The role of experience sampling and graphical displays on one's investment risk appetite and comprehension

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Abstract

Financial professionals have a great deal of discretion concerning how to relay information about the risk of financial products to their clients. This paper examines how different risk presentation modes influence how well investors understand the risk-return profile of financial products and how much risk they are willing to accept. We analyze four different ways of communicating risk: (i) numerical descriptions, (ii) experience sampling, (iii) graphical displays, and (iv) a combination of these formats in a 'risk simulation'. Participants receive information about a risky and a risk free fund and make an allocation between the two in an experimental investment portfolio. We find that risky allocations are elevated in both the risk simulation and experience sampling conditions. Greater risky allocations are associated with decreased risk perception, increased confidence in the risky fund, and a lower estimation of the probability of a loss. Despite these favorable perceptions the risky fund, participants in the risk simulation underestimate the probability of a high gain and are more accurate on comprehension questions regarding the expected return and the probability of a loss. We find no evidence of greater dissatisfaction with returns in these conditions and observe a willingness to take on similar levels of risk in subsequent allocations. Our paper has important implications for the current debate surrounding how financial advisors assess the suitability of investment products for their clients.

Keywords: Risk Taking, Risk Attitude, Risk Perception, Presentation Mode, Risk Comprehension, Experience-Description Gap

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1. INTRODUCTION

One of the most important financial decisions is how much risk to bear in one's investment portfolio. The behavioral finance literature shows that people find it extremely difficult to choose portfolios that match their preferences and may be easily influenced by non-normative features of the decision making environment. Financial professionals should provide clients with tools that are most likely to produce decisions in line with underlying preferences. One obvious step in the right direction is to use tools that result in stable decisions and comprehension about the risk-return profile of the chosen portfolio.

The manner in which people acquire knowledge about risk of investment products may affect how well they comprehend risk and have a dramatic influence on the risk they are willing to accept. The decision making literature distinguishes between two fundamentally distinct ways in which people learn about risk: *description* vs. *experience.* Decisions from *description* are based on explicitly stated probabilities associated with outcomes. Decisions from *experience* are based on sampling possible outcomes, meaning that the underlying probabilities must be judged or inferred based on the observed evidence. In an investment context, risk can be *described* in summary form, e.g., historical returns or factsheets. Alternatively, knowledge about risk can be acquired through *experience,* through feedback about the outcomes of previous decisions or observing outcomes in the market.

The literature on the 'experience-description gap' documents situations in which these two decision modes lead to different decisions. These findings raise the issue of what is the best way to present information about the risk of investment products. As empirical researchers, it may seem intuitive to us that risk should be described in summary statistical form. However, this is not obvious from this literature. Decision making from experience can reduce or reverse decision-making biases, such as overweighting of rare events as described by prospect theory (Barron and Erev 2003).

We extend research on the experience-description gap to the domain of investment decision making. Since investment outcomes are continuous, this is a more complex decision making task than what has been examined so far in the literature. The question of how risk presentation format influences investing is important as financial professionals have a great deal of discretion concerning how to relay this information to their clients. At worst they do not assess risk preferences at all or ask irrelevant questions about risk-seeing in other domains, such as "Are you a bungee jumper?"[1] Often, they assess willingness to take financial risks using psychometric scales.

[1] This was an item in a risk tolerance assessment of an European bank, which we will keep anonymous. Hanoch, Johnson, and Wilke (2006) showed in their study on domain specificity in risk taking that those individuals with high levels of risk taking in one domain (e.g., bungee jumpers) are sometimes very risk averse in other domains (e.g., financial decisions).

Our research question has important implications for policy making. In the EU, advisors are legally obliged to assess customers' risk preferences and issue '*appropriate guidance on and warnings of the risks associated with investments'* during the advisory process.[2] Similarly, the Securities and Exchange Commission in the US instructs banks to inform their clients about past performance of investment products and their special risks. Nevertheless, there is little instruction about how risk information should be presented. Research is needed to elucidate the implications of risk presentation format on willingness to accept and comprehend risk.

To further this objective, we developed a 'risk simulation' to more completely inform investors about the risk of investment products. The risk simulation incorporates both experience sampling and a graphical display of the full historical distribution of the MSCI USA. The simulation forces participants to sample possible outcomes for a five-year investment in a stock fund – the "risky fund". Each sampled outcome is used to build up the distribution and then the entire distribution is displayed. Participants are also shown the expected five-year return of a risk free fund. Finally, participants make an allocation between the risky fund and the risk free fund. We contrast this simulation with a numerical *description* of the expected value and variance of the risky fund. Further, we break-down the simulation into its constituent parts with a pure experience sampling and a pure distribution condition to determine their relative contributions. These different risk presentation modes are tested in an incentive compatible experimental investment portfolio, conducted online with participants drawn from a German university and the general population in the United States.

We find that the risk simulation increases the propensity to take financial risks in that participants invest a higher fraction of their endowment in the risky asset. This effect appears to be driven more by experience sampling than the displays of historical distributions. Thus, a main contribution of this paper is an extension of the literature on the experience-description gap to show that experience sampling leads to greater risk taking in the context of investing. We document three potential psychological mechanisms that vary with risk presentation format and may underlie this effect: reduced *over*estimation of the small probability of a loss, lower risk perception, and higher confidence about investing in the risky fund.

A second major contribution of this paper is improving risk communication to give investors a greater appreciation for potential benefits and the risks of investment products. We asses participants' comprehension of the risk-return profile of the risky investment product with both a subjective measure of how informed they feel and with objective measures that require them to estimate the expected return and probabilities associated with different outcomes. The risk simulation enhances comprehension of the

[2] See Article 19 of the Markets in Financial Instruments Directive (MiFID) of the European Union (The European Parliament and the European Council, 2004).

stock fund along several dimensions: the expected return, the perceived probability of a loss, and how informed they feel.

Another potential benefit of the risk simulation is that it leads participants to be less reactive when they receive a return that falls below expectations. Instead of accepting lower risk in a subsequent allocation decision, akin to pulling out of the market after a downturn, participants in the risk simulation condition are more likely to "stay the course" and make a consistent subsequent allocation decision.

The remainder of this paper proceeds as follows: in Section 2 we provide a literature review and formulate our hypotheses. Section 3 describes our experimental paradigm. Our main results are presented in Section 4. We describe how four different types of presentation formats influence people's investment allocation decisions: i) numerical description, ii) experience sampling, iii) graphical displays of distributions, and iv) a combination of these with the risk simulation. Section 5 explores comprehension and underlying psychological factors that affect the allocation decision. Section 6 examines whether the increased risk taking with the risk simulation leads to decision regret by analyzing satisfaction with returns and a subsequent allocation decision. Section 7 provides a discussion of our findings.

2. LITERATURE REVIEW AND HYPOTHESES

2.1 Risk Presentation, Risk Taking, and Comprehension

Research on risk presentation format addresses the question of whether risk taking behavior varies depending on whether the risk is experienced instead of simply described. When information about risk is acquired through *experience,* the probabilities associated with outcomes are not known or explicitly stated. They must be learned either through feedback from previous decisions or through experience-sampling, i.e. allowing people to sample possible outcomes before making a choice. This mirrors many decisions in everyday life in which people often do not have access to statistical probabilities and have to estimate risk based on personal experience and external information. For example, people draw on their own and other's past experiences when deciding whether to back up their hard drive, purchase insurance, or how cautiously to drive. The decision to invest in the stock market is not made based on the probability that the S&P 500 will go up over the next year. Rather, their intuition about the attractiveness of the stock market derives from their appreciation of how it has performed in the past.

Given identical underlying probability distributions, decisions based on description and experience can be substantially different, particularly for decisions that involve rare events. Hertwig, Barron, Weber, and Erev (2004) demonstrate that decisions based on numerical descriptions of outcomes and their associated probabilities differ significantly from decisions based on experience, in which probabilities are learned through pushing buttons to sample possible outcomes. Decisions based on numerical decisions are consistent with the overweighting of small probabilities, described by the probability weighting function of prospect theory (Kahneman and Tversky 1979). However, decisions based on experience show do not reflect a pattern consistent with overweighting. For example, in the descriptive condition of Hertwig, Barron, Weber, and Erev (2004), 36% choose to gamble on a .8 chance to win 4 points (.2 chance of 0 points) over a sure gain of 3 points, while in the experience condition 88% chose to gamble.

