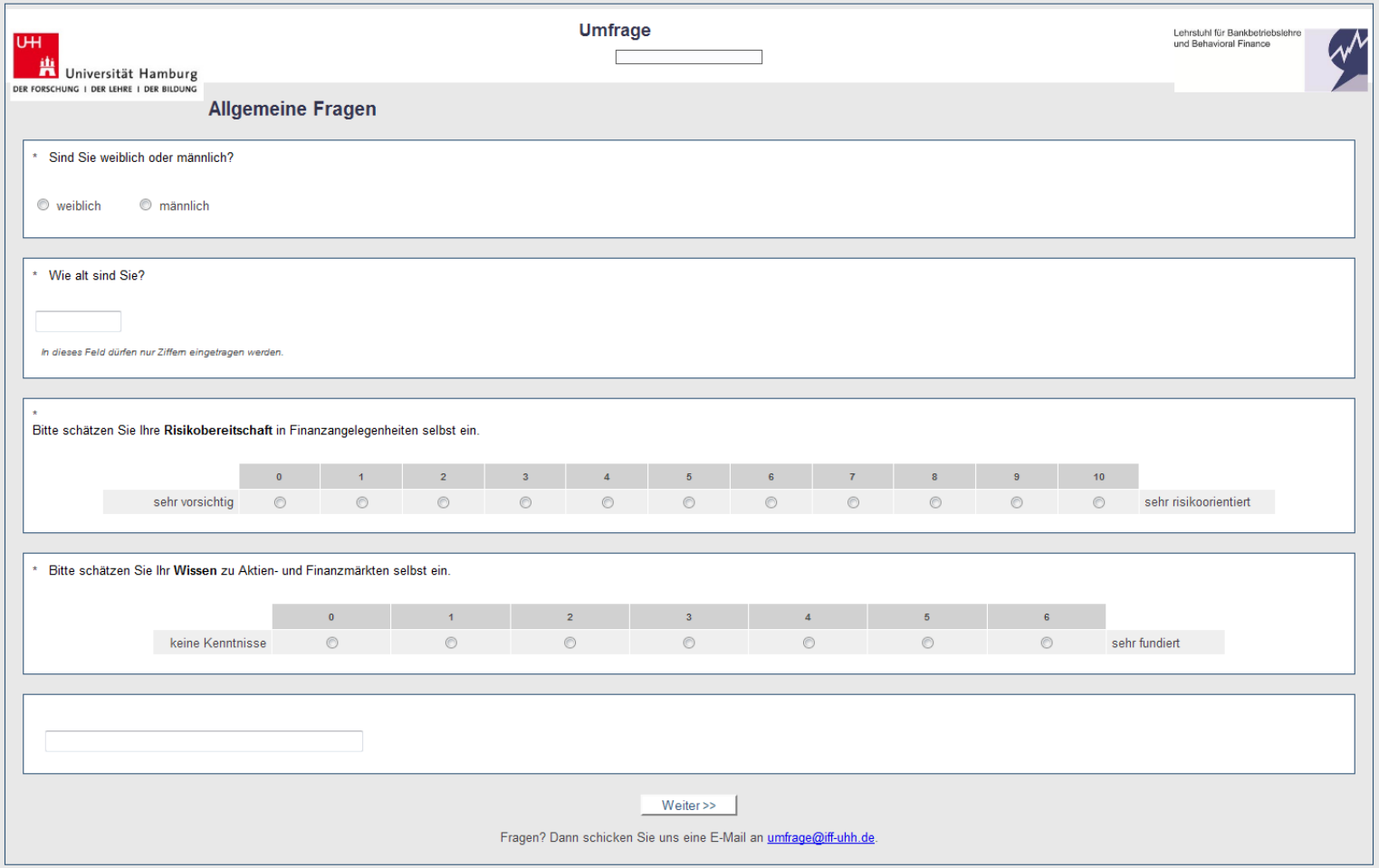
Experimental Design: Empirics I



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Lehrstuhl für Bankbetriebslehre und Behavioral Finance

Allgemeine Fragen

* Sind Sie weiblich oder männlich?

weiblich männlich

* Wie alt sind Sie?

In dieses Feld dürfen nur Ziffern eingetragen werden.

* Bitte schätzen Sie Ihre **Risikobereitschaft** in Finanzangelegenheiten selbst ein.

	0	1	2	3	4	5	6	7	8	9	10	
sehr vorsichtig												sehr risikoorientiert

* Bitte schätzen Sie Ihr **Wissen** zu Aktien- und Finanzmärkten selbst ein.

	0	1	2	3	4	5	6	
keine Kenntnisse								sehr fundiert

Weiter >>

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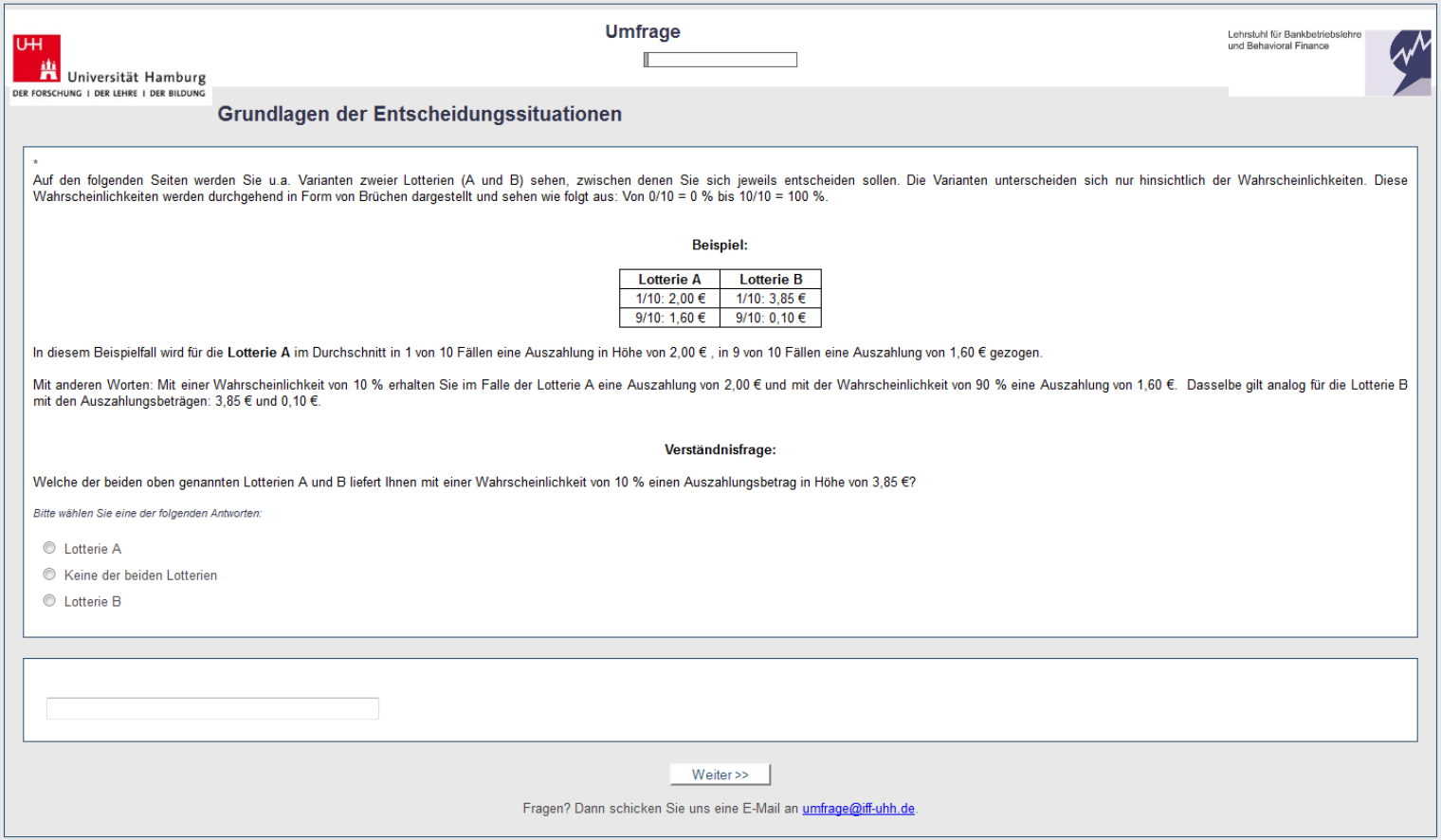
Experimental Design: Questions of Understanding I (Main Task I)



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Grundlagen der Entscheidungssituationen

*
Auf den folgenden Seiten werden Sie u.a. Varianten zweier Lotterien (A und B) sehen, zwischen denen Sie sich jeweils entscheiden sollen. Die Varianten unterscheiden sich nur hinsichtlich der Wahrscheinlichkeiten. Diese Wahrscheinlichkeiten werden durchgehend in Form von Brüchen dargestellt und sehen wie folgt aus: Von 0/10 = 0 % bis 10/10 = 100 %.

Beispiel:

Lotterie A	Lotterie B
1/10: 2,00 €	1/10: 3,85 €
9/10: 1,60 €	9/10: 0,10 €

In diesem Beispielfall wird für die **Lotterie A** im Durchschnitt in 1 von 10 Fällen eine Auszahlung in Höhe von 2,00 € , in 9 von 10 Fällen eine Auszahlung von 1,60 € gezogen.

Mit anderen Worten: Mit einer Wahrscheinlichkeit von 10 % erhalten Sie im Falle der Lotterie A eine Auszahlung von 2,00 € und mit der Wahrscheinlichkeit von 90 % eine Auszahlung von 1,60 €. Dasselbe gilt analog für die Lotterie B mit den Auszahlungsbeträgen: 3,85 € und 0,10 €.

Verständnisfrage:

Welche der beiden oben genannten Lotterien A und B liefert Ihnen mit einer Wahrscheinlichkeit von 10 % einen Auszahlungsbetrag in Höhe von 3,85 €?

Bitte wählen Sie eine der folgenden Antworten:

- Lotterie A
- Keine der beiden Lotterien
- Lotterie B

Weiter >>

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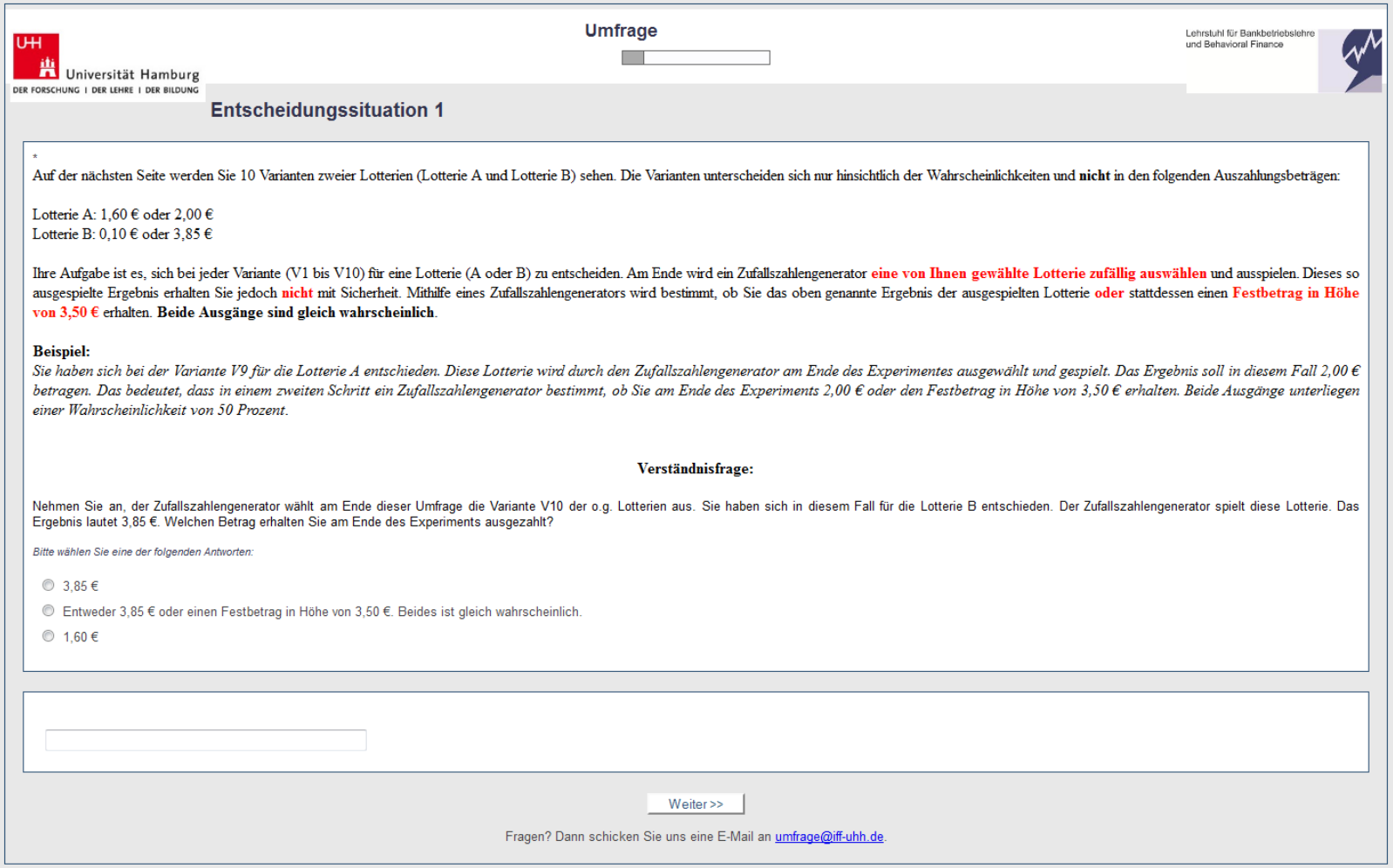
Experimental Design: Questions of Understanding II (Main Task I)



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Entscheidungssituation 1

*

Auf der nächsten Seite werden Sie 10 Varianten zweier Lotterien (Lotterie A und Lotterie B) sehen. Die Varianten unterscheiden sich nur hinsichtlich der Wahrscheinlichkeiten und **nicht** in den folgenden Auszahlungsbeträgen:

Lotterie A: 1,60 € oder 2,00 €
Lotterie B: 0,10 € oder 3,85 €

Ihre Aufgabe ist es, sich bei jeder Variante (V1 bis V10) für eine Lotterie (A oder B) zu entscheiden. Am Ende wird ein Zufallszahlengenerator **eine von Ihnen gewählte Lotterie zufällig auswählen** und ausspielen. Dieses so ausgespielte Ergebnis erhalten Sie jedoch **nicht** mit Sicherheit. Mithilfe eines Zufallszahlengenerators wird bestimmt, ob Sie das oben genannte Ergebnis der ausgespielten Lotterie **oder** stattdessen einen **Festbetrag in Höhe von 3,50 €** erhalten. **Beide Ausgänge sind gleich wahrscheinlich**.

Beispiel:
Sie haben sich bei der Variante V9 für die Lotterie A entschieden. Diese Lotterie wird durch den Zufallszahlengenerator am Ende des Experimentes ausgewählt und gespielt. Das Ergebnis soll in diesem Fall 2,00 € betragen. Das bedeutet, dass in einem zweiten Schritt ein Zufallszahlengenerator bestimmt, ob Sie am Ende des Experiments 2,00 € oder den Festbetrag in Höhe von 3,50 € erhalten. Beide Ausgänge unterliegen einer Wahrscheinlichkeit von 50 Prozent.

Verständnisfrage:

Nehmen Sie an, der Zufallszahlengenerator wählt am Ende dieser Umfrage die Variante V10 der o.g. Lotterien aus. Sie haben sich in diesem Fall für die Lotterie B entschieden. Der Zufallszahlengenerator spielt diese Lotterie. Das Ergebnis lautet 3,85 €. Welchen Betrag erhalten Sie am Ende des Experiments ausgezahlt?