Numerous studies find that experience sampling choices are consistent with a reduced weight placed on rare effects, despite little consensus about the underlying mechanisms behind the effect (Barron and Erev 2003, Weber, Shafir and Blais 2004, Fox and Hadar 2006, Hadar and Fox 2009, Hau, Pleskac, Kiefer, and Hertwig 2008, see Rakow and Newell 2010 for review). Fox and Hadar (2006, 2009) challenge whether the apparent reduced underweighting of rare events is truly a change in the psychological weight assigned to rare probability events. They argue the effect can be accounted for by sampling error that results in information asymmetry between the two conditions and leads people to underestimate the probability associated with the rare event in the experience condition. The empirical evidence is equivocal on this point. In favor of a sampling error explanation, the prospect theory weighting function applied to the *sampled* rather than *objective* probability can account for observed choices (Fox and Hadar 2006) and the experience-description gap is not observed when the experience condition is yoked to a description condition that provides the probabilities of what was actually sampled (Rawkow, Demes, and Newell 2008). However, using a similar strategy to remove the sampling error confound, the reverse was found. Consistent with reduced psychological weighting, the experience-description gap persisted when participants in the experience condition observed a completely representative sample of events and this resulted in accurate explicit probability judgments (Ungemach, Chater, and Stewart 2009).

We remain open to the possibility that the experience-description gap may be more than an artifact of sampling error and that experience sampling may affect judgments about possible outcomes. The literature is clear on the point that experience sampling leads to greater risk taking among experimental lotteries that have a small probability of a loss. However, this has not been tested whether this phenomena also occurs in more contextualized domains. The decision we analyze – to invest in an equity fund over a multi-year time horizon – fits the risk profile of a small probability of a loss. For example, over a five-year time horizon, the probability of a loss is < 20%.[3] In this context experience

[3] Based on the historical returns of the MSCI USA (1973-2008) the probability of a five-year return less than the capital invested is 16%.

sampling is expected to increase risky allocations. *Thus, we hypothesized that riskier allocations would be made in the risk simulation condition compared to the description condition (Hypothesis I).*

In addition to experience sampling, the risk simulation displays return distributions. Previous research in the myopic loss aversion literature suggests that distributions may also increase risk taking. Benarzti and Thaler (1999) offered participants 100 repeated plays of a gamble with a positive expected value, allowed them to make a decision, and later showed them the distribution of returns graphically. Many who initially decline the gamble subsequently accept it after seeing the return distribution. Using a different graphical presentation format**,** Beshears, Choi, Laibson, and Madrian (2011) also found that distributions can increase risk taking. The graphs they used showed the historical percentage returns of equity funds over a 30 year time horizon, ordered by lowest return to highest return. These displays increased allocation to equities by 11-12%. These results also lead us to hypothesize greater risk taking in the risk simulation (*Hypothesis 1).* In order to disentangle the relative effect of experience sampling and distribution displays, Experiments II and III compare a pure experience sampling and a pure distribution condition.

It is imperative that a decision aid which results in an increase risk taking should not be used unless it also leads to a similar or greater level of comprehension. We expected the risk simulation to increase comprehension of the risk-return profile of the risk fund. Lejarraga (2010) demonstrated that experience sampling can increase comprehension, as measured by frequency judgments of potential outcomes. In Lejarraga's description condition, participants viewed the probability of rain in four cities. In the experience condition, participants were allowed to sample whether there was sun or rain on a given day in each of the four cities. Following a delay period, participants estimated the number of days it would rain in a ten-day period in each of the cities. Frequency estimates were more accurate in the experience than in the description condition. Fox and Hadar (2006) asked participants to estimate the probabilities associated with outcome following experience sampling. They found a high degree of accuracy - the medium correlation between judged and experienced probabilities was .97 and the medium absolute error was .06. Ungemach, Chater, and Stewart (2009) document a similarly impressive level of accuracy. Based on these findings, we expected experience sampling to increase comprehension regarding the risk-return profile of the risky fund. *We hypothesized that the experience sampling and richer provision of information in the risk simulation condition would be associated with more accurate estimates of expected returns and probabilities associated with outcomes (Hypothesis II).*

Another criterion for assessing the merits of a decision aid is post-outcome evaluation. We wanted to ensure that increased risk taking was not associated with dissatisfaction with outcomes or second guessing about the validity of one's initial decision after receiving an unfavorable return (a tendency documented by research on the outcome bias (Baron and Hershey 1988)). In order to assess whether they experienced decision regret which lead them to re-evaluate their initial risk exposure, after receiving their return participants reported satisfaction with the return and were asked to make a subsequent allocation decision.

2.2 Drivers of Risk Taking

Both research and intuition suggest that loss aversion plays a crucial role in the risk investors are willing to take on. Benarzti and Thaler (1999) proposed that increased risk seeking they observed after displaying return distributions is due to the tendency to overestimate the probability of a loss until viewing the return distribution. They recommend that investors should be presented with aggregated distributions that reflect the range of possible outcomes of their investment decisions because people seem unable to comprehend the characteristics of this distribution from descriptions of probabilities. Other researchers in the investment decision making area have also stressed the important role of the perceived probability of a loss (see Klos, Weber, and Weber 2005). However, as far as we know, the perceived probability of a loss has never been explicitly assessed in the context of investment decisions. We expected that experience sampling would reduce the perceived probability of a loss given the robust finding that for prospects with a small probability of a loss, experience sampling leads to choices consistent with a reduced overweighting of this probability. We directly measure the perceived probability of a loss in Experiment III to determine whether this drives increased risk taking associated with experience sampling.

Experiment III also assesses other potential drivers of increased risk seeking that may change depending on the decision-making context. According to expected utility theory introduced by von Neumann and Morgenstern (1947), a rational investor would choose the risk-return-profile that maximizes his expected utility and would not be influenced by different modes of risk presentation. The approach of classical portfolio theory (Markowitz 1952) reflects a different approach with a similar implication: the decision about how much risk to accept in one’s investment portfolio is a trade-off between an investment’s expected return and variance, determined by the individuals' risk attitudes – and similarly should not differ depending on the manner in which the risk is presented:

Risk Taking = (Expected Return)-(Risk Attitude)(Expected Variance)

However, more recent behavioral studies imply that individual’s risk taking behavior can be better explained by *subjective* measures such as risk perception and perceived return (see Sarin and Weber 1993, Jia, Dyer, and Butler 1999, Nosić and Weber 2010). The behavioral model of risk taking suggests:

Risk Taking = (Perceived Return) – (Risk Attitude)(Perceived Risk)

These subjective beliefs can vary depending on the domain and situational features of the decision making environment. For example, risk attitude and risk perception elicited in a lottery context are not related to portfolio choices (Nosić and Weber 2010). Even within the same context, risk perception may vary. The perceived risk of an investment option changes depending on whether it follows from a series of gains or losses (Weber and Milliman 1997). This evidence suggests that these subjective perceptions will be influenced by the manner in which risk is communicated.

These subjective measures can show excellent predictive validity, particularly perceived risk. Perceived risk predicts risky choice, despite its weak relationship to the more objective measures, such as standard deviation (Keller, Sarin, and Weber 1986, Klos, Weber, and Weber 2005). Assessing perceived risk results in greater cross-situational stability of risk preferences compared to measuring attitude towards risk alone (Weber and Milliman 1997, Weber, Blais, and Betz 2002). Perceived risk has been found to mediate the relationship between situational factors (e.g., gain/loss framing) and risk taking (Sitkin and Pablo 1992, Sitkin and Weingert 1995). Therefore, we assess risk perception in Experiment III and analyze its role in the relationship between presentation mode and risk taking.

In Experiment III, we assessed another psychological construct to elucidate the relationship between risk communication and risk taking: confidence in the risky fund. The provision of richer information in the risk simulation might result in information overload. Measuring subjective confidence provides an additional indication about whether participants feel overburdened or whether they believe in the decision they make. Beyond increasing comprehension, an aim of the risk simulation is to provide information in a way people can feel confident and committed to their decision. Confidence in the risky fund conveyed through a better comprehension of the risk-return profile is likely to drive risk taking. Though there is a vast literature on *over*confidence and investment behavior (e.g., see Glaser and Weber 2010 for review), little research has examined the role of subjective feelings of confidence. In research outside of the investing domain, richer information is associated with increased confidence, although it does not increase decision accuracy (Oskamp 1965).

3. EXPERIMENTAL DESIGN AND DATA

3.1 Experimental Task

In each of the three experiments, participants were asked to allocate an endowment between two funds. Fund A was a risk free fund and fund B was a risky fund whose payoff was based on the historical returns off the MSCI US (which was not made explicit to participants).[4] Participants first received information about the five year risk-return-profile of the risk free fund and the risky fund separately. The manner in which this information was presented varied between conditions (described further in Section 3.2).