Bitte wählen Sie eine der folgenden Antworten:

- 3,85 €
- Entweder 3,85 € oder einen Festbetrag in Höhe von 3,50 €. Beides ist gleich wahrscheinlich.
- 1,60 €

Weiter >>

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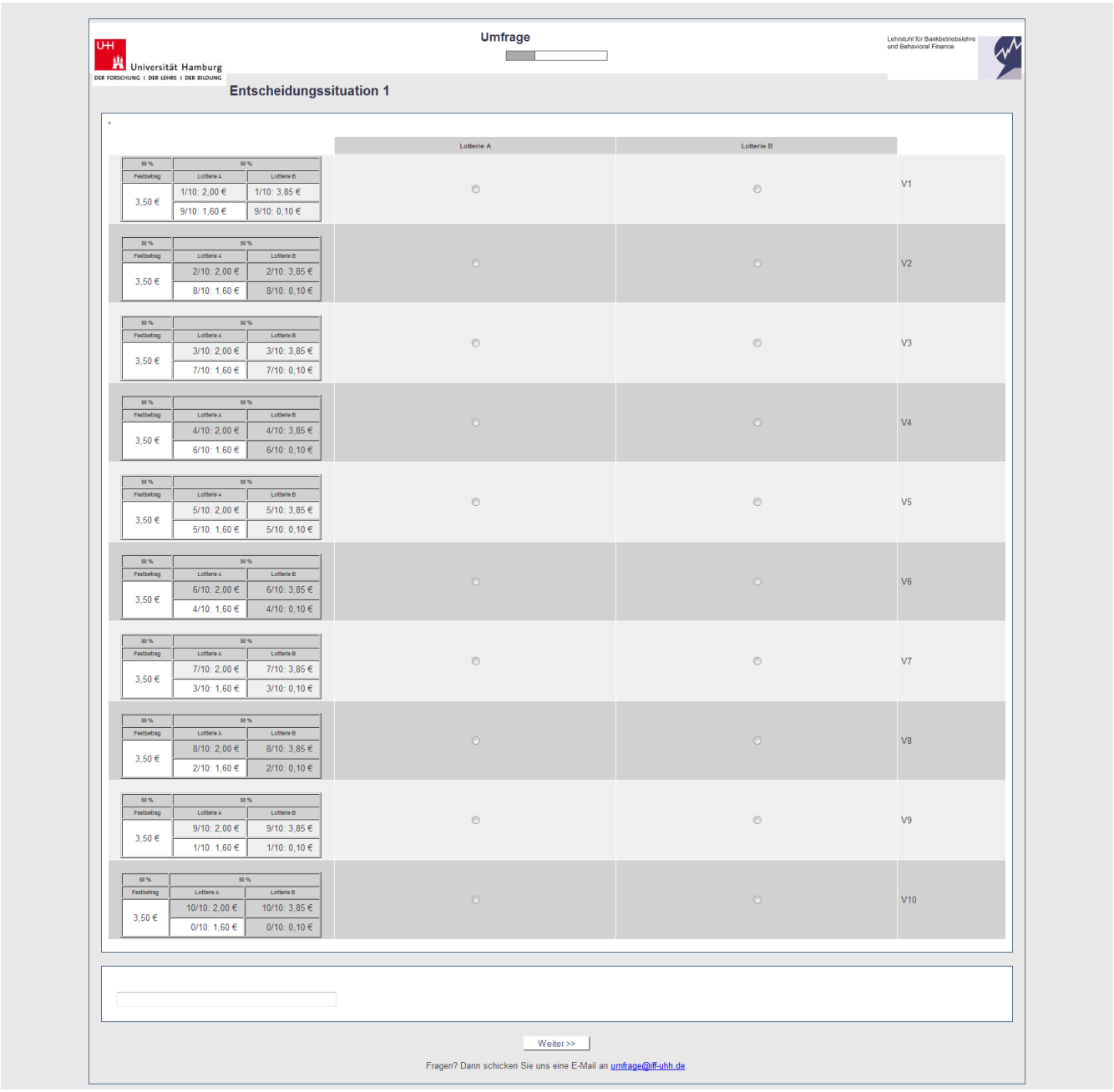
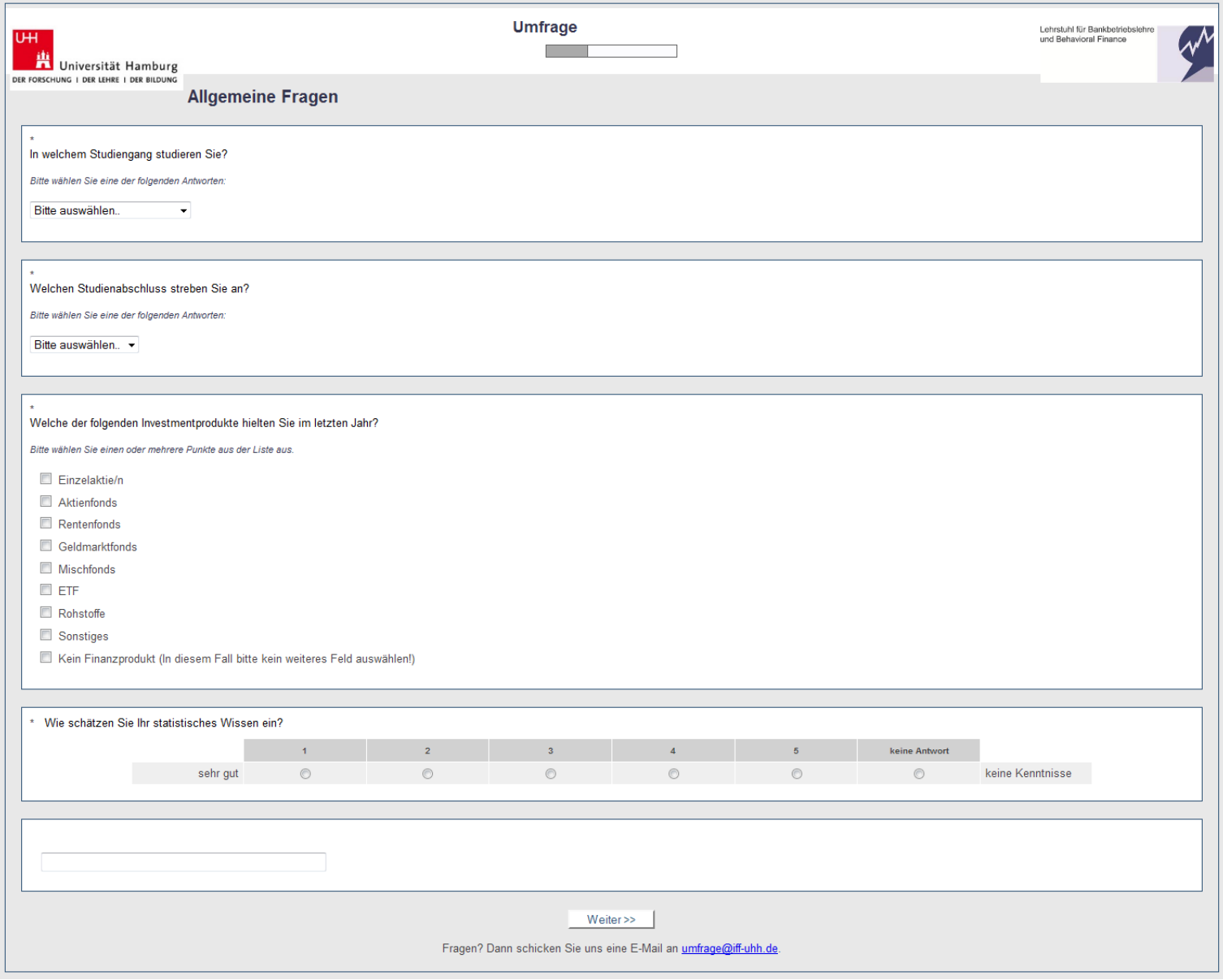
Experimental Design: Main Task I



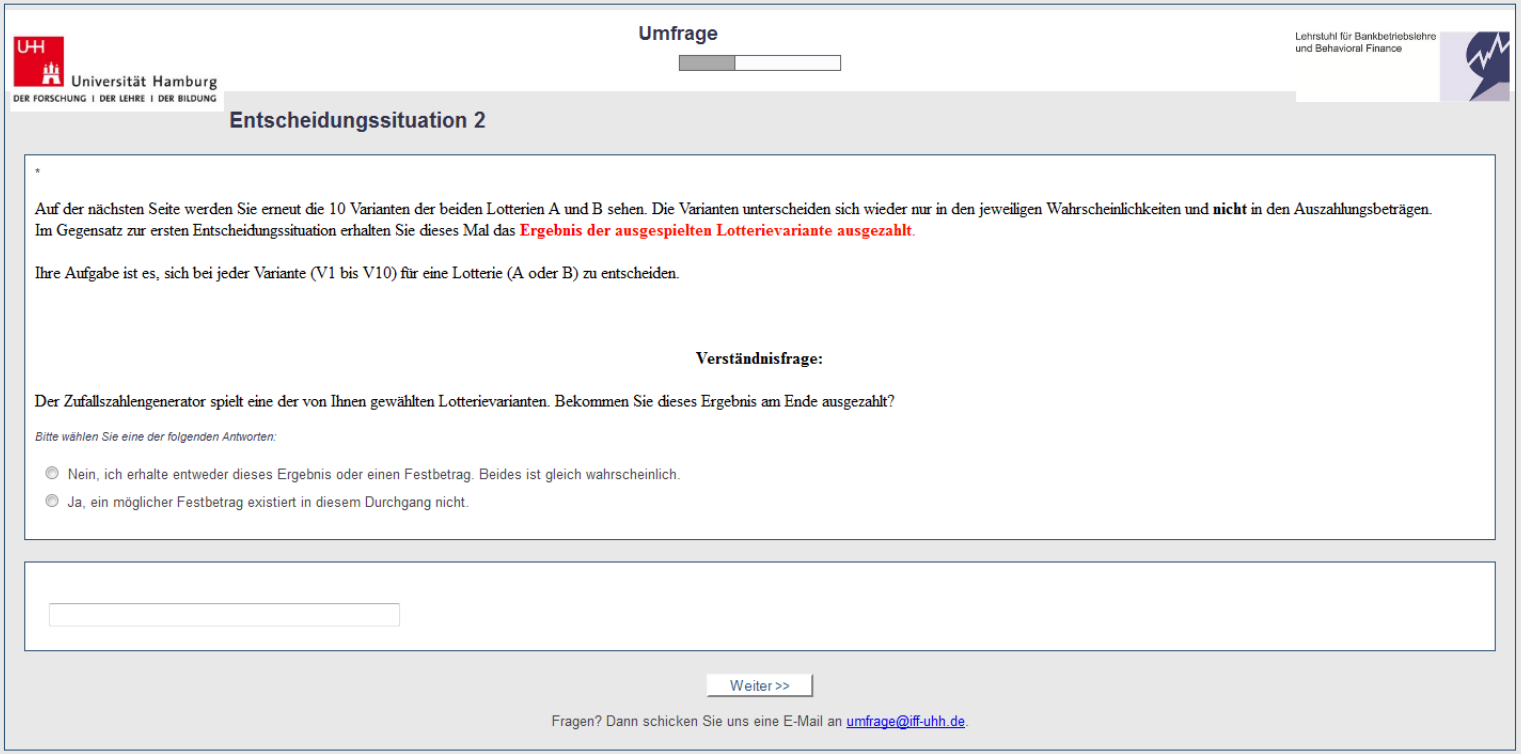
10 decision tasks: modified Holt and Laury lotteries with fixed amount of 3.5 for each stage

Experimental Design: Empirics II

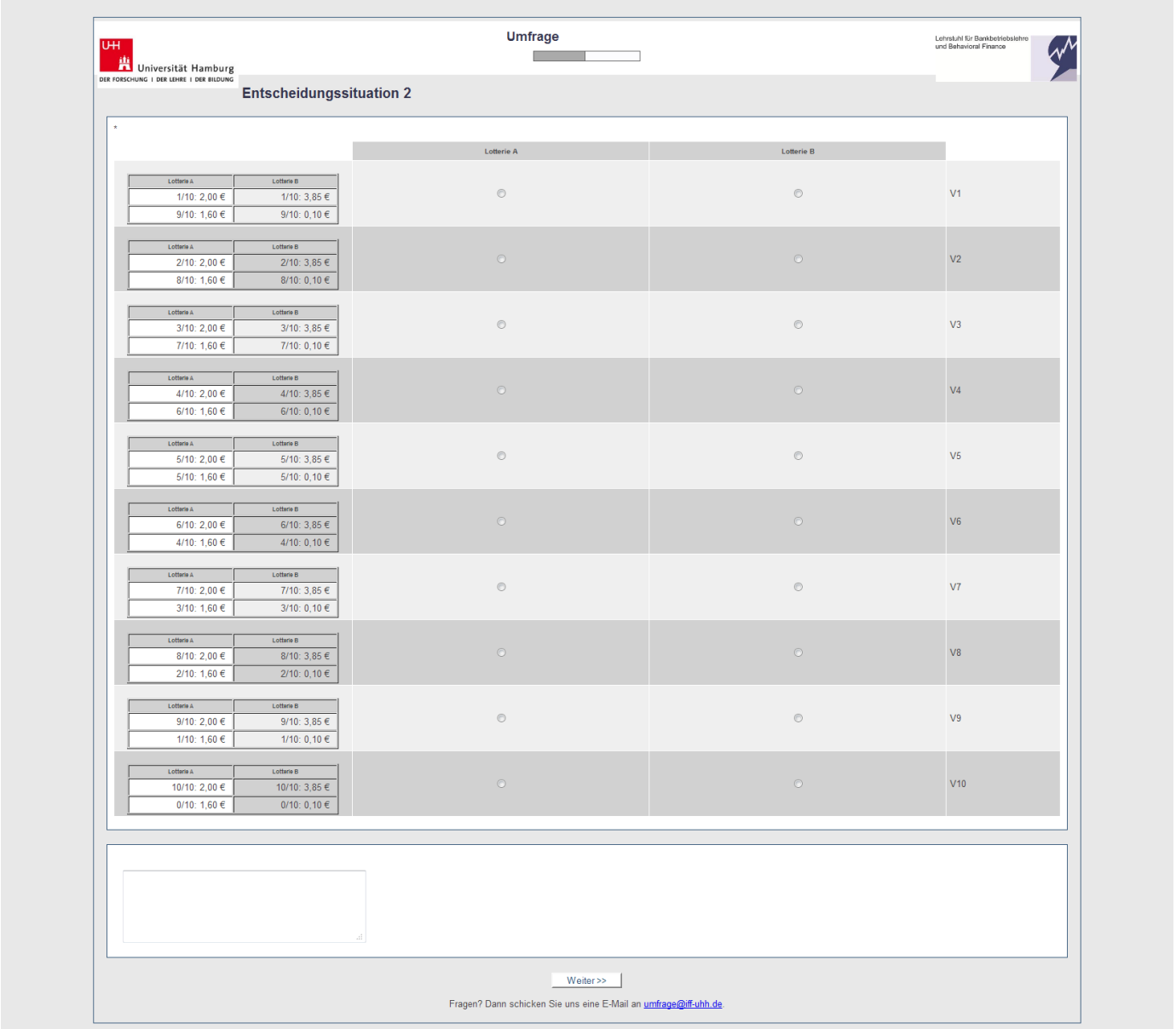


We captured additional empirics, financial background and self-assessement of statistical knowledge.

Experimental Design: Questions of Understanding (Main Task II)

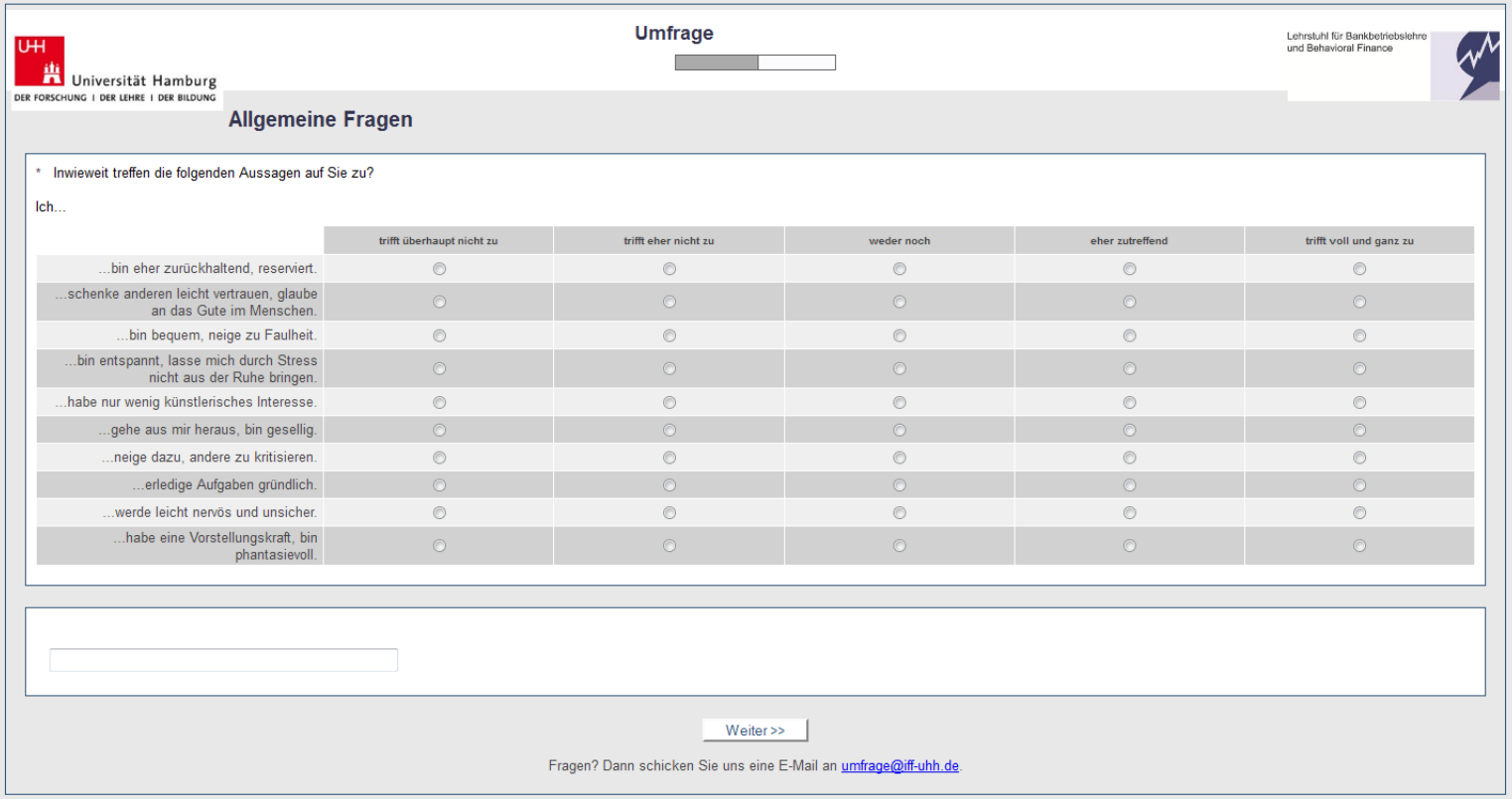


Experimental Design: Main Task II – Holt & Laury Choice List



Mere Holt and Laury lotteries (Holt and Laury (2002))

Experimental Design: Big Five Questionnaire (Caprara et al. (1993))



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Allgemeine Fragen

* Inwieweit treffen die folgenden Aussagen auf Sie zu?