Next participants made an *initial allocation*, which allowed them to view the diversified risk-return profile of this initial allocation over a five year time horizon in their assigned risk presentation mode. They could adjust their allocation via a scroll bar and observe how the risk-return profile of the portfolio as a whole changed as many times as they wanted before deciding on their *final allocation*. Only the final allocation was assessed in an incentive compatible manner. Participants were informed that at the end of the experiment a "financial market simulation" would be run to determine the five year return on their *final allocation* decision. It was explained that this simulation randomly generated a return based on the underlying distribution of allocation decision that they chose. Participants had the chance to win Amazon.com gift cards for their simulated return.[5] See Appendix A for an overview of the experimental flow.

Experiment III only then assessed psychological measures regarding the risky fund: perceived risk, confidence, and the comprehension questions. One comprehension question was subjective: how informed they felt about the risky fund. Several other comprehension questions assessed the objective accuracy of their knowledge about the risky fund by asking them to estimate the expected return, probability of a loss of investment capital, and probability of a return of 50% or greater. For further information about the differences between experiments see Appendix B. Appendix C provides an overview of the variables and measures.

In all experiments, before the financial market simulation participants reported control variables: risk attitude, financial literacy (adapted from van Rooij, Lusardi, and Alessi 2007), stock ownership, and demographics. The financial market simulation was run and participants then reported their satisfaction with their outcome on a 7-point scale. Finally, they reported how they would hypothetically allocate their endowment between the risk free and the risky fund if they could make the same investment decision again.

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[4] For the return on the MSCI US, we calculated the average return based on the historical returns from 1973 to 2008 of 8.95%. To calculate final wealth we assumed normally distributed continuous returns. Note that due to the underlying continuous-time framework, the final value of the portfolio's risky fraction follows a lognormal distribution. For the risk free return, we assumed an interest rate of 3.35%, which was based on the actual five year interest rate on time deposits in a bank account. The difference between the two returns corresponds to the standard characterization of the equity premium.

[5] Consistent with the existing procedures of the subject pool, we used gift cards instead of real money. Gift cards have several advantages – they can be sent via email and precluded the need for subjects to provide a name and mailing address, which helps ensure anonymity.

3.2 Stimuli

All three experiments included a description condition and the risk simulation condition. The risk simulation was developed to use experience sampling and graphical displays to communicate the asset risk in contrast to the way it is usually done in banks – by presenting return expectations with stated information about historical returns (reflected by the description condition).

In the description condition participants were given the expected return as a percentage and additionally as the expected amount of final wealth for each of the funds. The variance of the risky fund was explained in terms of frequencies (in 70 out of 100 cases your final wealth will be between X and Y, in 95 out of 100 cases your final wealth will be between U and Z, see Appendix D). They entered an initial asset allocation and saw the effects on return and variance of the diversified portfolio numerically. Next, they could adjust the allocation and see the corresponding effects on the return and variance until they decided on a final allocation.

In the risk simulation condition participants saw the expected returns and potential outcomes of their investment on a graphical interface.[6] They were first shown what the return would be if they were to invest the total amount in the risk free Fund A on a graphical display with a single line. The next step illustrated the expected return and variance of investing the total amount in the risky Fund B. To simulate experience sampling, the program drew potential returns out of the distribution at random and each draw contributed to a distribution function on the screen (see Appendix D). Participants were allowed to sample for as long as they wanted but were required to sample at least eight draws. After sampling, the simulation rapidly displayed another eight draws and then rapidly built up the entire distribution. After watching the simulation for the risky fund, participants entered an initial asset allocation between Fund A and Fund B and went through the simulation again, which now reflected the underlying distribution of their chosen diversified portfolio. They were able to adjust this allocation and repeat the simulation until they decided on a final allocation.

Experiments II and III attempted to deconstruct the risk simulation condition by examining two additional conditions: a pure experience sampling condition and a pure distribution condition. In the experience condition participants first drew returns from the distribution of the two funds separately, in a manner similar to the sampling procedure in Hertwig, Barron, Weber, and Erev (2004). Participants had

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[6] Goldstein, Johnson, and Sharpe (2008) introduce a similar interactive tool that uses distributions to aid decision making in the context of retirement portfolio selection. This tool elicits risk preferences by enabling people to choose the outcome distribution that they would like to determine their income in retirement, within cost constraints. This tool estimates parameters of risk aversion and loss aversion with reliability and validity. In contrast to the current paper, they do not compare how risk preferences differ between different modes of risk presentation, but compare different ways of informing customers about risk.

to sample at least three times from the risk free fund (which was always an outcome of $118) and at least eight times from the risky fund[7] and then entered in an initial allocation. Next they sampled from the diversified portfolio of their initial allocation and were able to adjust their allocation and continue to sample until they decided on a final allocation.

In the distribution condition participants viewed the return of the risk free fund on a graphical display (as a single line) and the distribution graph of returns for the risky Fund B and made their initial allocation. Next they could change this allocation and see how the distribution graph changed before deciding on their final allocation (see Appendix D).

3.3 Data and Participants

Experiment I was run at the University of Mannheim with one hundred and thirty-three undergraduates[8] (eighty-two male). The mean age was 22 with a range from 18 to 50 years. Approximately thirty percent of the students reported owning stocks. It took participants on average nineteen minutes to complete the experiment online, for which they were compensated with the chance to earn money in an incentive-compatible manner, based on the outcome of the financial market simulation of their final allocation decision. Participants allocated €1,000 and we randomly selected 10 students to receive an Amazon gift card for the amount of the financial market simulation divided by 100 (which resulted in payments between €10 and €18).

Experiment II recruited one hundred and eighty-eight participants[9] (sixty-six male) from the general population using the subject pool of the Yale School of Management. The mean age was 34 with a range from 18 to 70 years. Participants were predominantly Caucasian with an median income of $40,000 (range from $0 to $199,000). Fifty percent were college educated and approximately forty-five percent owned stocks. Participants again completed the experiment online and were offered a $5 Amazon.com gift certificate for their participation plus a 1 in 20 chance to earn additional performance-based money dependent on the outcome of their final allocation decision. Participants allocated an endowment of $100 and earnings ranged from $96 to $144.

[7] On average participants drew 14.48 times, with a range from 8 to 109 draws. The number of draws did not influence final allocations significantly.

[8] Ten participants were dropped from the original sample of 188 because they participated more than once. Five participants were excluded because they failed an attention-check question which asked what the experiment was about. Nine endorsed just clicking through the experiment or being very distracted. Thirty-one did not complete the experiment. In all experiments, the point at which participants dropped out did not vary between conditions.

[9] Thirty-seven observations were dropped from the original sample of 237 because the participant completed the experiment more than once, as identified by a duplicate IP address. Four participants were excluded because they failed to correctly respond to the attention check. One endorsed just clicking through the experiment. Seven did not complete the experiment.

Experiment III assessed comprehension and potential underlying psychological mechanisms so the sample size was increased to three hundred sixty-two participants[10] (one hundred twenty-two male), again using the subject distribution list of the Yale School of Management. Demographics were similar to those in Experiment II. The mean age was 35 with a range from 18 to 75 years. Participants were overwhelmingly Caucasian with a median income of $39,000 (range from $0 to $145,000). Fifty-three percent were college educated and approximately forty percent owned stocks. Participants again completed the experiment online in exchange for a 50% chance to earn a $5 Amazon.com gift certificate and a one in 40 chance to earn additional performance-based pay based on the outcome of their final allocation decision.

4. INFORMATION PRESENTATION AND ALLOCATION DECISIONS

We find that the manner in which people acquire knowledge about risk does affect their allocation decisions. In line with Hypothesis I, the final allocation was significantly higher in the risk simulation condition in all three experiments. Table 1 shows the means of the initial and final allocation to the risky fund. In all experiments the final allocation to the risky fund was significantly greater in the risk simulation condition compared to the experience condition.

Insert Table 1 here

The increased risky allocations in the risk simulation condition remains significant when we include control variables using OLS regression analysis[11] in Table 2. Consistent with previous literature (Hong, Kubik, Stein 2005, van Rooij et al. 2007, Nosić and Weber 2010), self-reported risk attitude is highly significant in all three experiments. The control variables financial literacy, stock ownership, age, education, and income were generally insignificant. Education and income were not collected from the student population since education is relatively constant in the sample and it is difficult to meaningfully assess income in a student sample. See Appendix C for an explanation of the variables used in this and all other analyses. There was no difference in the initial allocation between conditions.