Ich...

	trifft überhaupt nicht zu	trifft eher nicht zu	weder noch	eher zutreffend	trifft voll und ganz zu
...bin eher zurückhaltend, reserviert.	○	○	○	○	○
...schenke anderen leicht vertrauen, glaube an das Gute im Menschen.	○	○	○	○	○
...bin bequem, neige zu Faulheit.	○	○	○	○	○
...bin entspannt, lasse mich durch Stress nicht aus der Ruhe bringen.	○	○	○	○	○
...habe nur wenig künstlerisches Interesse.	○	○	○	○	○
...gehe aus mir heraus, bin gesellig.	○	○	○	○	○
...neige dazu, andere zu kritisieren.	○	○	○	○	○
...erledige Aufgaben gründlich.	○	○	○	○	○
...werde leicht nervös und unsicher.	○	○	○	○	○
...habe eine Vorstellungskraft, bin phantasievoll.	○	○	○	○	○

Weiter >>

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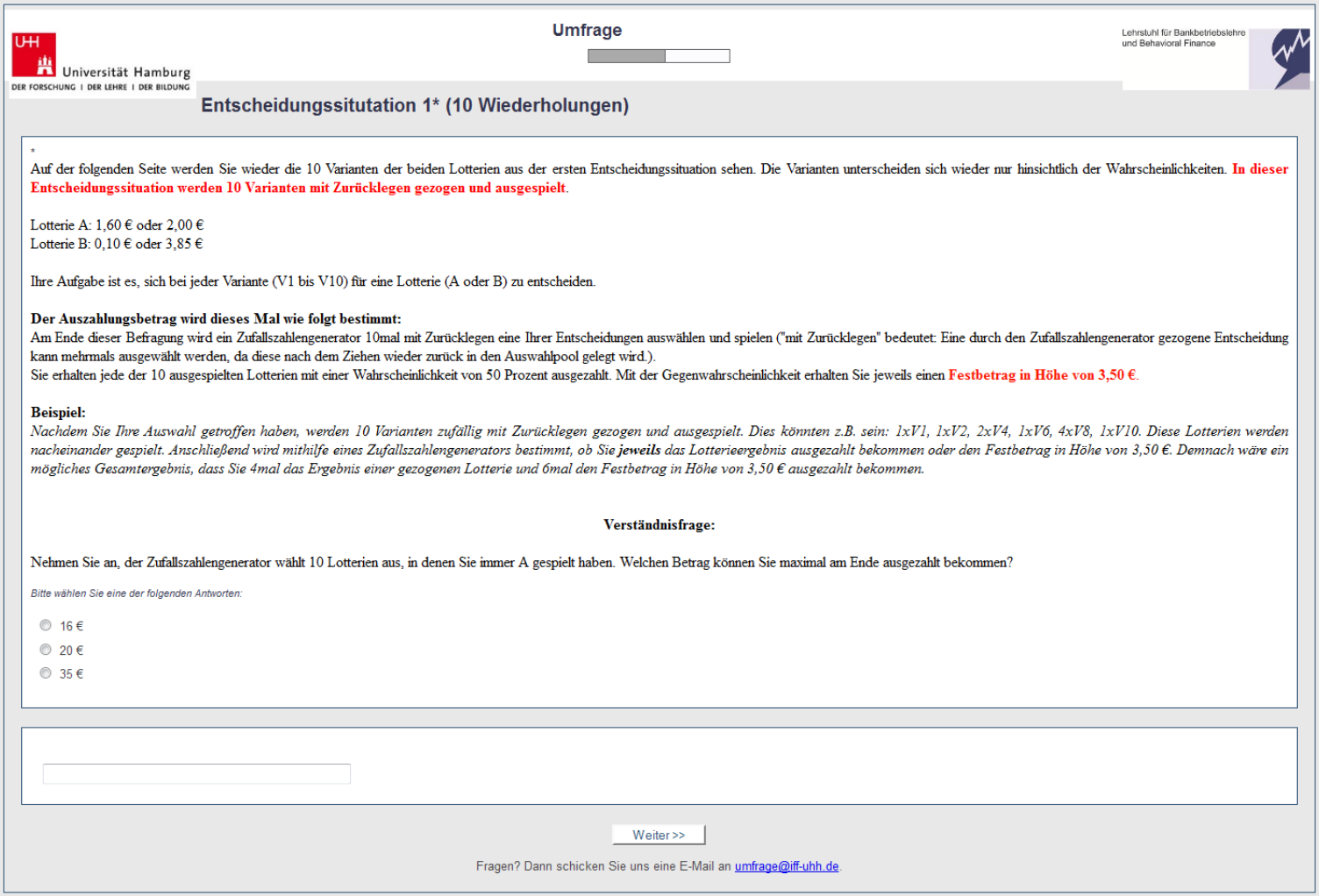
Experimental Design: Questions of Understanding (Main Task III)



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Entscheidungssitutation 1* (10 Wiederholungen)

*

Auf der folgenden Seite werden Sie wieder die 10 Varianten der beiden Lotterien aus der ersten Entscheidungssituation sehen. Die Varianten unterscheiden sich wieder nur hinsichtlich der Wahrscheinlichkeiten. **In dieser Entscheidungssituation werden 10 Varianten mit Zurücklegen gezogen und ausgespielt.**

Lotterie A: 1,60 € oder 2,00 €
Lotterie B: 0,10 € oder 3,85 €

Ihre Aufgabe ist es, sich bei jeder Variante (V1 bis V10) für eine Lotterie (A oder B) zu entscheiden.

Der Auszahlungsbetrag wird dieses Mal wie folgt bestimmt:
Am Ende dieser Befragung wird ein Zufallszahlengenerator 10mal mit Zurücklegen eine Ihrer Entscheidungen auswählen und spielen ("mit Zurücklegen" bedeutet: Eine durch den Zufallszahlengenerator gezogene Entscheidung kann mehrmals ausgewählt werden, da diese nach dem Ziehen wieder zurück in den Auswahlpool gelegt wird.).
Sie erhalten jede der 10 ausgespielten Lotterien mit einer Wahrscheinlichkeit von 50 Prozent ausgezahlt. Mit der Gegenwahrscheinlichkeit erhalten Sie jeweils einen **Festbetrag in Höhe von 3,50 €**.

Beispiel:
*Nachdem Sie Ihre Auswahl getroffen haben, werden 10 Varianten zufällig mit Zurücklegen gezogen und ausgespielt. Dies könnten z.B. sein: 1xV1, 1xV2, 2xV4, 1xV6, 4xV8, 1xV10. Diese Lotterien werden nacheinander gespielt. Anschließend wird mithilfe eines Zufallszahlengenerators bestimmt, ob Sie **jeweils** das Lotterieergebnis ausgezahlt bekommen oder den Festbetrag in Höhe von 3,50 €. Demnach wäre ein mögliches Gesamtergebnis, dass Sie 4mal das Ergebnis einer gezogenen Lotterie und 6mal den Festbetrag in Höhe von 3,50 € ausgezahlt bekommen.*

Verständnisfrage:

Nehmen Sie an, der Zufallszahlengenerator wählt 10 Lotterien aus, in denen Sie immer A gespielt haben. Welchen Betrag können Sie maximal am Ende ausgezahlt bekommen?

Bitte wählen Sie eine der folgenden Antworten:

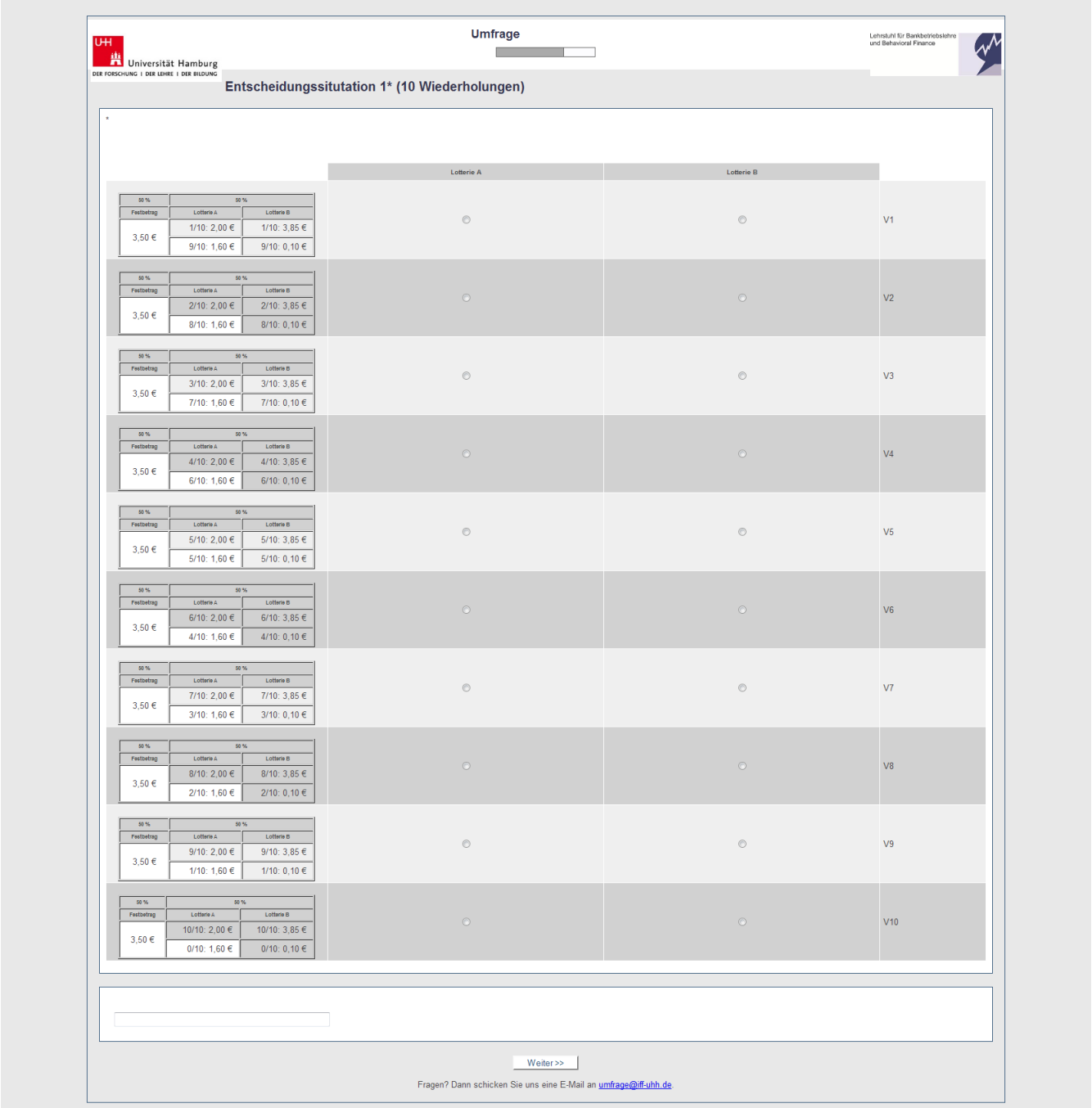
- 16 €
- 20 €
- 35 €

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

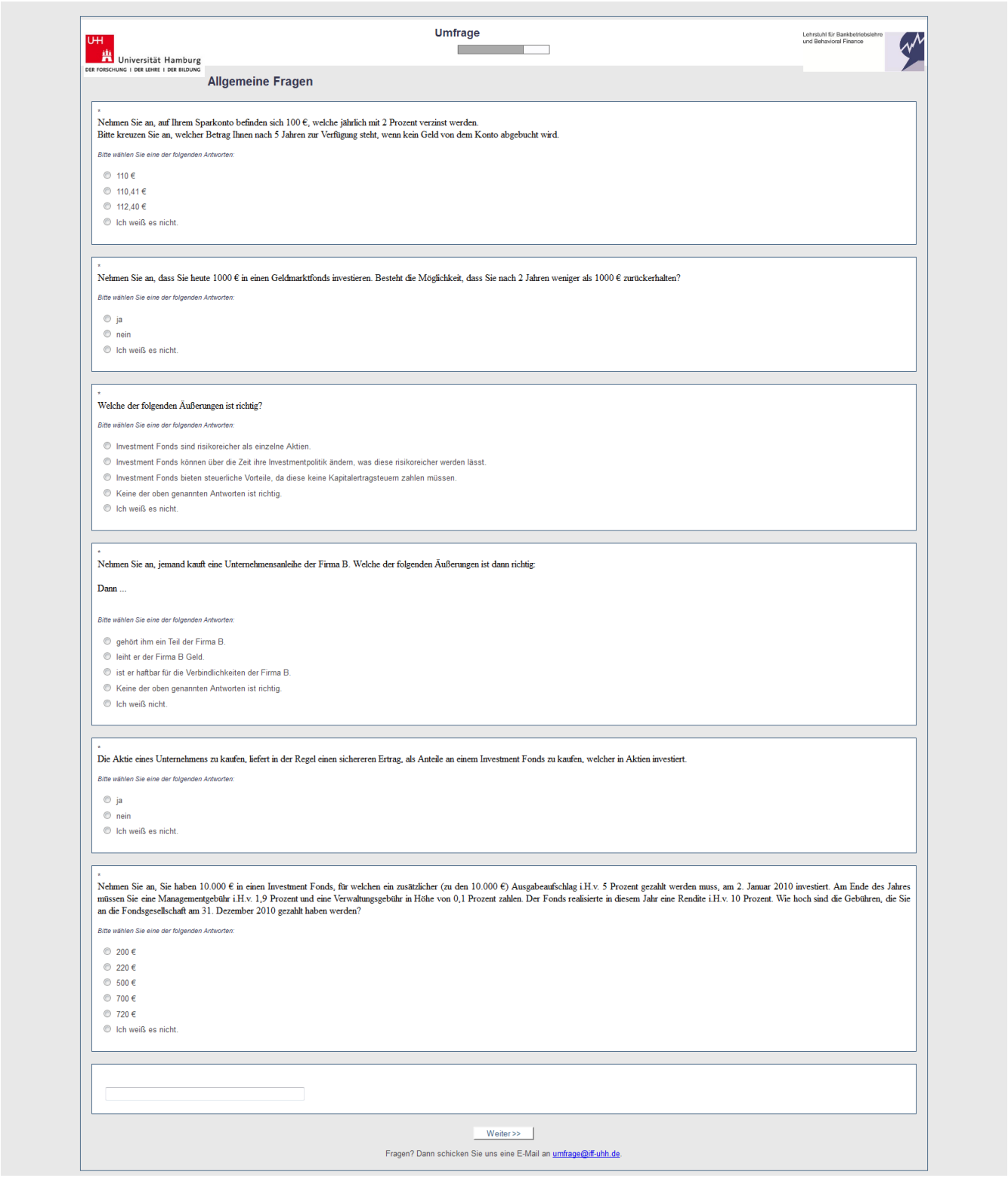
Modified Holt and Laury lotteries (Holt and Laury (2002)) – 10 draws with replacement

Experimental Design: Main Task III – modified Holt & Laury Choice List



10 draws with replacement

Experimental Design: Questionnaire – Financial Literacy



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Allgemeine Fragen

*
Nehmen Sie an, auf Ihrem Sparkonto befinden sich 100 €, welche jährlich mit 2 Prozent verzinst werden.
Bitte kreuzen Sie an, welcher Betrag Ihnen nach 5 Jahren zur Verfügung steht, wenn kein Geld von dem Konto abgebucht wird.

Bitte wählen Sie eine der folgenden Antworten:

- 110 €
- 110,41 €
- 112,40 €
- Ich weiß es nicht.

*
Nehmen Sie an, dass Sie heute 1000 € in einen Geldmarktfonds investieren. Besteht die Möglichkeit, dass Sie nach 2 Jahren weniger als 1000 € zurückerhalten?

Bitte wählen Sie eine der folgenden Antworten:

- ja
- nein
- Ich weiß es nicht.

*
Welche der folgenden Äußerungen ist richtig?

Bitte wählen Sie eine der folgenden Antworten:

- Investment Fonds sind risikoreicher als einzelne Aktien.
- Investment Fonds können über die Zeit ihre Investmentpolitik ändern, was diese risikoreicher werden lässt.
- Investment Fonds bieten steuerliche Vorteile, da diese keine Kapitalertragsteuern zahlen müssen.
- Keine der oben genannten Antworten ist richtig.
- Ich weiß es nicht.

*
Nehmen Sie an, jemand kauft eine Unternehmensanleihe der Firma B. Welche der folgenden Äußerungen ist dann richtig:

Dann ...

Bitte wählen Sie eine der folgenden Antworten:

- gehört ihm ein Teil der Firma B.
- leiht er der Firma B Geld.
- ist er haftbar für die Verbindlichkeiten der Firma B.
- Keine der oben genannten Antworten ist richtig.
- Ich weiß nicht.

*
Die Aktie eines Unternehmens zu kaufen, liefert in der Regel einen sichereren Ertrag, als Anteile an einem Investment Fonds zu kaufen, welcher in Aktien investiert.

Bitte wählen Sie eine der folgenden Antworten:

- ja
- nein
- Ich weiß es nicht.

*
Nehmen Sie an, Sie haben 10.000 € in einen Investment Fonds, für welchen ein zusätzlicher (zu den 10.000 €) Ausgabeaufschlag i.H.v. 5 Prozent gezahlt werden muss, am 2. Januar 2010 investiert. Am Ende des Jahres müssen Sie eine Managementgebühr i.H.v. 1,9 Prozent und eine Verwaltungsgebühr in Höhe von 0,1 Prozent zahlen. Der Fonds realisierte in diesem Jahr eine Rendite i.H.v. 10 Prozent. Wie hoch sind die Gebühren, die Sie an die Fondsgesellschaft am 31. Dezember 2010 gezahlt haben werden?

Bitte wählen Sie eine der folgenden Antworten:

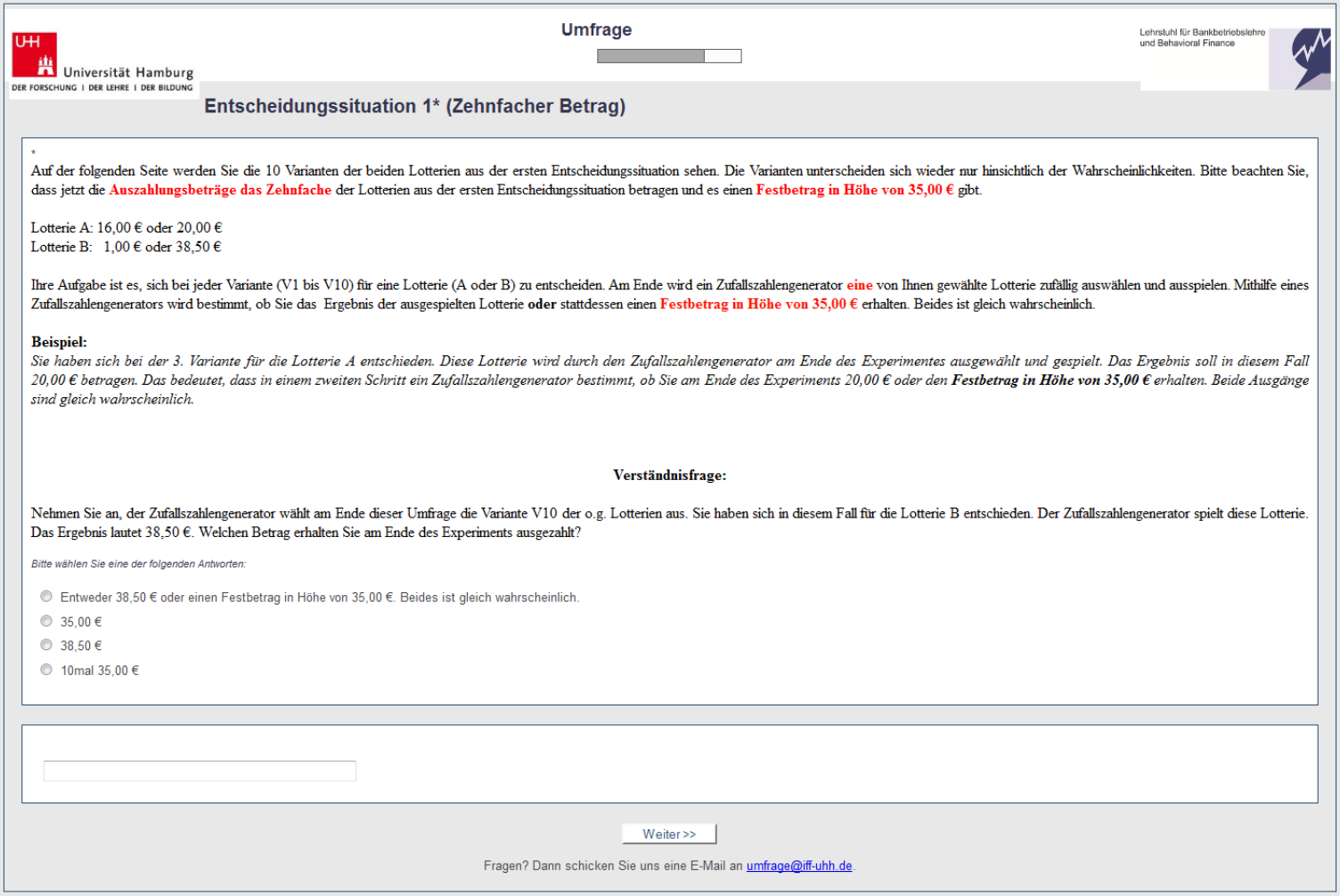
- 200 €
- 220 €
- 500 €
- 700 €
- 720 €
- Ich weiß es nicht.

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de

Measure for financial literacy according to Nöth and Puhan (2009)

Experimental Design: Questions of Understanding (Main Task IV)



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Entscheidungssituation 1* (Zehnfacher Betrag)

*
Auf der folgenden Seite werden Sie die 10 Varianten der beiden Lotterien aus der ersten Entscheidungssituation sehen. Die Varianten unterscheiden sich wieder nur hinsichtlich der Wahrscheinlichkeiten. Bitte beachten Sie, dass jetzt die **Auszahlungsbeträge das Zehnfache** der Lotterien aus der ersten Entscheidungssituation betragen und es einen **Festbetrag in Höhe von 35,00 €** gibt.

Lotterie A: 16,00 € oder 20,00 €
Lotterie B: 1,00 € oder 38,50 €

Ihre Aufgabe ist es, sich bei jeder Variante (V1 bis V10) für eine Lotterie (A oder B) zu entscheiden. Am Ende wird ein Zufallszahlengenerator **eine** von Ihnen gewählte Lotterie zufällig auswählen und ausspielen. Mithilfe eines Zufallszahlengenerators wird bestimmt, ob Sie das Ergebnis der ausgespielten Lotterie **oder** stattdessen einen **Festbetrag in Höhe von 35,00 €** erhalten. Beides ist gleich wahrscheinlich.

Beispiel:
*Sie haben sich bei der 3. Variante für die Lotterie A entschieden. Diese Lotterie wird durch den Zufallszahlengenerator am Ende des Experimentes ausgewählt und gespielt. Das Ergebnis soll in diesem Fall 20,00 € betragen. Das bedeutet, dass in einem zweiten Schritt ein Zufallszahlengenerator bestimmt, ob Sie am Ende des Experiments 20,00 € oder den **Festbetrag in Höhe von 35,00 €** erhalten. Beide Ausgänge sind gleich wahrscheinlich.*

Verständnisfrage:

Nehmen Sie an, der Zufallszahlengenerator wählt am Ende dieser Umfrage die Variante V10 der o.g. Lotterien aus. Sie haben sich in diesem Fall für die Lotterie B entschieden. Der Zufallszahlengenerator spielt diese Lotterie. Das Ergebnis lautet 38,50 €. Welchen Betrag erhalten Sie am Ende des Experiments ausgezahlt?

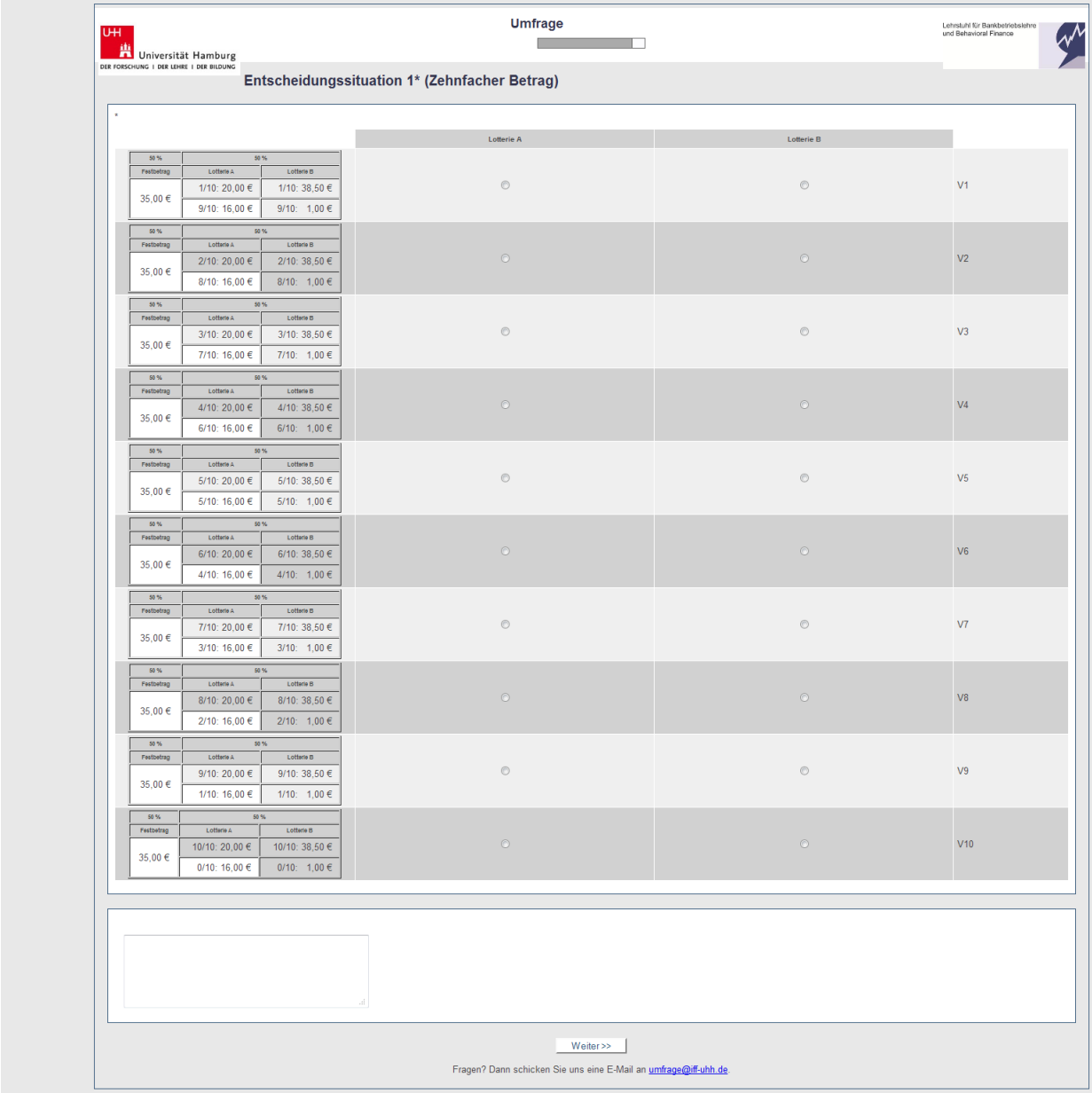
Bitte wählen Sie eine der folgenden Antworten:

- Entweder 38,50 € oder einen Festbetrag in Höhe von 35,00 €. Beides ist gleich wahrscheinlich.
- 35,00 €
- 38,50 €
- 10mal 35,00 €

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Experimental Design: Main Task IV – modified Holt & Laury Choice List



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Entscheidungssituation 1* (Zehnfacher Betrag)

	50 %	50 %	Lotterie A	Lotterie B	
	Festbetrag	Lotterie A	Lotterie B		
V1	35,00 €	1/10: 20,00 €	1/10: 38,50 €	○	○	V1
		9/10: 16,00 €	9/10: 1,00 €			
V2	35,00 €	2/10: 20,00 €	2/10: 38,50 €	○	○	V2
		8/10: 16,00 €	8/10: 1,00 €			
V3	35,00 €	3/10: 20,00 €	3/10: 38,50 €	○	○	V3
		7/10: 16,00 €	7/10: 1,00 €			
V4	35,00 €	4/10: 20,00 €	4/10: 38,50 €	○	○	V4
		6/10: 16,00 €	6/10: 1,00 €			
V5	35,00 €	5/10: 20,00 €	5/10: 38,50 €	○	○	V5
		5/10: 16,00 €	5/10: 1,00 €			
V6	35,00 €	6/10: 20,00 €	6/10: 38,50 €	○	○	V6
		4/10: 16,00 €	4/10: 1,00 €			
V7	35,00 €	7/10: 20,00 €	7/10: 38,50 €	○	○	V7
		3/10: 16,00 €	3/10: 1,00 €			
V8	35,00 €	8/10: 20,00 €	8/10: 38,50 €	○	○	V8
		2/10: 16,00 €	2/10: 1,00 €			
V9	35,00 €	9/10: 20,00 €	9/10: 38,50 €	○	○	V9
		1/10: 16,00 €	1/10: 1,00 €			
V10	35,00 €	10/10: 20,00 €	10/10: 38,50 €	○	○	V10
		0/10: 16,00 €	0/10: 1,00 €			

Weiter >>

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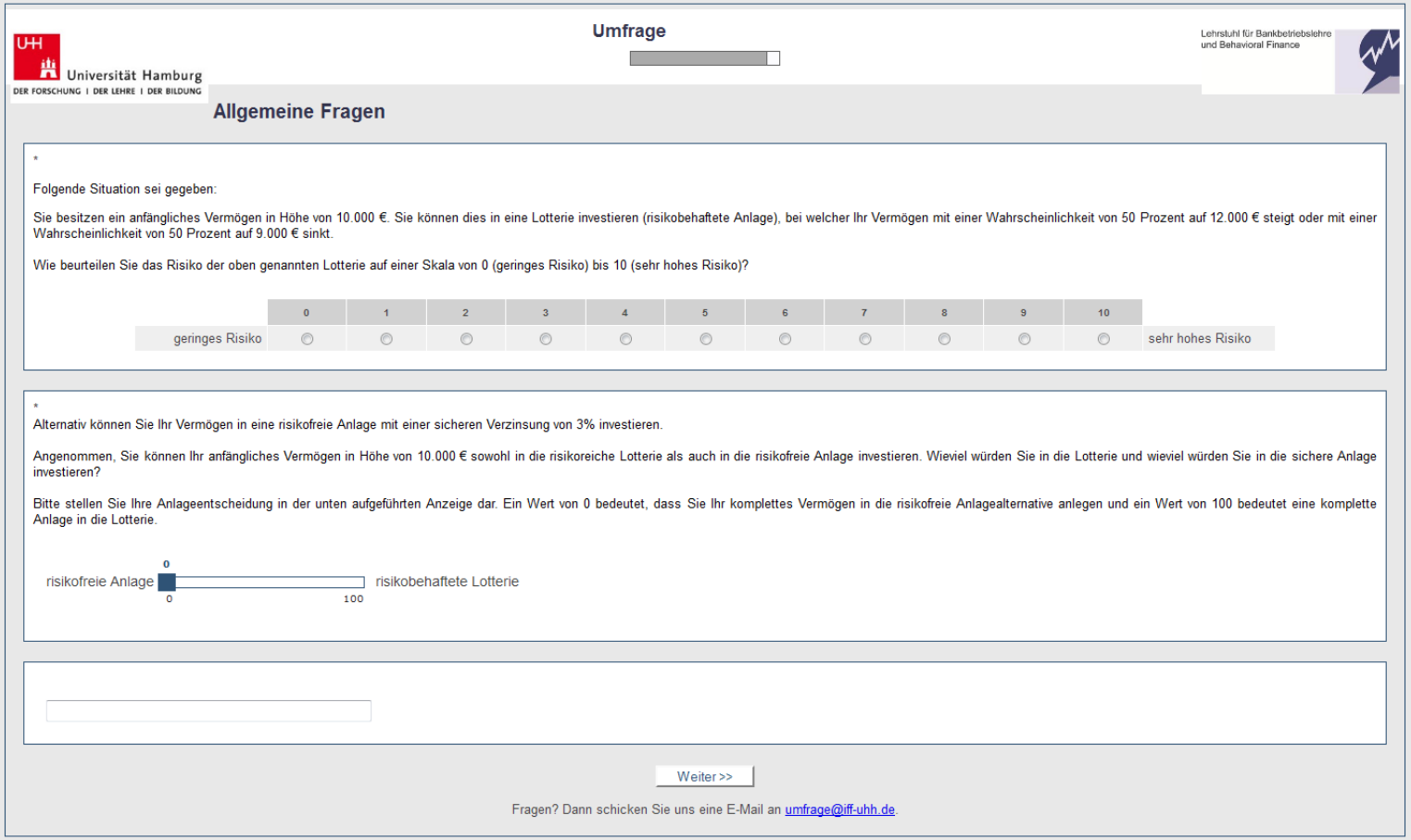
all amounts multiplied by factor 10

Experimental Design: Self Assessment Risk Taking



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Allgemeine Fragen

*

Folgende Situation sei gegeben:

Sie besitzen ein anfängliches Vermögen in Höhe von 10.000 €. Sie können dies in eine Lotterie investieren (risikobehaftete Anlage), bei welcher Ihr Vermögen mit einer Wahrscheinlichkeit von 50 Prozent auf 12.000 € steigt oder mit einer Wahrscheinlichkeit von 50 Prozent auf 9.000 € sinkt.

Wie beurteilen Sie das Risiko der oben genannten Lotterie auf einer Skala von 0 (geringes Risiko) bis 10 (sehr hohes Risiko)?

	0	1	2	3	4	5	6	7	8	9	10	
geringes Risiko	○	○	○	○	○	○	○	○	○	○	○	sehr hohes Risiko

*

Alternativ können Sie Ihr Vermögen in eine risikofreie Anlage mit einer sicheren Verzinsung von 3% investieren.

Angenommen, Sie können Ihr anfängliches Vermögen in Höhe von 10.000 € sowohl in die risikoreiche Lotterie als auch in die risikofreie Anlage investieren. Wieviel würden Sie in die Lotterie und wieviel würden Sie in die sichere Anlage investieren?

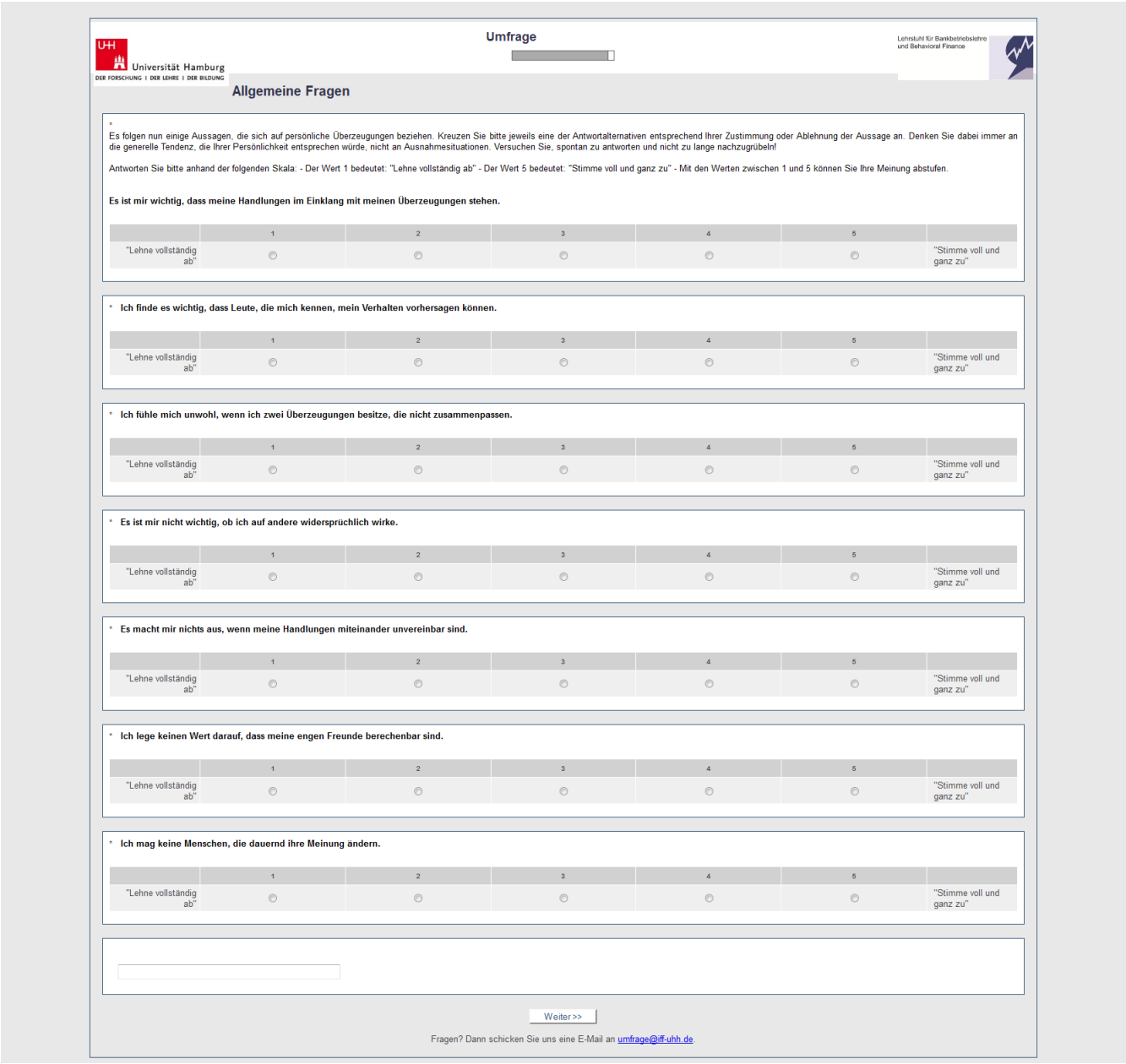
Bitte stellen Sie Ihre Anlageentscheidung in der unten aufgeführten Anzeige dar. Ein Wert von 0 bedeutet, dass Sie Ihr komplettes Vermögen in die risikofreie Anlagealternative anlegen und ein Wert von 100 bedeutet eine komplette Anlage in die Lotterie.