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[10] Thirty-tree observations were dropped from the original sample of 429 because they participated more than once. Nine participants were excluded because they failed the attention-check. Fourteen endorsed just clicking through the experiment or being very distracted. Eleven did not complete the experiment.

[11] Results also hold using Tobit regression analysis censored by €0 and €1,000 for Experiment I and $0 and $100 for Experiments II and III.

Results suggest that adding information through the use of experience sampling and a distribution function leads to more risky asset allocations. This raises the question of whether it is the presence of one or both of these features that results in riskier allocations. This is explored in Experiments II and III by adding a pure experience sampling and a pure distribution condition.

Insert Table 2 here

Table 2 analyses the results including control variables in an OLS regression, we find in Experiments II that risky allocations are elevated in the experience and distribution conditions compared to the description condition, but are not significantly different (see Table 2, Column 3). With the increased sample size in Experiment III, the difference between experience and description is significant (see Table 2, Column 5).

This evidence of the experience-description gap[12] suggests that the increased risk taking in the risk simulation is driven more by experience sampling rather than by the presentation of the distribution function. Nevertheless, it does not explain the whole effect, as the difference between the description and combination risk simulation condition is greater than the difference between description and experience conditions. There were no significant differences between the description and distribution conditions (Table 2, Columns 3 and 5).

5. COMPREHENSION & POTENTIAL PSYCHOLOGICAL DRIVERS OF RISK TAKING

5.1 Comprehension

We analyze whether the manner in which people acquire information about risk affects their comprehension, as measured in several ways. Three comprehension questions had objectively correct responses and required them to estimate aspects of the underlying risk-return profile of the risky fund: expected return, probability of a loss (downside) probability of a high gain (upside potential). Two subjective questions assessed how informed they felt regarding the risky and risk free fund. See Table 3 for comprehension results.

[12] Hertwig et al. 2004 and Fox and Hadar 2006 invoke two mechanisms to explain the experience-description-gap: reliance on relatively small samples of information due to limited search (*sampling error*) and overweighting of recently sampled information due to memory constraints (*recency effects*). After controlling for these variables, we continue to find a significant difference between experience and description. It seems that the effect cannot be fully explained by the sampled outcomes. Results are available on request.

The first question assessed the expected return of the risky fund after five years with an initial investment of $100. Note that in all conditions except the experience condition, participants were explicitly given the return of the risky fund and only had to recall it correctly. The correct answer based on historical returns is $153 and participants choose from among five intervals. The highest percentage of right answers was in the risk simulation condition (57%,), though this is not significantly higher than any of the other conditions. In the experience condition, where the exact expected return was not stated, correct responses (47%) were similar to the description condition (46%). In order to understand the direction and magnitude of incorrect answers, we created a new variable to reflect overestimation by assigning the value -1 to the $100-$140 interval (the interval that underestimated the return), 0 to $141-$180 (the correct interval), 1 to $181-$220, 2 to $220-$260, and 3 to >$260. Using ordered probit analysis with control variables, there is significantly less overestimation of the return in the risk simulation condition compared to the description condition (z= 2.28, p= .02), in line with Hypothesis II. Using the midpoint of each interval to estimate the magnitude of overestimation in each condition, the expected return in the risk simulation condition is overestimated by $13 in the risk simulation condition and $24 in the description condition (see Columns 3 and 4 of Table 3).

Insert Table 3 here

Participants estimated the probability that the five year return of a $100 allocation to the risky fund would fall below $100 (correct answer 16%) or exceed $150 (correct answer 54%). Note that the correct responses to these questions were not explicitly stated; participants had to have a sense of the risk-return distribution in order to give a correct answer. Across conditions, participants do not display consistent over- or underestimation regarding the variance of the return. Overall, there is an overestimation of the chance of receiving a loss (overall mean 29%) but an underestimation of a return higher than 150 (overall mean 36%).

Participants were asked to estimate the probability of a loss with the question: “If we put $100 in the riskier fund, in how many cases out of 100 will final wealth fall below $100 after five years?” (Column 5, Table 3).[13] Estimations in the risk simulation were significantly more accurate compared to the description condition using OLS regression analysis with control variables (β=-15.37.91, t= 4.97, p < 0.01), in line with Hypothesis II. In the experience condition participants were also significantly more accurate about the probability of a loss compared to the description condition (β =-6.77, t= 3.13, p=0.03), suggesting that experience sampling, not the presentation of the distribution function, drives the effects

[13] One observation was dropped because it exceeded 100 (180).

we see in the risk simulation condition. This is consistent with the experience-description gap literature, which documents very high calibration between judged and sampled probabilities.

Though participants in the risk simulation condition overestimate the probability of a loss to a lesser extent and are willing to accept more risk, they do not have unrealistically optimistic expectations. They are most accurate about the perceived return and underestimate the probability of a gain to a higher degree than in all other conditions, though this effect is not significant (Column 6 of Table 3). Again, participants in the experience sampling condition are highly calibrated at judging probabilities, demonstrating significantly more accuracy compared to all other conditions ($t_{(358)}$=2.12, p=0.04).

It is especially important to identify strategies for those with low financial literacy to understand the underlying risk-return profile of their investments. We divide our sample into high and low financial literacy by splitting participants at median financial literacy score (which is equal to the mean). Across conditions, those with low financial literacy are less accurate about the estimated expected return ($t_{(359)}$= 1.71, p= 0.09) and the estimated probability of a loss ($t_{(358)}$= 2.50, p= 0.01). However, participants with low financial knowledge in the risk simulation condition are significantly more accurate about the probability of a loss compared to people with high financial knowledge in other conditions ($t_{(183)}$=2.09, p=0.04). This suggests that the risk simulation holds promise as a tool for financial education.

It may be that participants in the risk simulation give more accurate estimations (aside from estimations of upside potential), but do not feel more informed since the risk simulation might have been perceived as overly complicated. We asked participants how informed they feel about the risky and the risk free fund on a 7-point scale. For the risk free fund we find no significant difference in "feeling informed" (mean answers ranged from 5.38 in the experience condition to 5.65 in the risk simulation condition). With regard to the risky fund, which is more complex to understand, participants felt significantly more informed in the risk simulation condition compared to all other conditions $t_{(359)}$=2.84, p<0.01) (Column 7 of Table 3).

5.2 Risk perception and confidence

In Experiment III we sought to better understand the psychological drivers that are associated with increased risk taking in the risk simulation. In an exploratory fashion, we examined possible psychological perceptions that could be induced by different presentation formats and drive risk taking.

The behavioral model of risk taking posits that risk taking is a function of risk attitude, perceived return, and perceived risk, which can be influenced by the decision making context. As discussed in the comprehension section, perceived return was lowest in the risk simulation, making it an unlikely candidate as psychological driver of risk taking. Attitude towards risk, always a significant control variable, behaves like a stable personality trait and does not vary based on risk presentation format. In contrast, perceived risk is associated with risk taking in a manner that varies with presentation format.

After making their allocation decision, participants were asked to report how risky they perceived the risky fund to be on a seven-point scale (anchored at "not risky at all" and "very risky"). Risk perception is significantly lower in the risk simulation (M=4.34) compared to description (M=4.93; $t_{(190)}$= 3.10, p<0.01). It may be that the risk simulation reduces risk perception, which in turn increases risky allocations. The perceived probability of a loss can be considered an indicator of risk perception. Across conditions, both the subjective report of risk perception and the judged probability of a loss closely track risky allocations (see Figure 1).

Insert Figure 1 here

In addition to the factors of the behavioral model we assessed confidence about investing in the risky fund. Confidence is significantly higher in the risk simulation (M= 4.89) compared to confidence in the description condition (M= 4.25; $t_{(190)}$=3.32, p<0.01). This coupled with the finding that participants in the risk simulation condition feel more informed about their decision is a positive indicator that the risk simulation leads to positive subjective feelings regarding the allocation decision. Across conditions, confidence also closely tracks risky allocations (see Figure 1). [14]

6. POST-RETURN DECISION EVALUATION

Does the manner in which people acquire information about risk influence their satisfaction with their outcomes? Those in the risk simulation condition might only be temporarily convinced to accept greater risk and later come to regret their decision, especially if they receive a loss or a return that does not meet their expectations.

After receiving the outcome of their decisions from the financial market simulation, participants reported satisfaction with their return. We find no evidence that people in the risk simulation condition regret their relatively high allocations to the risky fund. In all three experiments participants in the risk simulation condition were not less satisfied with the outcomes than in the description condition (see Table 4). Even for people whose return fell below the expected value of their allocation decision, satisfaction was not reduced for those in the risk simulation condition.