0
risikofreie Anlage — risikobehaftete Lotterie
0 100

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Experimental Design: Questionnaire Preferences for Consistency



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Allgemeine Fragen

Es folgen nun einige Aussagen, die sich auf persönliche Überzeugungen beziehen. Kreuzen Sie bitte jeweils eine der Antwortalternativen entsprechend Ihrer Zustimmung oder Ablehnung der Aussage an. Denken Sie dabei immer an die generelle Tendenz, die Ihrer Persönlichkeit entsprechen würde, nicht an Ausnahmesituationen. Versuchen Sie, spontan zu antworten und nicht zu lange nachzugrübeln!

Antworten Sie bitte anhand der folgenden Skala: - Der Wert 1 bedeutet: "Lehne vollständig ab" - Der Wert 5 bedeutet: "Stimme voll und ganz zu" - Mit den Werten zwischen 1 und 5 können Sie Ihre Meinung abstufen.

Es ist mir wichtig, dass meine Handlungen im Einklang mit meinen Überzeugungen stehen.

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

* **Ich finde es wichtig, dass Leute, die mich kennen, mein Verhalten vorhersagen können.**

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

* **Ich fühle mich unwohl, wenn ich zwei Überzeugungen besitze, die nicht zusammenpassen.**

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

* **Es ist mir nicht wichtig, ob ich auf andere widersprüchlich wirke.**

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

* **Es macht mir nichts aus, wenn meine Handlungen miteinander unvereinbar sind.**

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

* **Ich lege keinen Wert darauf, dass meine engen Freunde berechenbar sind.**

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

* **Ich mag keine Menschen, die dauernd ihre Meinung ändern.**

	1	2	3	4	5	
"Lehne vollständig ab"						"Stimme voll und ganz zu"

Weiter >>

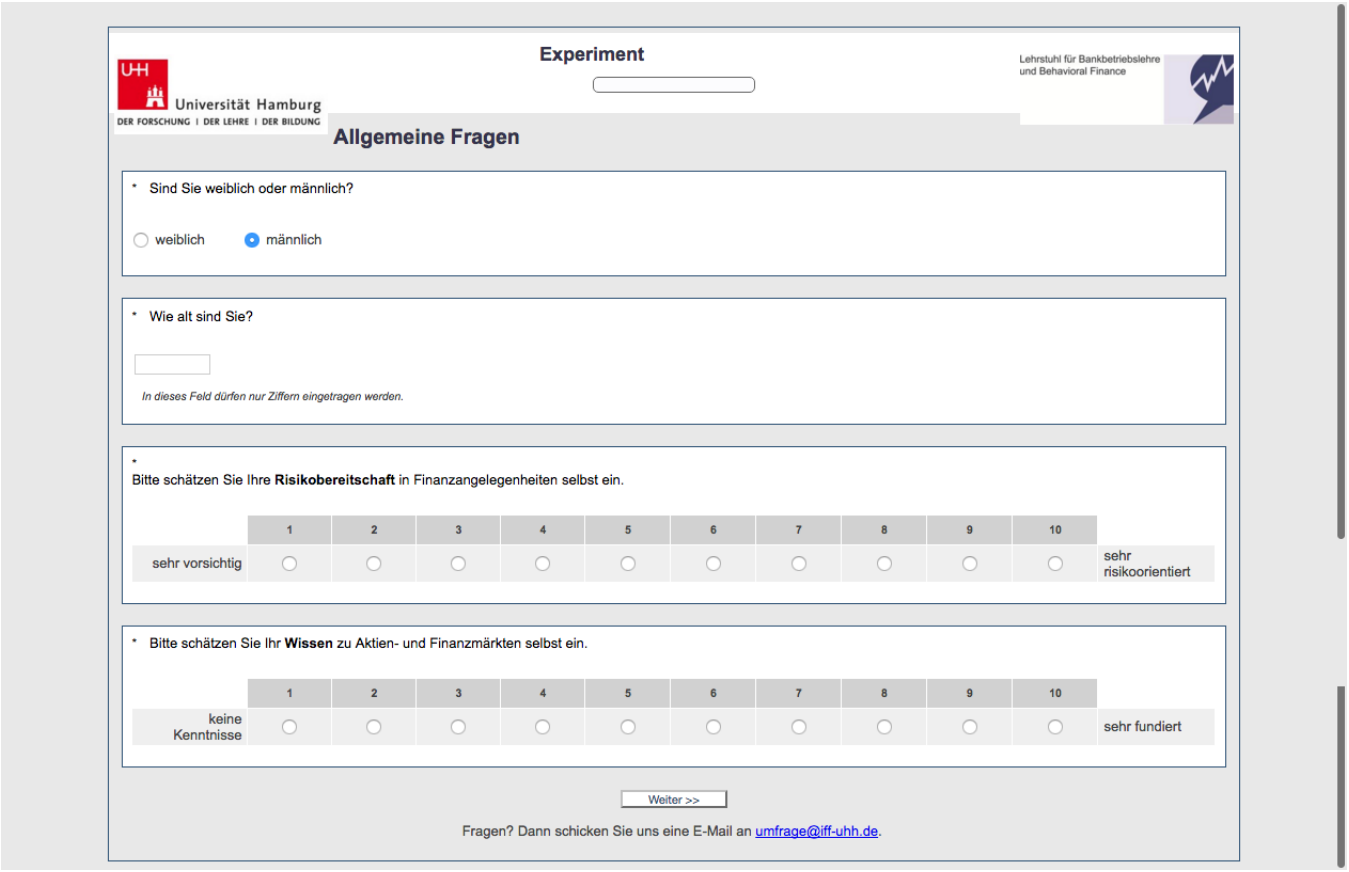
Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Measure for preferences for consistency according to Cialdini et al. (1995)

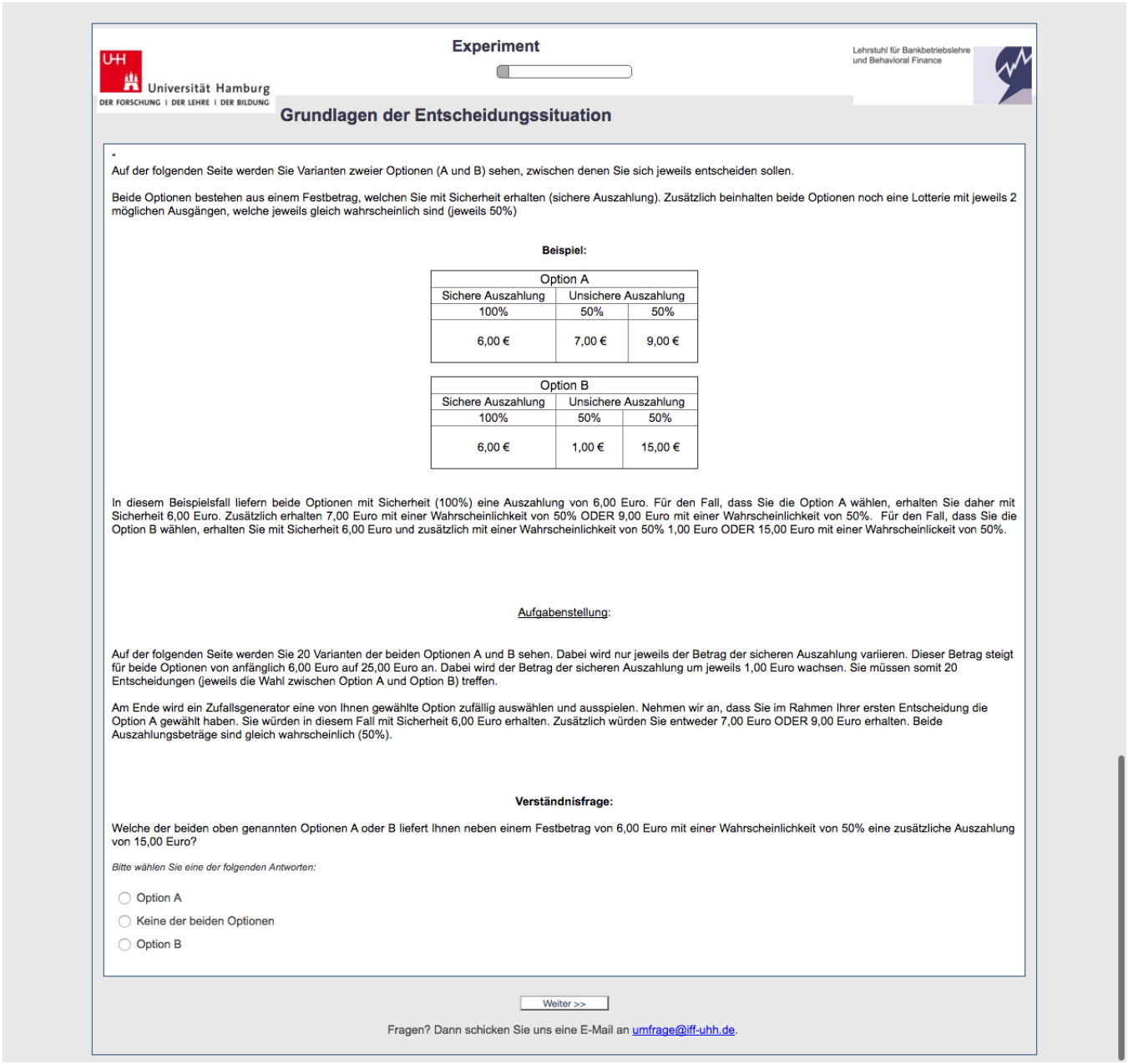
Experimental Design: Last Instructions and Information

A.2 Appendix – Risk Taking and Compensation Schemes (Experiment Documentation)

Experimental Design: Page 1 and Empirics



Experimental Design: Questions of Understanding (Main Task



Experiment

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Grundlagen der Entscheidungssituation

*

Auf der folgenden Seite werden Sie Varianten zweier Optionen (A und B) sehen, zwischen denen Sie sich jeweils entscheiden sollen.

Beide Optionen bestehen aus einem Festbetrag, welchen Sie mit Sicherheit erhalten (sichere Auszahlung). Zusätzlich beinhalten beide Optionen noch eine Lotterie mit jeweils 2 möglichen Ausgängen, welche jeweils gleich wahrscheinlich sind (jeweils 50%)

Beispiel:

Option A		
Sichere Auszahlung	Unsichere Auszahlung	
100%	50%	50%
6,00 €	7,00 €	9,00 €

Option B		
Sichere Auszahlung	Unsichere Auszahlung	
100%	50%	50%
6,00 €	1,00 €	15,00 €

In diesem Beispielsfall liefern beide Optionen mit Sicherheit (100%) eine Auszahlung von 6,00 Euro. Für den Fall, dass Sie die Option A wählen, erhalten Sie daher mit Sicherheit 6,00 Euro. Zusätzlich erhalten 7,00 Euro mit einer Wahrscheinlichkeit von 50% ODER 9,00 Euro mit einer Wahrscheinlichkeit von 50%. Für den Fall, dass Sie die Option B wählen, erhalten Sie mit Sicherheit 6,00 Euro und zusätzlich mit einer Wahrscheinlichkeit von 50% 1,00 Euro ODER 15,00 Euro mit einer Wahrscheinlickeit von 50%.

Aufgabenstellung:

Auf der folgenden Seite werden Sie 20 Varianten der beiden Optionen A und B sehen. Dabei wird nur jeweils der Betrag der sicheren Auszahlung variieren. Dieser Betrag steigt für beide Optionen von anfänglich 6,00 Euro auf 25,00 Euro an. Dabei wird der Betrag der sicheren Auszahlung um jeweils 1,00 Euro wachsen. Sie müssen somit 20 Entscheidungen (jeweils die Wahl zwischen Option A und Option B) treffen.

Am Ende wird ein Zufallsgenerator eine von Ihnen gewählte Option zufällig auswählen und ausspielen. Nehmen wir an, dass Sie im Rahmen Ihrer ersten Entscheidung die Option A gewählt haben. Sie würden in diesem Fall mit Sicherheit 6,00 Euro erhalten. Zusätzlich würden Sie entweder 7,00 Euro ODER 9,00 Euro erhalten. Beide Auszahlungsbeträge sind gleich wahrscheinlich (50%).

Verständnisfrage:

Welche der beiden oben genannten Optionen A oder B liefert Ihnen neben einem Festbetrag von 6,00 Euro mit einer Wahrscheinlichkeit von 50% eine zusätzliche Auszahlung von 15,00 Euro?

Bitte wählen Sie eine der folgenden Antworten:

- ○ Option A
- ○ Keine der beiden Optionen
- ○ Option B

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Experimental Design: First Main Task

. . .

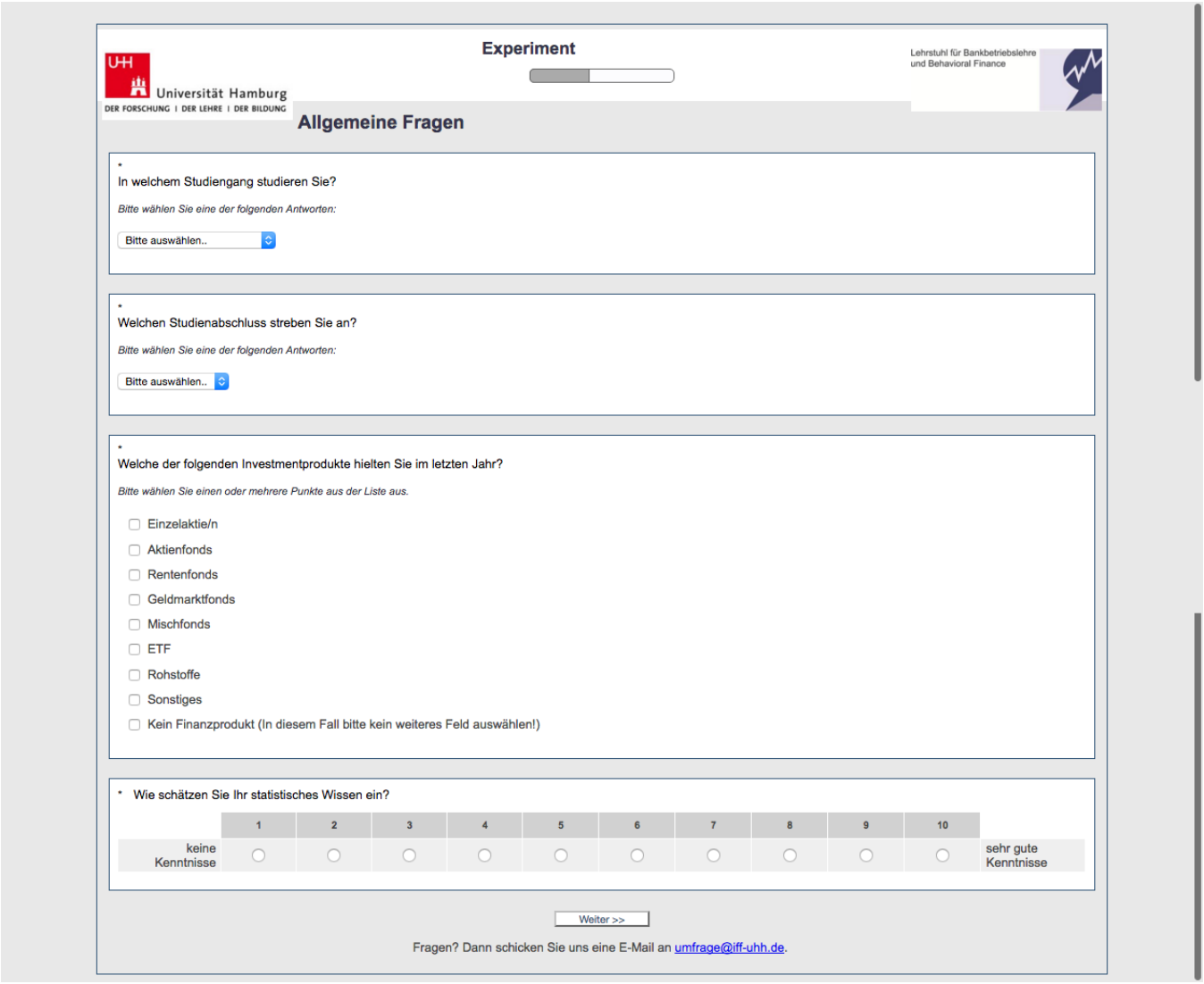
. . .

. . .

. . .

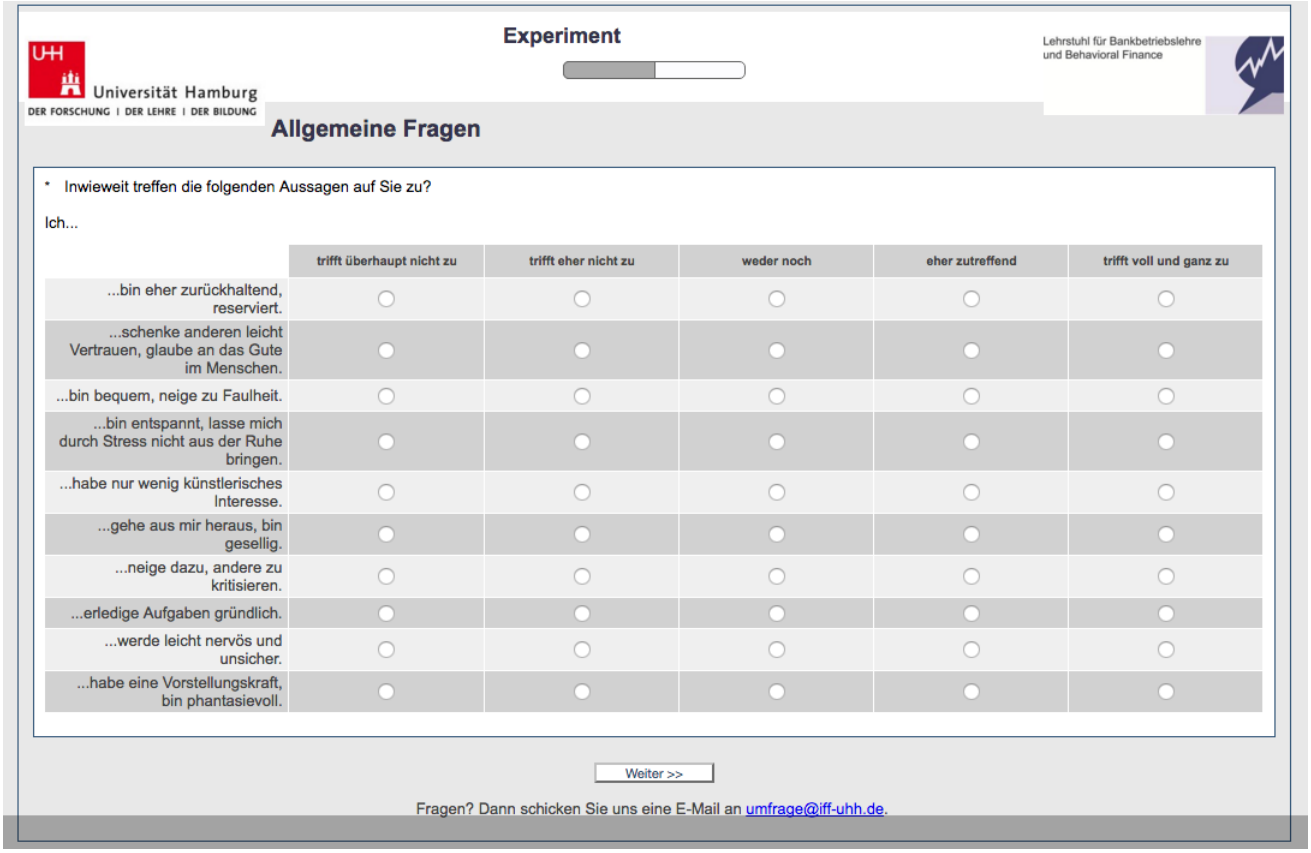
20 decision tasks: fixed amount from 6 euros to 25 euros by steps of 1 euro.

Experimental Design: Empirics



We captured additional empirics, financial background and self-assessement of statistical knowledge

Experimental Design: Big Five Questionnaire



Experiment

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Allgemeine Fragen

* Inwieweit treffen die folgenden Aussagen auf Sie zu?

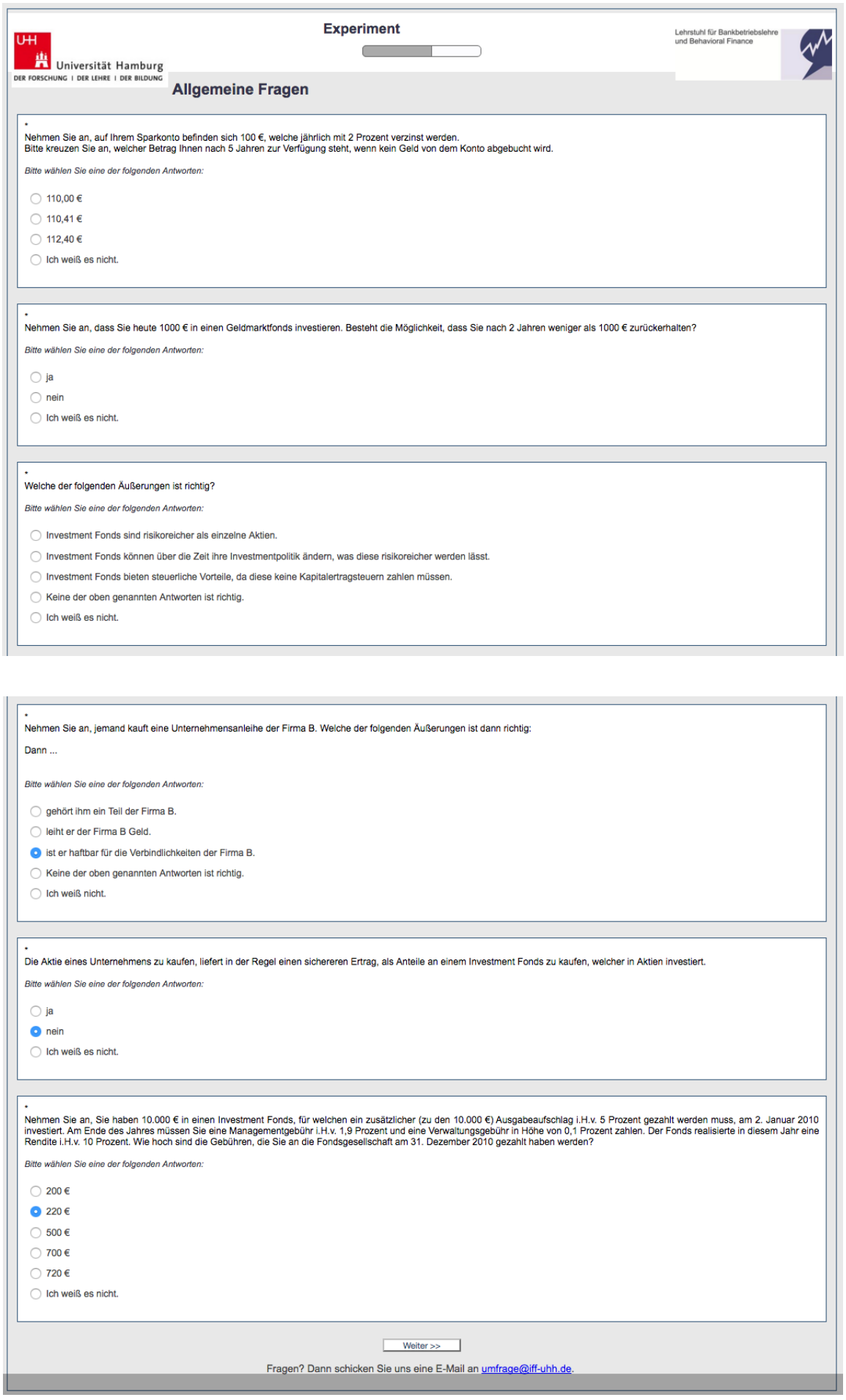
Ich...

	trifft überhaupt nicht zu	trifft eher nicht zu	weder noch	eher zutreffend	trifft voll und ganz zu
...bin eher zurückhaltend, reserviert.	○	○	○	○	○
...schenke anderen leicht Vertrauen, glaube an das Gute im Menschen.	○	○	○	○	○
...bin bequem, neige zu Faulheit.	○	○	○	○	○
...bin entspannt, lasse mich durch Stress nicht aus der Ruhe bringen.	○	○	○	○	○
...habe nur wenig künstlerisches Interesse.	○	○	○	○	○
...gehe aus mir heraus, bin gesellig.	○	○	○	○	○
...neige dazu, andere zu kritisieren.	○	○	○	○	○
...erledige Aufgaben gründlich.	○	○	○	○	○
...werde leicht nervös und unsicher.	○	○	○	○	○
...habe eine Vorstellungskraft, bin phantasievoll.	○	○	○	○	○

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Experimental Design: Financial Literacy



Experiment

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Allgemeine Fragen

*
Nehmen Sie an, auf Ihrem Sparkonto befinden sich 100 €, welche jährlich mit 2 Prozent verzinst werden.
Bitte kreuzen Sie an, welcher Betrag Ihnen nach 5 Jahren zur Verfügung steht, wenn kein Geld von dem Konto abgebucht wird.

Bitte wählen Sie eine der folgenden Antworten:

- ○ 110,00 €
- ○ 110,41 €
- ○ 112,40 €
- ○ Ich weiß es nicht.

*
Nehmen Sie an, dass Sie heute 1000 € in einen Geldmarktfonds investieren. Besteht die Möglichkeit, dass Sie nach 2 Jahren weniger als 1000 € zurückerhalten?

Bitte wählen Sie eine der folgenden Antworten:

- ○ ja
- ○ nein
- ○ Ich weiß es nicht.

*
Welche der folgenden Äußerungen ist richtig?

Bitte wählen Sie eine der folgenden Antworten:

- ○ Investment Fonds sind risikoreicher als einzelne Aktien.
- ○ Investment Fonds können über die Zeit ihre Investmentpolitik ändern, was diese risikoreicher werden lässt.
- ○ Investment Fonds bieten steuerliche Vorteile, da diese keine Kapitalertragsteuern zahlen müssen.
- ○ Keine der oben genannten Antworten ist richtig.
- ○ Ich weiß es nicht.

*
Nehmen Sie an, jemand kauft eine Unternehmensanleihe der Firma B. Welche der folgenden Äußerungen ist dann richtig:

Dann ...

Bitte wählen Sie eine der folgenden Antworten:

- ○ gehört ihm ein Teil der Firma B.
- ○ leiht er der Firma B Geld.
- ◉ ist er haftbar für die Verbindlichkeiten der Firma B.
- ○ Keine der oben genannten Antworten ist richtig.
- ○ Ich weiß nicht.

*
Die Aktie eines Unternehmens zu kaufen, liefert in der Regel einen sichereren Ertrag, als Anteile an einem Investment Fonds zu kaufen, welcher in Aktien investiert.

Bitte wählen Sie eine der folgenden Antworten:

- ○ ja
- ◉ nein
- ○ Ich weiß es nicht.

*
Nehmen Sie an, Sie haben 10.000 € in einen Investment Fonds, für welchen ein zusätzlicher (zu den 10.000 €) Ausgabeaufschlag i.H.v. 5 Prozent gezahlt werden muss, am 2. Januar 2010 investiert. Am Ende des Jahres müssen Sie eine Managementgebühr i.H.v. 1,9 Prozent und eine Verwaltungsgebühr in Höhe von 0,1 Prozent zahlen. Der Fonds realisierte in diesem Jahr eine Rendite i.H.v. 10 Prozent. Wie hoch sind die Gebühren, die Sie an die Fondsgesellschaft am 31. Dezember 2010 gezahlt haben werden?

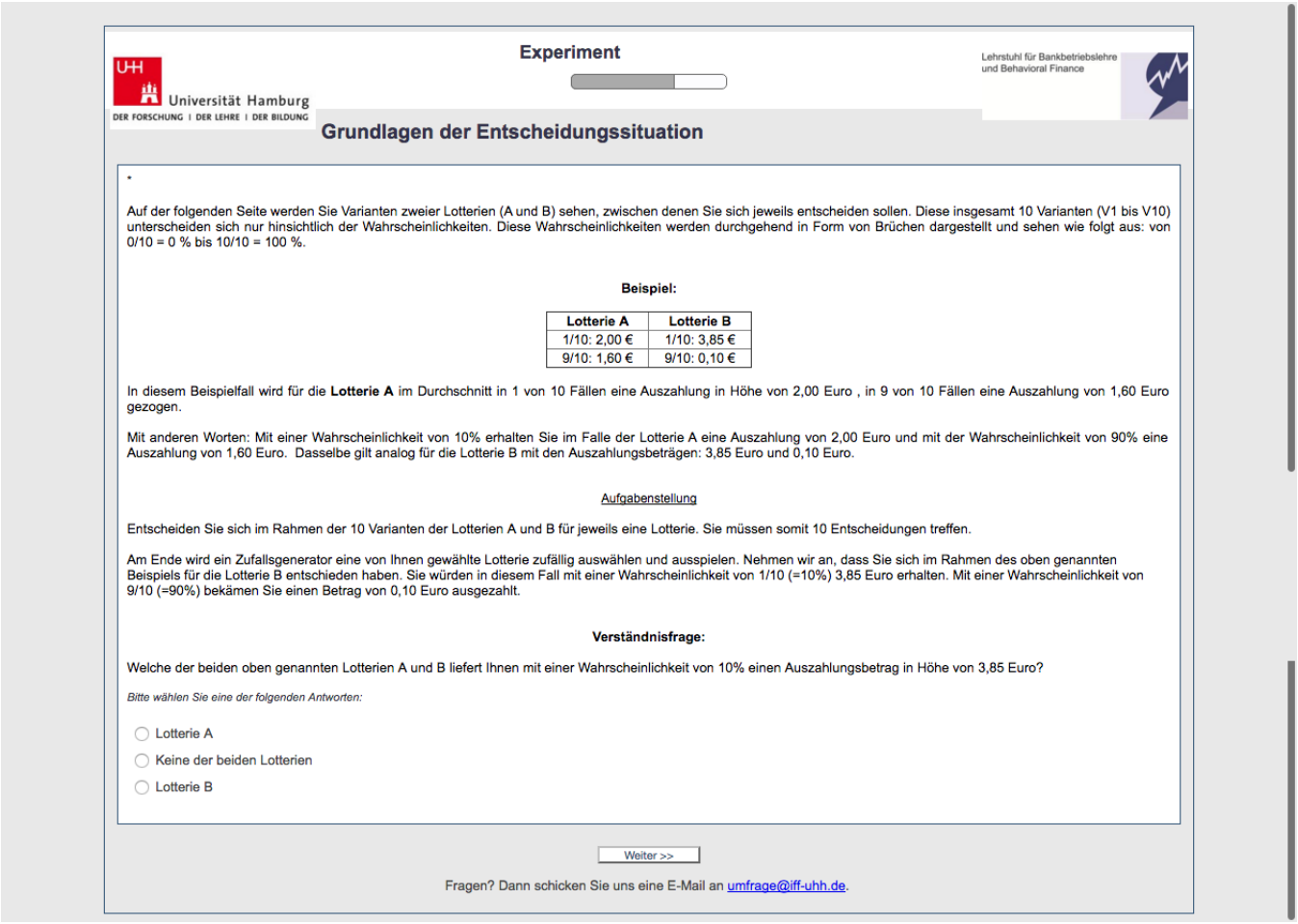
Bitte wählen Sie eine der folgenden Antworten:

- ○ 200 €
- ◉ 220 €
- ○ 500 €
- ○ 700 €
- ○ 720 €
- ○ Ich weiß es nicht.

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Experimental Design: Question of Understanding Holt & Laury Choice List



Experiment

Universität Hamburg
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Lehrstuhl für Bankbetriebslehre und Behavioral Finance

Grundlagen der Entscheidungssituation

*

Auf der folgenden Seite werden Sie Varianten zweier Lotterien (A und B) sehen, zwischen denen Sie sich jeweils entscheiden sollen. Diese insgesamt 10 Varianten (V1 bis V10) unterscheiden sich nur hinsichtlich der Wahrscheinlichkeiten. Diese Wahrscheinlichkeiten werden durchgehend in Form von Brüchen dargestellt und sehen wie folgt aus: von 0/10 = 0 % bis 10/10 = 100 %.

Beispiel:

Lotterie A	Lotterie B
1/10: 2,00 €	1/10: 3,85 €
9/10: 1,60 €	9/10: 0,10 €

In diesem Beispielfall wird für die **Lotterie A** im Durchschnitt in 1 von 10 Fällen eine Auszahlung in Höhe von 2,00 Euro , in 9 von 10 Fällen eine Auszahlung von 1,60 Euro gezogen.

Mit anderen Worten: Mit einer Wahrscheinlichkeit von 10% erhalten Sie im Falle der Lotterie A eine Auszahlung von 2,00 Euro und mit der Wahrscheinlichkeit von 90% eine Auszahlung von 1,60 Euro. Dasselbe gilt analog für die Lotterie B mit den Auszahlungsbeträgen: 3,85 Euro und 0,10 Euro.

Aufgabenstellung

Entscheiden Sie sich im Rahmen der 10 Varianten der Lotterien A und B für jeweils eine Lotterie. Sie müssen somit 10 Entscheidungen treffen.

Am Ende wird ein Zufallsgenerator eine von Ihnen gewählte Lotterie zufällig auswählen und ausspielen. Nehmen wir an, dass Sie sich im Rahmen des oben genannten Beispiels für die Lotterie B entschieden haben. Sie würden in diesem Fall mit einer Wahrscheinlichkeit von 1/10 (=10%) 3,85 Euro erhalten. Mit einer Wahrscheinlichkeit von 9/10 (=90%) bekämen Sie einen Betrag von 0,10 Euro ausgezahlt.

Verständnisfrage:

Welche der beiden oben genannten Lotterien A und B liefert Ihnen mit einer Wahrscheinlichkeit von 10% einen Auszahlungsbetrag in Höhe von 3,85 Euro?