[14] Mediation analysis for these measures indicates that risky allocations in the tool conditions are mediated by decreased risk perception, increased confidence in the risky fund, and a lower estimation of the probability of a loss. Results are available on request.

Insert Table 4 here

Another indicator of how people evaluate their allocation decision after receiving their return is their subsequent (hypothetical) allocation decision. Across conditions, there are high correlations between the allocation and subsequent allocation (r_{Exp1}= .52, r_{Exp2}=.70, r_{Exp3}=.72). All t-tests comparing subsequent allocation in the tool simulation and the description condition are highly significant, consistent with the pattern of results we see for the final allocation. Participants' willingness to subsequently take on a similar level of risk in the risk simulation suggests that they do not regret their previous allocation decision.

Another way to address the issue of decision regret is to analyze the difference between the first and the subsequent allocation to gain a better understanding of the subjects' reactivity to returns between conditions. Figure 3 plots the subsequent minus the first allocation against the variable luck, which reflects whether subjects earned more or less than their expected return in their final outcome. For example, if a participant invested the total $100 endowment in the risky fund and received an outcome of 160 in the financial market simulation, the variable luck is calculated as 160 – 153 (the expected return) = 7. We combine the data from Experiments II and III, in which participants allocated a $100 endowment.

Insert Figure 2 here

Across conditions, participants are reactive to losses but not gains. They reduce their allocation to the risky fund in reaction to a return less than the expected value of their allocation (i.e., luck <0). This tendency appears less pronounced in the risk simulation and experience conditions compared to the description and distribution conditions (see Figure 2). In order to assess this pattern more formally, we focus on the subsample of participants where the expected value falls short of the realized return (i.e. luck<0) and regress the difference between subsequent and final allocation on the interaction terms of the dummy variables for the condition and luck. A higher coefficient suggests that participants reduce their risky allocation in a hypothetical subsequent allocation as a result of a more negative difference between expected and realized return. We find evidence of a lower reactivity to losses in the risk simulation condition. Participants are significantly less reactive in the risk simulation condition compared to distribution ($F_{(1,314)}$ = 6.59, p= 0.01) and in the experience condition compared to distribution ($F_{(1,314)}$ = 4.26, p= 0.04). Participants are more reactive to losses than participants in the experience and the risk simulation condition in the description condition; however this effect is not significant.

7. DISCUSSION

Research to date had not examined the optimal way to inform investors about the riskiness of investment products in a manner that maximizes comprehension and does not diminish satisfaction with returns. The results of the current paper suggest that a risk presentation format which incorporates experience sampling and distributions of returns may help achieve this objective. With this increased comprehension comes an increased willingness accept risk in one's portfolio. We do not wish to imply that research should aim to bolster people's willingness to take on investment risk, but rather that it is essential to understand how the information provided in the context of this decision influences the propensity to accept risk and comprehension regarding return expectations. We examine risk taking in an experimental paradigm that models a common investment decision: allocating assets between the risk free return and a diversified equity fund. The risk simulation may have a different effect on risk taking in an alternative paradigm, such as one that pits a diversified stock fund versus an asset with a high probability of a loss.

Our main result is that information presentation format reliably affects allocation to a stock fund over the risk free rate. Across three experiments, when the presentation format both includes experience sampling and displays the distribution of returns, risky allocations are higher compared to stating the expected return and standard deviation. Experiments II and III suggest that experience sampling is the more powerful driver of the riskier allocations compared to displays of return distributions. However, experience sampling does not entirely explain the increased risk taking in the risk simulation since risk taking in the distribution condition was consistently (though non-significantly) elevated compared to the description condition. Presentation of the distribution function may have some additive effect. Future research should further explore different graphical presentation formats. For example, displays that contrast annual historic returns of bond and stock funds have been found to increase allocations to the stock fund (Beshears, Choi, Laibson, and Madrian 2011).

We examined whether there are negative repercussions to accepting more risk in the risk simulation. Increased risk taking in the risk simulation does not compromise comprehension. Participants in the risk simulation condition were most accurate about the expected return and the probability of a loss and felt significantly more informed about their decision. We do not observe any evidence of greater decision regret or unrealistic expectations about the risky fund. Participants in the risk simulation conditions are no less satisfied with the return they receive and maintain the same or greater risk level when they are asked how they would allocate their money if they could make a subsequent allocation decision. In conditions that included sampling subsequent allocation decisions tend to be less reactive to variance in returns. Experience sampling seems to prepare participants for the possibility of a loss, resulting in a decreased tendency to react to losses by taking on less risk in a subsequent decision. If we extrapolate from the current findings, we would predict that experience sampling could assist people in sticking to a long term investment plan in the face of market volatility. However, the current paper is an experimental paradigm intended to model decision-making that would occur over the course of years compressed into the short time span of the experiment. Further research should examine the role of experience sampling in actual investment decision with feedback and ongoing decision making extended in time.

Across conditions, risky allocations are associated with a pattern of lower perceived probability of a loss, lower risk perception, and greater confidence in the risky fund. Consistent with the behavioral model of risk taking, these findings suggest that subjective perceptions can be powerful determinants of risk taking. Risk presentation format may act on these perceptions to drive risk taking. To test this proposition, further research should explore whether these perceptions vary by risk presentation mode prior to choice (which then could determine risk taking) or are simply after-effects of making riskier choices.

Future research should examine the effect of the risk simulation for other types of financial decisions. As discussed above, we do not expect the risk simulation to uniformly increase risk-taking. Future research could examine allocations among funds of various risk levels, foreign vs. domestic funds, more than two funds, etc. Further, a limitation of this paper is that we examine a single time horizon: five years. As described by the research on myopic loss aversion, extending the time horizon is likely to increase risk taking. It may be that the effect of information presentation format will interact with this effect. Specifically, the effect of the risk simulation on increased risk taking is likely to diminish with longer time horizons. Future research could also look beyond investment decisions. Risk simulations could also be used to inform home buyers about the risks associated with the real estate market, such as home prices and fluctuations in interest rates.

This research contributes to the objective of helping people understand the risk that they face in their investment decisions. Instead of simply using psychometric scales to assess willingness to accept risk, financial providers could provide tools to further clients' understanding of the implications of portfolios with different risk profiles and ensure suitability. The use of experience sampling in financial simulations may be a fruitful strategy for banks to improve the quality of the information they provide about their investment products to ensure that clients understand both the risks they take and the amount of risk they are prepared to take.

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Table 1: Allocation to the risky fund

Table 1 reports the results mean allocations, standard deviations, and median allocations to the risky fund expressed in percent of total endowment. There was a €1,000 endowment in Experiment I a $100 endowment in Experiment II and III.

	Experiment I (Students) Allocation			Experiment II (General Population) Allocation			Experiment III (General Population) Allocation		
	n	**Initial**	**Final**	**n**	**Initial**	**Final**	**n**	**Initial.**	**Final**
Description	75			44			99		
Mean		43.56	**60.42**		52.68	**54.39**		47.95	**57.71**
Std. Dev.		30.85	26.34		28.44	26.04		31.84	27.85
Median		45.00	60.00		50.00	50.00		50.00	60.00
Risk Simulation	58			45			93		
Mean		44.54	**74.15**		52.27	**66.53**		47.16	**70.59**
Std. Dev.		31.68	23.60		25.77	25.50		31.29	26.31
Median		37.50	81.00		50.00	65.00		50.00	75.00
t-test description vs. risk simulation			$t_{(131)}=3.12$ $p<0.01$			$t_{(87)}=2.22$ $p=0.03$			$t_{(190)}=3.38$ $p<0.01$
Distribution				50			81		
Mean					58.32	59.52		50.04	62.46
Std. Dev.					24.03	27.48		27.67	27.33
Median					50.00	60.00		50.00	65.00
Experience				51			88		
Mean					52.61	61.00		41.72	66.65
Std. Dev.					25.46	24.64		31.04	26.62
Median					50.00	65.00		50.00	70.00

Table 2: Final allocation to the risky fund

This table reports OLS regression analysis of final allocations to the risky fund. See Appendix C for an overview of control variables. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level, income expressed in ten thousands, standard errors in parentheses.

	Experiment I	**Experiment II**		**Experiment III**	
	Description vs. Risk Simulation	Description vs. Risk Simulation	Experience and Distribution vs. Description	Description vs. Risk Simulation	Experience and Distribution vs. Description
Risk Simulation	132.72***	13.83***		11.92***	
	(38.42)	(5.24)		(3.64)	
Experience			7.61		9.78***
			(5.09)		(3.80)
Distribution			7.75		4.74
			(5.16)		(3.87)
Risk Attitude	137.69***	9.72***	8.81***	10.37***	7.46***
	(22.63)	(2.93)	(2.39)	(2.00)	(1.76)
Financial Literacy	7.19	1.65	1.47	-1.11	-0.44
	(7.99)	(1.25)	(1.05)	(0.86)	(0.65)
Stock Ownership	-48.85	12.03**	5.34	1.77	0.61
	(44.72)	(5.69)	(4.99)	(4.16)	(3.81)
Age	16.04**	0.05	-0.37*	0.001	0.08
	(6.23)	(0.23)	(0.20)	(1.16)	(0.14)
Gender	31.70	3.49	-0.63	1.14	6.54*
	(40.92)	(5.92)	(4.72)	(4.19)	(3.55)
Education		1.97	-3.61	4.39**	1.62
		(2.85)	(2.35)	(2.15)	(1.82)
Income		-1.22	0.07	-0.21	-0.00
		(1.03)	(0.07)	(0.17)	(0.00)
Constant	-189.03	1.96	31.15***	20.70**	29.11***
	(156.06)	(14.21)	(12.17)	(9.91)	(8.32)
Observations	133	89	145	192	268
R-squared	0.33	0.30	0.18	0.21	0.13

Table 3: Comprehension about the risky fund

This table reports the mean deviation from corrects answers to comprehension questions about the risky fund and the mean of feeling informed about the risky fund on a seven-point scale.

Condition	n	Correct return interval	Overestimation of the return+	Overestimation of the probability of a loss	Underestimation of the probability of a gain > $150	Feeling Informed
Description	99	46%	$24	0.21	0.15	4.60
Distribution	81	54%	$27	0.23	0.19	4.39
Experience	88	47%	$26	0.15	0.12	4.37
Risk Simulation	93	57%	$13	0.05	0.21	4.99

+Overestimation of return is estimated from the return intervals by averaging the midpoint of the intervals.

Table 4: Satisfaction with returns

This table reports the mean of overall self assessed return satisfaction (7 point scale) and return satisfaction for a subsample of participants - those who received a return below the expected value of their chosen portfolio. Standard deviations are in parentheses. The n in brackets reflect the subsample with luck < 0.

	Experiment I (Students)			Experiment II (General Population)			Experiment III (General Population)		
Condition	**n**		**luck < 0**	**n**		**luck < 0.**	**n**		**luck < 0**
Description	65	4.25	3.03	44	5.41	4.70	99	5.25	4.72
	[37]	(2.02)	(1.66)	(23)	(1.59)	(1.43)	(60)	(1.58)	(1.63)
Risk Simulation	54[2]	4.10	3.28	44	5.12	4.54	93	5.31	4.75
	[29]	(1.90)	(1.94)	(26)	(1.59)	(1.70)	(55)	(1.62)	(1.64)

Figure 1: Graphical overview of main results of Experiment III

Figure 1 displays the pattern of increased confidence, decreased risk perception, and decreased perceived probability of a loss associated with investment allocations to the risky fund. Perceived risk and confidence, originally measured on a 7-point scale, are multiplied by 10 to facilitate comparisons with allocation decisions.

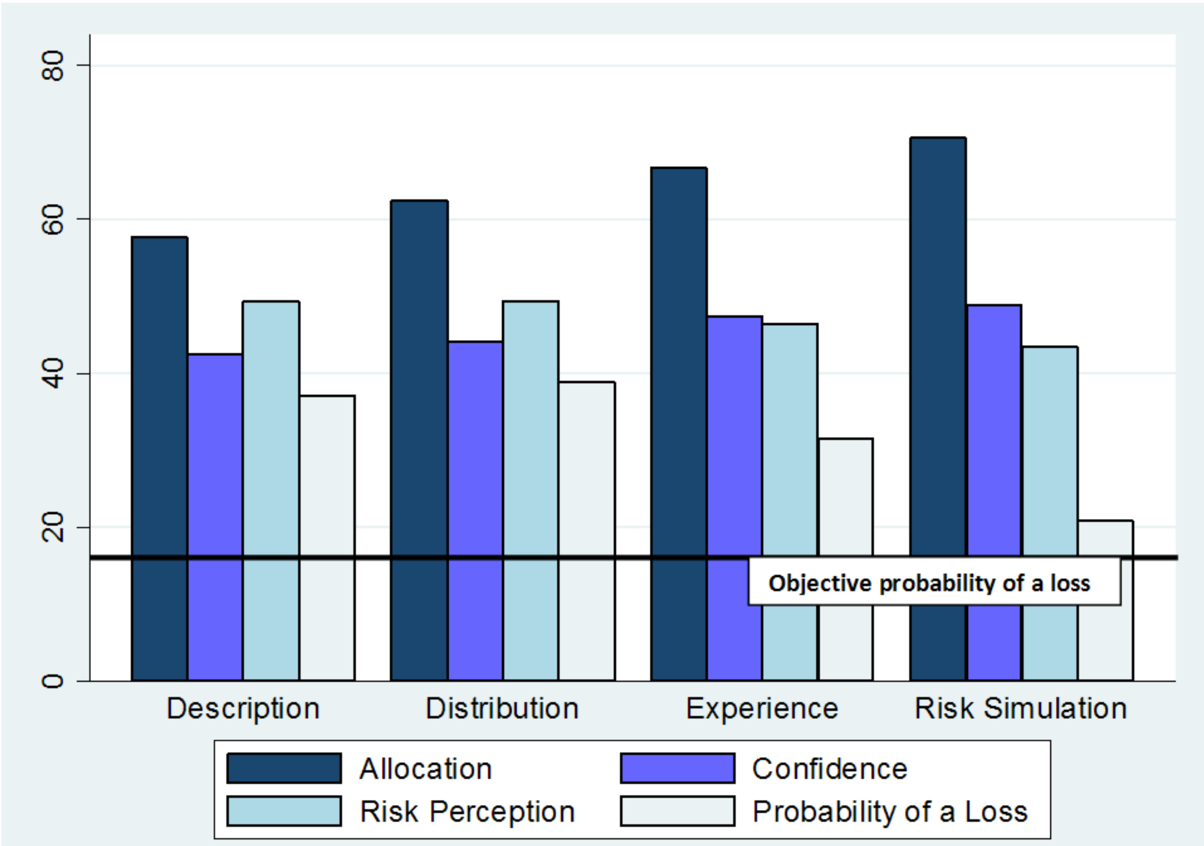
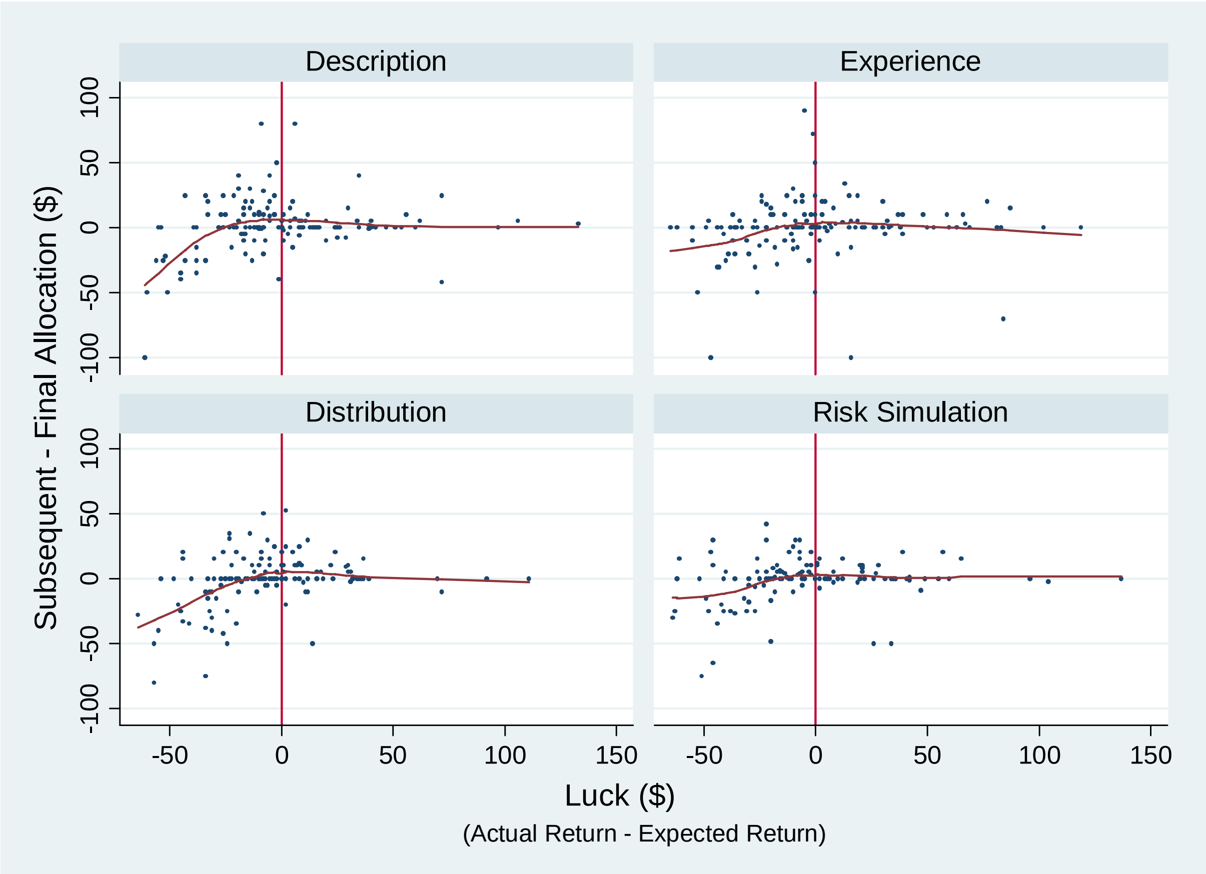
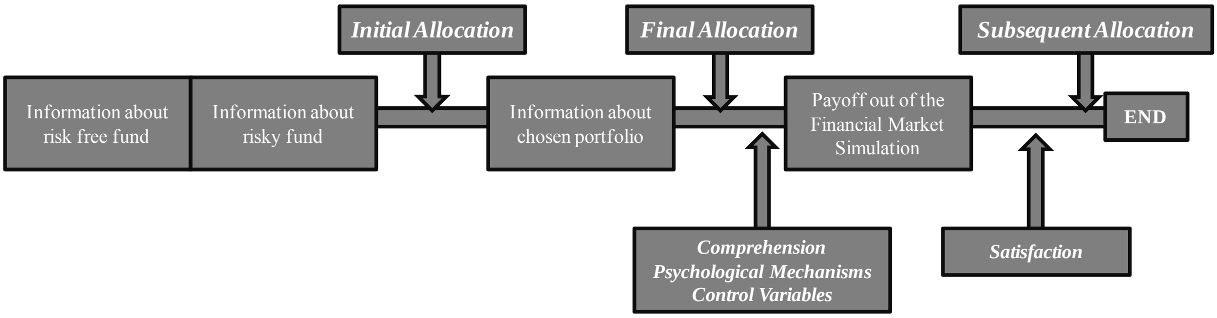