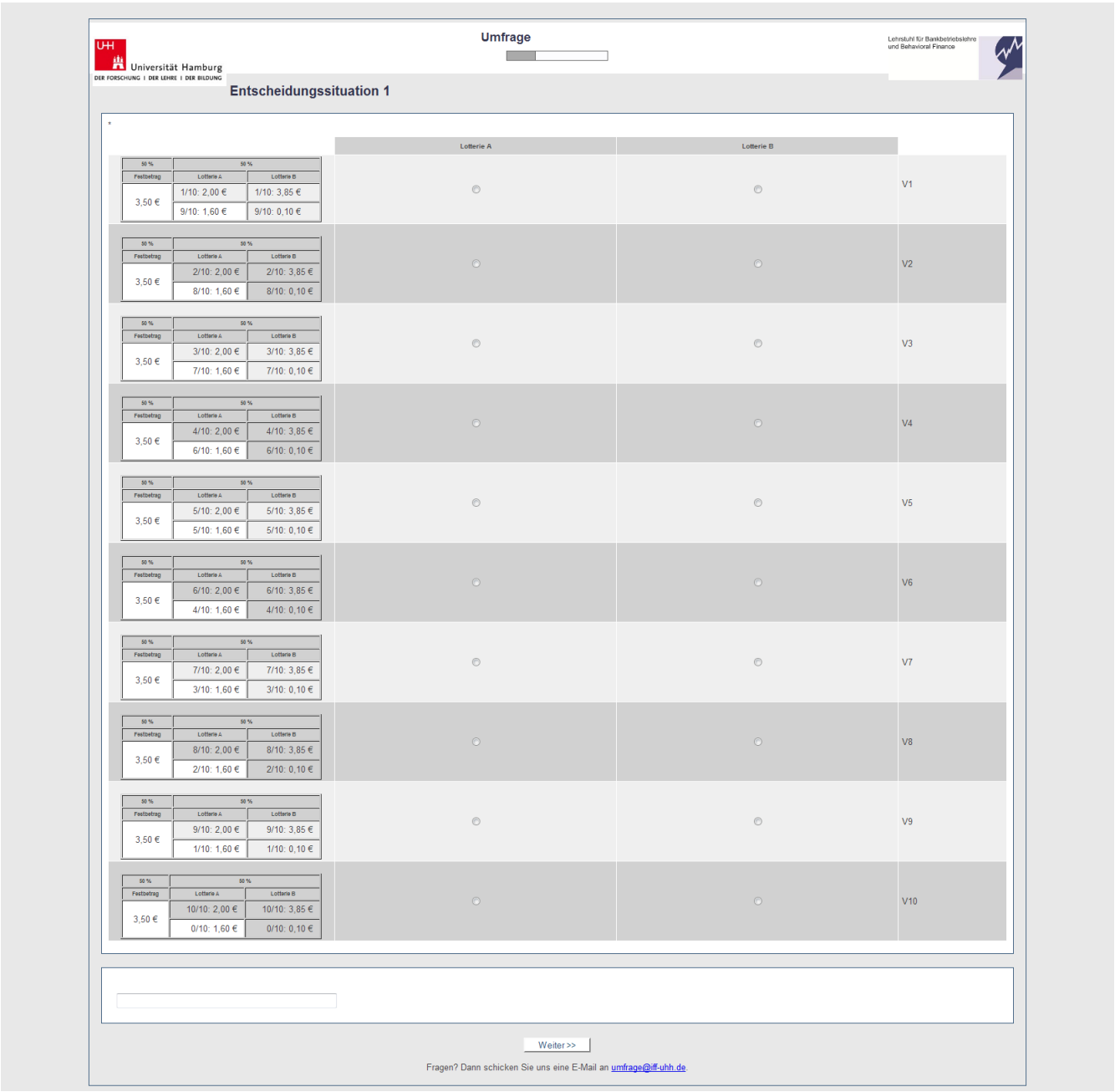
Bitte wählen Sie eine der folgenden Antworten:

- ○ Lotterie A
- ○ Keine der beiden Lotterien
- ○ Lotterie B

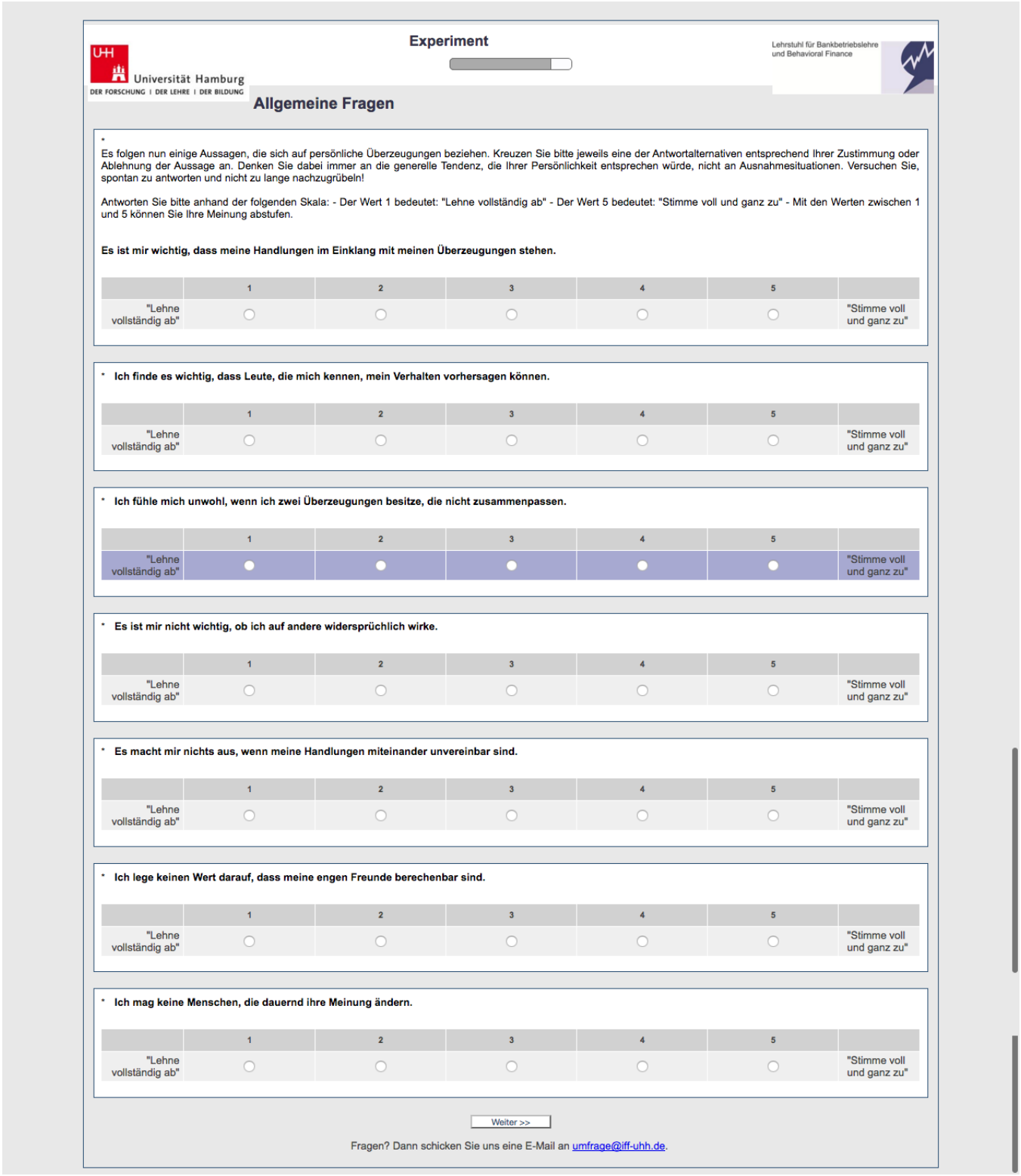
Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Experimental Design: Second Main Task – Holt & Laury Choice List



Experimental Design: Questionnaire Preferences for Consistency



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Allgemeine Fragen

*
Es folgen nun einige Aussagen, die sich auf persönliche Überzeugungen beziehen. Kreuzen Sie bitte jeweils eine der Antwortalternativen entsprechend Ihrer Zustimmung oder Ablehnung der Aussage an. Denken Sie dabei immer an die generelle Tendenz, die Ihrer Persönlichkeit entsprechen würde, nicht an Ausnahmesituationen. Versuchen Sie, spontan zu antworten und nicht zu lange nachzugrübeln!

Antworten Sie bitte anhand der folgenden Skala: - Der Wert 1 bedeutet: "Lehne vollständig ab" - Der Wert 5 bedeutet: "Stimme voll und ganz zu" - Mit den Werten zwischen 1 und 5 können Sie Ihre Meinung abstufen.

Es ist mir wichtig, dass meine Handlungen im Einklang mit meinen Überzeugungen stehen.

	1	2	3	4	5	
"Lehne vollständig ab"	○	○	○	○	○	"Stimme voll und ganz zu"

* **Ich finde es wichtig, dass Leute, die mich kennen, mein Verhalten vorhersagen können.**

	1	2	3	4	5	
"Lehne vollständig ab"	○	○	○	○	○	"Stimme voll und ganz zu"

* **Ich fühle mich unwohl, wenn ich zwei Überzeugungen besitze, die nicht zusammenpassen.**

	1	2	3	4	5	
"Lehne vollständig ab"	●	●	●	●	●	"Stimme voll und ganz zu"

* **Es ist mir nicht wichtig, ob ich auf andere widersprüchlich wirke.**

	1	2	3	4	5	
"Lehne vollständig ab"	○	○	○	○	○	"Stimme voll und ganz zu"

* **Es macht mir nichts aus, wenn meine Handlungen miteinander unvereinbar sind.**

	1	2	3	4	5	
"Lehne vollständig ab"	○	○	○	○	○	"Stimme voll und ganz zu"

* **Ich lege keinen Wert darauf, dass meine engen Freunde berechenbar sind.**

	1	2	3	4	5	
"Lehne vollständig ab"	○	○	○	○	○	"Stimme voll und ganz zu"

* **Ich mag keine Menschen, die dauernd ihre Meinung ändern.**

	1	2	3	4	5	
"Lehne vollständig ab"	○	○	○	○	○	"Stimme voll und ganz zu"

Weiter >>

Fragen? Dann schicken Sie uns eine E-Mail an umfrage@iff-uhh.de.

Last Instructions and Information

A.3 Appendix – Asset Management of German Foundations

A.3.1 Regulatory Main Principles for German Foundations

According to Hüttemann and Schön (2007) §80 Abs. 2 S. 1 BGB constitutes both regulatory main principles of the German foundation law: (1) preservation of the endowment, (2) generating revenues in order to permanently fulfill the foundations purposes.

§80 BGB Entstehung einer rechtsfähigen Stiftung
(1) Zur Entstehung einer rechtsfähigen Stiftung sind das Stiftungsgeschäft und die Anerkennung durch die zuständige Behörde des Landes erforderlich, in dem die Stiftung ihren Sitz haben soll.
(2) Die Stiftung ist als rechtsfähig anzuerkennen, wenn das Stiftungsgeschäft den Anforderungen des §81 Abs. 1 genügt, die dauernde und nachhaltige Erfüllung des Stiftungszwecks gesichert erscheint und der Stiftungszweck das Gemeinwohl nicht gefährdet. Bei einer Stiftung, die für eine bestimmte Zeit errichtet und deren Vermögen für die Zweckverfolgung verbraucht werden soll (Verbrauchsstiftung), erscheint die dauernde Erfüllung des Stiftungszwecks gesichert, wenn die Stiftung für einen im Stiftungsgeschäft festgelegten Zeitraum bestehen soll, der mindestens zehn Jahre umfasst.
(3) Vorschriften der Landesgesetze über kirchliche Stiftungen bleiben unberührt. Das gilt entsprechend für Stiftungen, die nach den Landesgesetzen kirchlichen Stiftungen gleichgestellt sind.

A.3.2 German Translation of Table 4.1

Table A.1: Preservation Principles of the German Federal States

Reichweite des Prinzips der Vermögenserhaltung	Bundesland
Der Bestand ist zu erhalten.	Baden-Wüertemberg, Sachsen-Anhalt, Schleswig-Holstein, Thüringen
Der Bestand ist ungeschmälert zu erhalten.	Bayern, Berlin, Bremen, Hessen, Niedersachsen, Nordrhein-Westfalen, Saarland
Der Bestand ist möglichst.	Hamburg, Rheinland-Pfalz
Der ist wertmäßig und in seiner Ertragskraft zu erhalten	Sachsen
Keine Vorgaben	Brandenburg, Mecklenburg-Vorpommern

A.3.3 Extracts from Federal State Foundation Laws

Below, we display these parts of the federal states foundation-laws which directly refer to the preservation of the endowment and the asset management. The complete legislative texts can be found at:
http://www.stiftungen.org/de/stiftungswissen/recht-und-steuern/landesstiftungsgesetze.html

Foundation-Law Baden-Württemberg (in the version of December 16, 2003)
§7 - Stiftungsverwaltung, Stiftungsvermögen
(1) Die Stiftung ist nach den Gesetzen, dem Stiftungsgeschäft und der Stiftungssatzung sparsam und wirtschaftlich zu verwalten. Die Verwaltung dient der dauernden und nachhaltigen Erfüllung des Stiftungszwecks.
(2) Das Stiftungsvermögen ist in seinem Bestand zu erhalten, es sei denn, dass die Satzung eine Ausnahme zulässt oder der Stifterwille nicht anders zu verwirklichen ist; der Bestand der Stiftung muss auch in diesen Fällen für angemessene Zeit gewährleistet sein. Das Stiftungsvermögen ist von anderen Vermögen getrennt zu halten.

Foundation-Law Bayern (in the version of September 26, 2008)
Artikel 6 - Verwaltung der Stiftungen
(1) Das Vermögen der Stiftung ist sicher und wirtschaftlich zu verwalten. Es ist vom Vermögen anderer Rechtsträger getrennt zu halten. Es darf unter keinem Vorwand dem Vermögen des Staates, einer Gemeinde, eines Gemeindeverbands oder einer sonstigen Körperschaft oder Anstalt des öffentlichen Rechts einverleibt werden. Der Anfall des Vermögens aufgehobener Stiftungen wird dadurch nicht berührt.
(2) Das Vermögen, das der Stiftung zugewendet wurde, um aus seiner Nutzung den Stiftungszweck dauernd und nachhaltig zu erfüllen (Grundstockvermögen), ist ungeschmälert zu erhalten.
(3) Erträge des Vermögens der Stiftung und zum Verbrauch bestimmte Zuwendungen dürfen nur zur Erfüllung des Stiftungszwecks verwendet werden. Die Zuführung von Erträgen zum Grundstockvermögen, um dieses in seinem Wert zu erhalten, bleibt hiervon unberührt.

Foundation-Law Berlin (in the version of July 22, 2003)
§3
Das Stiftungsvermögen ist in seinem Bestand ungeschmälert zu erhalten. Das Stiftungsgeschäft oder die Satzung kann Ausnahmen zulassen.

Foundation-Law Bremen (in the version of Feburary 27, 2007)
§7 - Stiftungsvermögen und Erträge
(1) Das Stiftungsvermögen ist in seinem Bestand ungeschmälert zu erhalten. Die Stiftungsbehörde kann Ausnahmen zulassen, wenn der Stifterwille anders nicht zu verwirklichen ist und der Bestand der Stiftung für angemessene Zeit gewährleistet ist.
(2) Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten.
(3) Die Erträge des Stiftungsvermögens und Zuwendungen an die Stiftung sind ausschließlich für den Stiftungszweck und zur Deckung der notwendigen Verwaltungskosten der Stiftung zu verwenden; die Verwendung für den Stiftungszweck schließt die Bildung angemessener Rücklagen ein. Sie können dem Stiftungsvermögen zugeführt werden, soweit es die Satzung vorsieht oder zur Erhaltung des Stiftungsvermögens in seinem Wert angezeigt ist. Zuwendungen sind dem Stiftungsvermögen zuzuführen, wenn der Zuwendende es bestimmt.
(4) Reichen Stiftungserträge und Zuwendungen zur Erfüllung des Stiftungszwecks nicht aus, so sollen sie dem Stiftungsvermögen zugeführt werden, sofern erwartet werden kann, dass aus den Erträgen des vergrößerten Stiftungsvermögens in absehbarer Zeit der Stiftungszweck nachhaltig erfüllt werden kann.

Foundation-Law Hamburg (in the version of December 14, 2005)
§4 - Vermögen und Verwaltung der Stiftung
(1) Die Stiftungsorgane haben nach Maßgabe des Stifterwillens für die dauernde und nachhaltige Verwirklichung des Stiftungszwecks zu sorgen.
(2) Das Stiftungsvermögen ist von anderen Vermögen getrennt zu halten. Es ist sicher und ertragbringend anzulegen; Umschichtungen sind in diesem Rahmen zulässig. Soweit nicht in der Satzung etwas anderes bestimmt ist, ist das Stiftungsvermögen möglichst ungeschmälert zu erhalten, es sei denn, der Stifterwille kann auf diese Weise nicht verwirklicht werden.
(3) Soweit nicht in der Satzung etwas anderes bestimmt ist, sind die Erträge des Stiftungsvermögens und die nicht ausdrücklich zum Vermögen gewidmeten Zuwendungen Dritter nach Abzug der notwendigen Verwaltungskosten zur Verwirklichung des Stiftungszwecks zu verwenden. Rücklagen können gebildet werden, soweit dies der nachhaltigen Verwirklichung des Stiftungszwecks dient und die Satzung nicht entgegensteht.
(4) Die Stiftung hat jährlich eine Jahresrechnung mit einer Vermögensübersicht und einem Bericht über die Erfüllung des Stiftungszwecks zu erstellen; die Grundsätze ordnungsmäßiger Buchführung sind entsprechend anzuwenden.

Foundation-Law Hessen (in the version of September 6, 2007)
§6 Stiftungsvermögen
(1) Das Stiftungsvermögen ist in seinem Bestand ungeschmälert zu erhalten. Die Aufsichtsbehörde kann Ausnahmen zulassen, wenn der Stifterwille anders nicht zu verwirklichen und der Bestand der Stiftung für angemessene Zeit gewährleistet ist
(2) Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten.
(3) Der Ertrag des Stiftungsvermögens und Zuwendungen dürfen nur entsprechend dem Stiftungszweck verwendet werden. Das gleiche gilt im Falle des Abs. 1 Satz 2 für das Stiftungsvermögen.

Foundation-Law Niedersachsen (in the version of November 23, 2004)
§6 Verwaltung der Stiftung
(1) Das Stiftungsvermögen ist in seinem Bestand ungeschmälert zu erhalten. Die Stiftungsbehörde kann Ausnahmen zulassen, wenn der Stifterwille anders nicht zu verwirklichen und der Bestand der Stiftung für angemessene Zeit gewährleistet ist. Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten.
(2) Die Erträge des Stiftungsvermögens sind ausschließlich für den Stiftungszweck zu verwenden. Sie dürfen dem Stiftungsvermögen zugeführt werden, wenn es die Satzung vorsieht oder wenn es zum Ausgleich von Vermögensverlusten erforderlich ist. Zuwendungen an die Stiftung sind für den Stiftungszweck zu verwenden, soweit sie nicht ausdrücklich dem Stiftungsvermögen zugeführt werden sollen.
(3) Die Mitglieder der Stiftungsorgane sind zur ordnungsmäßigen Verwaltung der Stiftung verpflichtet. Organmitglieder, die ihre Pflichten schuldhaft verletzen, sind der Stiftung zum Ersatz des daraus entstehenden Schadens verpflichtet. Die Haftung wegen grober Fahrlässigkeit kann nicht ausgeschlossen werden.
(4) Die Verwaltungskosten sind auf ein Mindestmaß zu beschränken. Die Mitglieder der Stiftungsorgane haben Anspruch auf Ersatz angemessener Auslagen. Bei entgeltlicher Tätigkeit von Organmitgliedern sind Art und Umfang der Dienstleistungen und der Vergütung vor Aufnahme der Tätigkeit schriftlich zu regeln. Ist eine Behörde Stiftungsorgan, so hat die Stiftung im Zweifel nur die Auslagen zu ersetzen.

Foundation-Law Nordrhein-Westfalen (in the version of Feburary 15, 2005)
§4 Grundsätze (1) Die Stiftungsorgane haben die Stiftung so zu verwalten, wie es die dauernde und nachhaltige Verwirklichung des Stiftungszwecks im Sinne der Stiftungssatzung oder - hilfsweise - des mutmaßlichen Willens der Stifterin oder des Stifters erfordert.
(2) Soweit nicht in der Satzung etwas anderes bestimmt ist oder der Wille der Stifterin oder des Stifters auf andere Weise nicht verwirklicht werden kann, ist das Stiftungsvermögen ungeschmälert zu erhalten. Vermögensumschichtungen sind nach den Regeln ordentlicher Wirtschaftsführung zulässig.
(3) Soweit nicht in der Satzung etwas anderes bestimmt ist, sind die Erträge des Stiftungsvermögens sowie Zuwendungen Dritter, die nicht ausdrücklich zur Erhöhung des Stiftungsvermögens bestimmt sind, zur Verwirklichung des Stiftungszwecks und zur Deckung der Verwaltungskosten zu verwenden.

Foundation-Law Rheinland-Pfalz (in the version of July 19, 2004)
§7 - Verwaltung der Stiftung
(1) Die Stiftungsorgane haben nach Maßgabe des Stifterwillens für die dauernde und nachhaltige Verwirklichung des Stiftungszwecks zu sorgen.
(2) Soweit nicht in der Satzung etwas anderes bestimmt ist oder der Stifterwille auf andere Weise nicht verwirklicht werden kann, ist das Stiftungsvermögen möglichst ungeschmälert zu erhalten; Umschichtungen des Stiftungsvermögens sind nach den Regeln ordentlicher Wirtschaftsführung zulässig. Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten.
(3) Soweit nicht in der Satzung etwas anderes bestimmt ist, sind die Erträge des Stiftungsvermögens und die nicht zu seiner Erhöhung bestimmten Zuwendungen Dritter zur Verwirklichung des Stiftungszwecks und zur Deckung der Verwaltungskosten zu verwenden. Die Erträge können auch dem Stiftungsvermögen zugeführt werden, soweit dies der nachhaltigen Verwirklichung

des Stiftungszwecks dient.
(4) Die Stiftung hat innerhalb von sechs Monaten nach Schluss des Geschäftsjahres eine Jahresrechnung mit einer Vermögens- übersicht und einem Bericht über die Erfüllung des Stiftungszwecks zu erstellen.

Foundation-Law Saarland (in the version of August 9, 2004)
§6 - Stiftungsvermögen
(1) Das Stiftungsvermögen ist in seinem Bestand ungeschmälert zu erhalten. Die Stiftungsbehörde kann Ausnahmen zulassen, wenn der Stifterwille anders nicht zu verwirklichen und der Bestand der Stiftung für angemessene Zeit gewährleistet ist. Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten. (2) Die Erträge des Stiftungsvermögens und Zuwendungen an die Stiftung sind ausschließlich für den Stiftungszweck und zur Deckung der Verwaltungskosten der Stiftung sowie zur Bildung angemessener Rücklagen zu verwenden. Sie können dem Stiftungsvermögen zugeführt werden, wenn es in der Satzung vorgesehen oder im Einzelfalle notwendig ist, um die Ertragskraft des Vermögens auch in Zukunft sicherzustellen. Zuwendungen müssen dem Stiftungsvermögen zugeführt werden, wenn Zuwendende es bestimmen (Zustiftung).

Foundation-Law Sachsen (in the version of August 7, 2004)
§4 - Stiftungsverwaltung
(1) Die Stiftung ist zur dauernden und nachhaltigen Erfüllung des Stiftungszwecks sparsam und wirtschaftlich zu verwalten.
(2) Die Stiftung hat nach den Grundsätzen ordnungsmäßiger Buchführung Rechnung zu führen.
(3) Das Stiftungsvermögen ist wertmäßig in seinem Bestand und seiner Ertragskraft zu erhalten, es sei denn, dass die Satzung oder die Stiftungsbehörde eine Ausnahme zulässt und der Stiftungszweck nicht anders zu verwirklichen ist. Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten.

Foundation-Law Sachsen-Anhalt (in the version of Januar 20, 2011)
§7 - Pflichten der Stiftung
(1) Die Stiftung hat ihr Vermögen im Einklang mit den Rechtsvorschriften und dem in Stiftungsgeschäft und Stiftungssatzung zum Ausdruck kommenden Stifterwillen nach den Regeln ordentlicher Wirtschaftsführung zu verwalten. Die Verwaltung dient der dauernden und nachhaltigen Erfüllung des Stiftungszwecks.
(2) Das Vermögen, das der Stiftung zugewendet wurde, um aus seiner Nutzung den Stiftungszweck nachhaltig zu erfüllen (Grundstockvermögen), ist in seinem Bestand zu erhalten, es sei denn, dass der Stiftungszweck anders nicht zu erfüllen ist. Das Grundstockvermögen ist vom übrigen Vermögen getrennt zu halten. Der Bestand und seine Veränderungen sind gesondert nachzuweisen.
(3) Die Erträge des Grundstockvermögens und diejenigen Zuwendungen Dritter, die nicht ausdrücklich zur Erhöhung des Grundstockvermögens bestimmt sind, sind zur Erfüllung des Stiftungszwecks zu verwenden.
(4) Die Stiftung ist verpflichtet, der Aufsichtsbehörde 1. die Zusammensetzung der Organe, 2. die zur Vertretung Befugten nebst deren ladungsfähigen Anschriften und 3. Änderungen der Angaben nach den Nummern 1 und 2 innerhalb einer Frist von einem Monat nach Eintritt der Wirksamkeit mitzuteilen. Die Stiftung hat der Aufsichtsbehörde ferner jederzeit auf Verlangen Auskünfte zu erteilen sowie Geschäfts- und Kassenbücher, Akten und sonstige Unterlagen zur Einsichtnahme vorzulegen.

(5) Die Stiftung ist verpflichtet, der Aufsichtsbehörde innerhalb von zwölf Monaten nach Ablauf des Geschäftsjahres eine Jahresrechnung mit einer Vermögensübersicht und einen Bericht über die Erfüllung des Stiftungszwecks (Rechnungsabschluss) vorzulegen.
(6) Wird die Stiftung durch einen Wirtschaftsprüfer, einen vereidigten Buchprüfer, eine Wirtschaftsprüfergesellschaft, eine Buchprüfungsgesellschaft, einen Prü- fungsverband oder eine Behörde geprüft, so ist anstelle der Jahresrechnung und der Vermögensübersicht der Prüfungsbericht einzureichen. Die Prüfung hat sich auch auf die satzungsgemäße Verwendung der Stiftungsmittel und die Erhaltung des Grundstockvermögens zu erstrecken. Das Ergebnis der Prüfung ist in einem Abschlussvermerk des Prüfers festzuhalten.

Foundation-Law Schleswig-Holstein (in the version of October 12, 2005)
§4 - Verwaltung der Stiftung
(1) Die zur Verwaltung der Stiftung berufenen Organe haben für die dauernde und nachhaltige Erfüllung des Stiftungszwecks zu sorgen.
(2) Das der Stiftung zur dauernden und nachhaltigen Erfüllung des Stiftungszwecks zugewandte Vermögen (Stiftungsvermögen) ist in seinem Bestand zu erhalten, es sei denn, dass die Satzung eine Ausnahme zulässt oder der Stifterwille anders nicht zu verwirklichen ist. Das Stiftungsvermögen ist von anderem Vermögen getrennt zu halten.
(3) Die Erträge des Stiftungsvermögens sowie die Zuwendungen von Dritten sind für den Stiftungszweck und die notwendigen Verwaltungskosten der Stiftung zu verwenden. Dies gilt jedoch nicht für Zuwendungen von Dritten, die nach dem Willen der oder des Zuwendenden dazu bestimmt sind, dem Stiftungsvermögen zugeführt zu werden (Zustiftungen). Diese werden Bestandteil des Stiftungsvermögens nach Absatz 2 Satz 1.
(4) Die Stiftungsorgane können Erträge dem Stiftungsvermögen zuführen, sofern dies notwendig ist, um die Ertragskraft des Stiftungsvermögens auch in Zukunft sicherzustellen, oder soweit sie im Einzelfall zur Erfüllung des Stiftungszwecks keine Verwendung finden. Dies gilt auch für Zuwendungen von Dritten, sofern dies nicht deren erklärtem Willen widerspricht.
(5) Ist das Stiftungsvermögen einer Stiftung derart geschwächt, dass die nachhaltige Erfüllung des Stiftungszwecks nicht mehr gewährleistet erscheint, so kann die zuständige Behörde schriftlich anordnen, dass die Erträge des Stiftungsvermögens ganz oder teilweise so lange anzusammeln und dem Stiftungsvermögen zuzuführen sind, bis die Stiftung wieder leistungsfähig ist.
(6) Sind die Mitglieder der Stiftungsorgane nicht hauptamtlich zur Verwaltung der Stiftung berufen, kann die Satzung 1.den Ersatz ihrer notwendigen Auslagen und ihres entgangenen Arbeitsverdienstes oder 2.die Gewährung einer angemessenen Aufwandsentschädigung vorsehen.
(7) über den Bestand und die Veränderungen des Stiftungsvermögens sowie alle Einnahmen und Ausgaben der Stiftung ist ordnungsgemäß Buch zu führen.

Foundation-Law Thüringen (in the version of December 16, 2008)
§8 - Verwaltung und Rechnungslegung der Stiftung
(1) Die Stiftungsorgane haben die Stiftung sparsam und nach den Regeln ordentlicher Wirtschaftsführung zu verwalten. Die Verwaltung dient der dauernden und nachhaltigen Verwirklichung des Stiftungszwecks.
(2) Das Stiftungsvermögen ist in seinem Bestand zu erhalten, es sei denn, dass die Satzung eine Ausnahme zulässt, der Stiftungszweck anders nicht zu verwirklichen ist und die Dauerhaftigkeit der Stiftung gewährleistet bleibt. Das Stiftungsvermögen sowie Veränderungen

in seinem Bestand sind getrennt von anderen Vermögensmassen gesondert nachzuweisen. (3) Die Erträge des Stiftungsvermögens sind zur Verwirklichung des Stiftungszwecks sowie für die entstehenden Verwaltungskosten zu verwenden. Gleiches gilt für Zuwendungen Dritter, die nicht ausdrücklich zur Erhöhung des Stiftungsvermögens bestimmt sind, soweit in der Satzung nicht etwas anderes bestimmt ist.

Appendix B

General Appendix

B.1 Abstracts and Current Status of Papers (§6 (5) PromO)

Chapter 2: Risk Taking and Induced Reference Points

Abstract (English) Based on the model of Köszegi and Rabin (2007) (KR) and the assumption that expectations can determine the reference point and thus risk taking, we conduct an experiment. We transfer the results provided by Abeler et al. (2011), who provide experimental evidence for the model of KR, from the field of work performance to individual risk taking. By controlling the expectations of our subjects we can show that induced expectations can have a significant impact on individual willingness to take risks.

Abstract (German) Ausgehend von dem theoretischen Modell von Köszegi and Rabin (2007) und deren Annahme, dass Erwartungen den Referenzpunkt und damit das Risikoverhalten beeinflussen können, führen wir eine experimentelle Untersuchung dieser Frage durch. Wir übertragen dazu die Ergebnisse von Abeler et al. (2011), die dieses Modell für den Bereich der Arbeitsleistung experimentell validieren können, auf den Bereich der Risikoübernahme. Wir können zeigen, dass unter kontrollierten Erwartungen, die Bereitschaft Risiken einzugehen, durch das gezielte Induzieren einer Erwartungshaltung signifikant beeinflusst werden kann.

Current Status Working Paper

Chapter 3: Risk Taking and Compensation Schemes

Abstract (English) Motivated by recent regulatory initiatives in the financial sector such as bonus caps, we conduct a risk taking experiment and show that a shift in the structure of executive remuneration can increase the willingness to take risks. By gradually increasing the fixed component of total compensation, subjects switch from choosing a low variance lottery to a high variance lottery. More than half of our subjects reveal EUT-inconsistent choice behavior. This behavior can be explained by reference dependent preferences, with the fixed salary serving as reference point.

Abstract (German) Ausgehend von jüngsten regulatorischen Maßnahmen im Finanzsektor, wie insbesondere die Deckelung von Bonuszahlungen und der einhergehenden Erhöhung der Festgehälter durch die Finanzinstitute, führen wir ein Experiment durch. Wir können zeigen, dass ein solcher Eingriff in die Vergütungsstruktur, die Bereitschaft Risiken einzugehen, erhöhen kann. Im Rahmen der Versuchsanordnung erhöhen wir schrittweise die fixe Gehaltskomponente und können zeigen, dass mehr als die Hälfte unserer Versuchspersonen ein Verhalten offenbaren, welches die Vorhersagen der Erwartungsnutzen-Theorie verletzt. Dieses Verhalten lässt sich mit referenzabhängigen Präferenzen erklären, wobei das Festgehalt als Referenzpunkt dient.

Current Status Working Paper

Chapter 4: Asset Management of German Foundations

Abstract (English) This study has two objectives. First, we define a legal and financial framework for the asset management of German non-profit foundations. Second, we derive asset management strategies within this framework in order to compare different approaches and test their suitability for the purposes of German non-profit foundations by means of stochastic simulations. We find that simple heuristics such as GDP-weighted stock portfolios suggested by Jacobs et al. (2014) provide superior results in comparison with empiric asset allocations. Additionally, we calculate potential welfare losses resulting from inefficient (empirical) investment behavior.

Abstract (German) Diese Studie hat zwei Ziele. Zunächst definieren wir einen rechtlichen und finanzwirtschaftlichen Handlungsrahmen für die Vermögensverwaltung von deutschen gemeinnützigen Stiftungen. Im Anschluss leiten wir unterschiedliche Anlagestrategien ab, welche diesen rechtlichen Kriterien unterliegen. Wir zeigen, dass einfache Heuristiken, wie z.B. die von Jacobs et al. (2014) vorgeschlagene Gewichtung von Aktien mittels des BIP, Ergebnisse liefern, die den empirisch belegbaren Anlagestrategien deutscher Stiftungen überlegen sind. Wir vergleichen diese Strategien mit empirischen Vermögensallokationen deutscher Stiftungen und berechnen die sich daraus ergebenen möglichen Verluste für die Wohlfahrt.

Current Status Working Paper

B.2 Statement of Personal Contribution (§6 (3) PromO)

		Main Tasks		
Chapter	**Co-Author**	**Design**	**Execution**	**Reporting**
2	Markus Nöth	Review of literature Development of research question Design of the experimental main setup (i.e., adaption of Holt and Laury lotteries) Supplement of the experimental main setup (i.e., query of personality factors: Big-Five factor model) (S)	Testing and debugging of experiment (S) Conducting of experiment Preparation of data Raising of funds for experiment (S) Interpretation and discussion of results	Drawing up of working paper Presentation of results at conferences and research seminars
3		Review of literature Development of research question Design of the experimental setup	Testing and debugging of experiment Conducting of experiment Preparation of data Raising of funds for experiment (S) Interpretation and discussion of results	Drawing up of working paper Presentation of results at conferences and research seminars
4		Review of literature Development of research question Choice of methodology (stochastic simulations) Selection and procurement of raw data	Preparation of data Running of stochastic simulations Interpretation and discussion of results	Drawing up of working paper Presentation of results at conferences and research seminars

Note: Tasks followed by (S) were performed in partnership with supervisor Markus Nöth.

B.3 Affidavit (§6 (4) PromO)

Hiermit erkläre ich, Roger Gothmann, an Eides statt, dass ich die Dissertation mit dem Titel: *Essays on Individual and Institutional Willingness to Take Risks*

selbstständig und bei einer Zusammenarbeit mit anderen Wissenschaftlern gemäß der beigefügten Darlegung nach §6 (3) der Promotionsordnung der Fakultät Wirtschafts- und Sozialwissenschaften vom 24. August 2010 verfasst und keine anderen als die von mir angegebenen Hilfsmittel benutzt habe. Die den herangezogenen Werken wörtlich oder sinngemäß entnommenen Stellen sind als solche gekennzeichnet.

Ich versichere, dass ich keine kommerzielle Promotionsberatung in Anspruch genommen habe und die Arbeit nicht schon in einem früheren Promotionsverfahren im In- oder Ausland angenommen oder als ungenügend beurteilt worden ist.

Hamburg, 13. Februar 2019 Roger Gothmann