Figure 2: Subsequent allocation as a function of investment success (luck)

This figure reports the subsequent allocation minus final allocation dependent on luck (outcome of the market simulation minus the expected return), in Experiment II and III combined across all conditions.



APPENDIX A: Overview of experimental set up



APPENDIX B: Overview of experimental methods

	Experiment I	Experiment II	Experiment III
Conditions			
Description	*	*	*
Risk Simulation	*	*	*
Experience		*	*
Distribution		*	*
Measures			
Financial Literacy	*	*	*
Risk Perception			*
Confidence			*
Feeling Informed			*
Comprehension			*

APPENDIX C: Overview of variables and measures

Allocation Variables	
Initial	The first number participants typed in for the allocation to the risky fund after viewing information about the two funds separately. This could be adjusted before deciding on the Final Allocation.
Final	The allocation to the risky fund (out of €1,000 in Experiment I and $100 in Experiment II and III) chosen after being informed about the diversified portfolio return and standard deviation of the initial allocation.
Subsequent	The hypothetical allocation made after seeing the results of the market simulation which determined their payoff (e.g., how they would choose again if they had another chance).
Control Variables	
Risk Attitude	Self reported: Please estimate your willingness to take financial risk (1= Not willing to accept any risk; 5=willing to accept substantial risk to potentially earn a greater return).
Financial Literacy	The score is the sum of the 11 financial literacy questions (highest score 11, lowest 0) adapted from van Rooij, Lusardi & Alessi 2007
Age	Age of the participant.
Gender	An indicator variable that equals one if the gender of the participant is male, zero otherwise.
Stock Ownership	An indicator variable that equals one if subjects own stocks or stock funds, zero otherwise.
Income	Self-reported income of participants in 1,000s of dollars / euros.
Education	0=some high school or no high school, 1=high school graduate, 2=specific (trade) school/ some college/ associate (2 year) degree, 3=college graduate, 4=advanced degree
Subjective Variables	
Risk Perception	How risky do you perceive Fund B (the risky fund) to be? (1=not risky at all, 7=very risky)
Confidence	How confident do you feel about investing in the risky fund? (Experiment III); How confident do you feel about your decision (Experiment I and II) 1= completely unconfident, 7=completely confident
Comprehension Variables	

Perceived Return	If we put \$100 in the riskier fund, what is the expected return of the \$100 after five years? (Give your best estimate.) Coded to reflect under- and overestimation: -1=\$100 - \$140, 0=\$141 - \$180 (correct interval), 1=\$181 - \$220, 2=\$221 - \$260, 3>\$260
Perceived Probability of a Loss	If we put \$100 in the riskier fund, in how man out of 100 cases will the return fall below \$100 after five years? In ________ out of 100 cases
Upside Potential	If we put \$100 in the riskier fund, in how man out of 100 cases will the return fall be above \$150 after five years? In ________ out of 100 cases
Informed	How informed do you feel about the funds? (1=completely uninformed, 7=completely informed)
Post-Return Decision Evaluation	
Satisfaction	Question asked after participants were shown their simulated return after five years: How satisfied are you with your return? (1=completely unsatisfied, 7=completely satisfied)
Luck	A variable measuring the outcome of the market simulation minus the expected return of the final allocation.

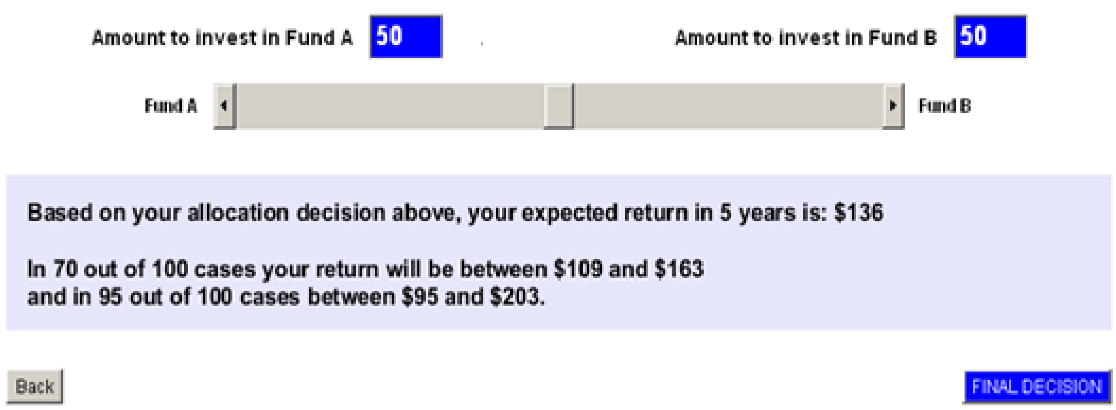
APPENDIX D: Overview of experimental conditions

DESCRIPTION CONDITION

Participants read descriptions of the risk free and the risky fund:

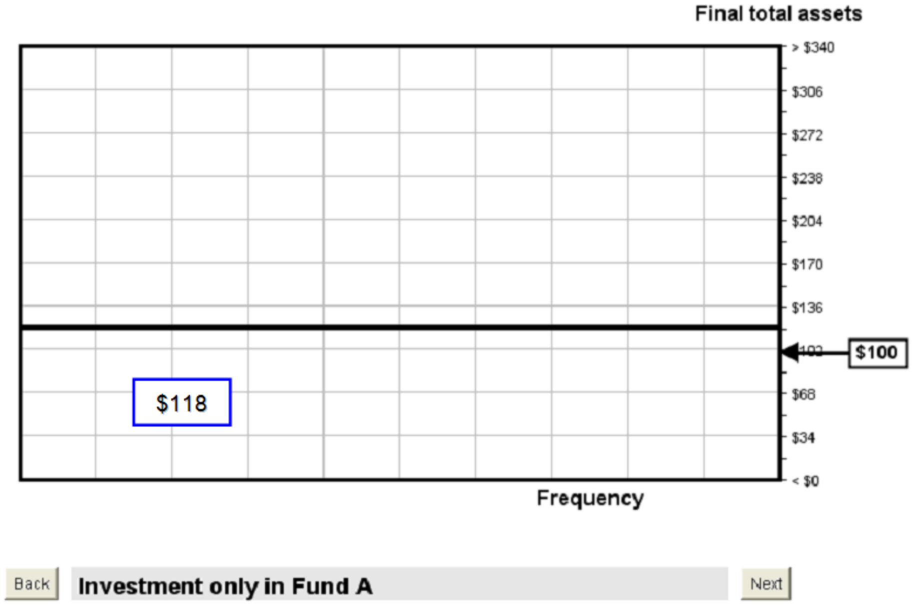
> You will choose how much to invest in a risk-free asset and how much to invest in a riskier asset.
>
> Fund A is a risk-free asset. It has a guaranteed annual return of 3.35% for sure. If you invest the full $100 in Fund A you will have a return of $118 in 5 years, net of fees.
>
> Fund B is a risky asset. It has an expected annual return of 8.92% with an annual standard deviation of 15.89%. If you invest the full $100 in that asset, you will have an expected final outcome of $153 in 5 years. However, the actual return is not known. It could be higher or lower. In 70 out of 100 cases your final wealth will be between $100 and $208 and in 95 out of 100 cases between $72 and $289.
> Now you will choose how to invest the $100.
>
> You can change the amounts you allocate to Fund A and Fund B by moving the scroll bar below and seeing how the expected return and the standard deviation of your total investment amount changes. When you have decided, click *final decision* below.

Next they made an initial allocation, which they could adjust using a slider and see how the expected return and variation changed before deciding on a final allocation:

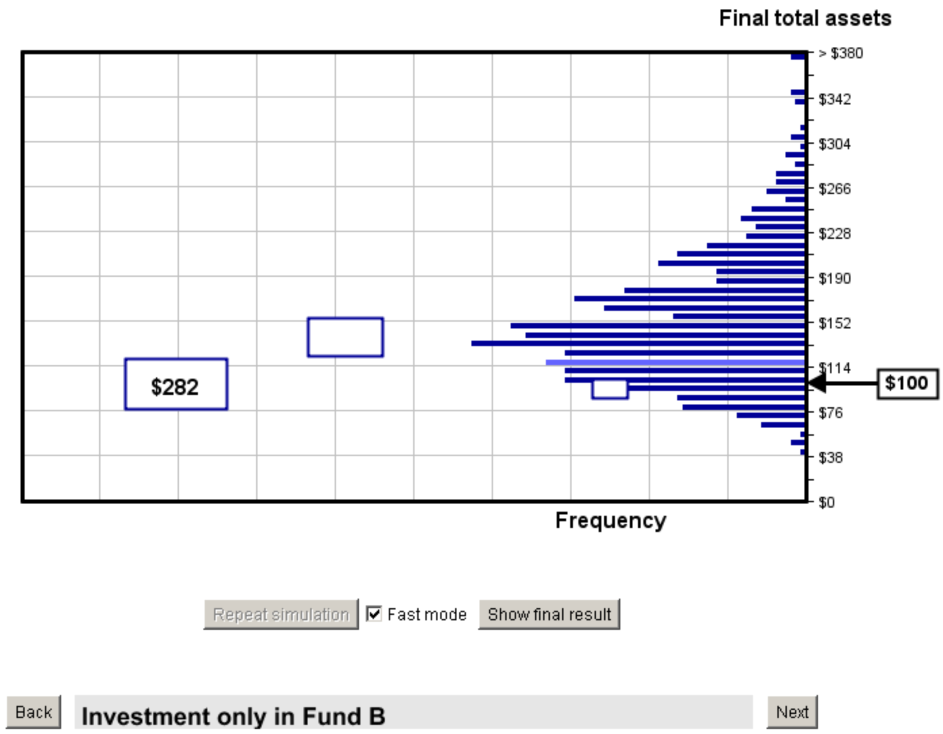


RISK SIMULATION CONDITION

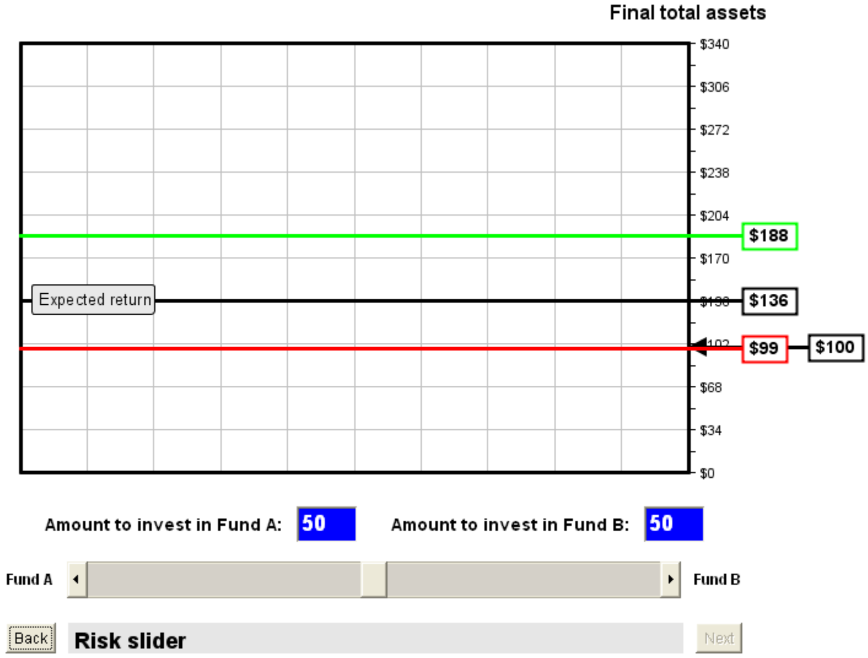
An experience sampling simulation draws the return of the risk free fund, resulting in a flat line:



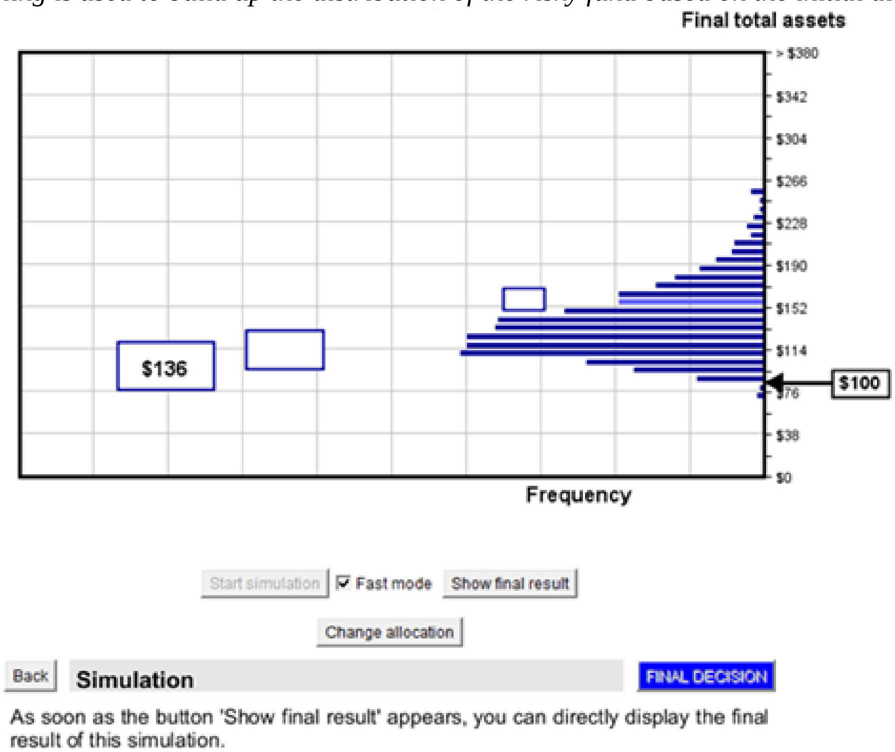
Experience sampling is used to build up the distribution of *the risky fund. Eight samples must be viewed before the simulation can go into "fast mode" to rapidly build up the distribution:*



Participants choose an initial allocation and could adjust it using a risk slider:



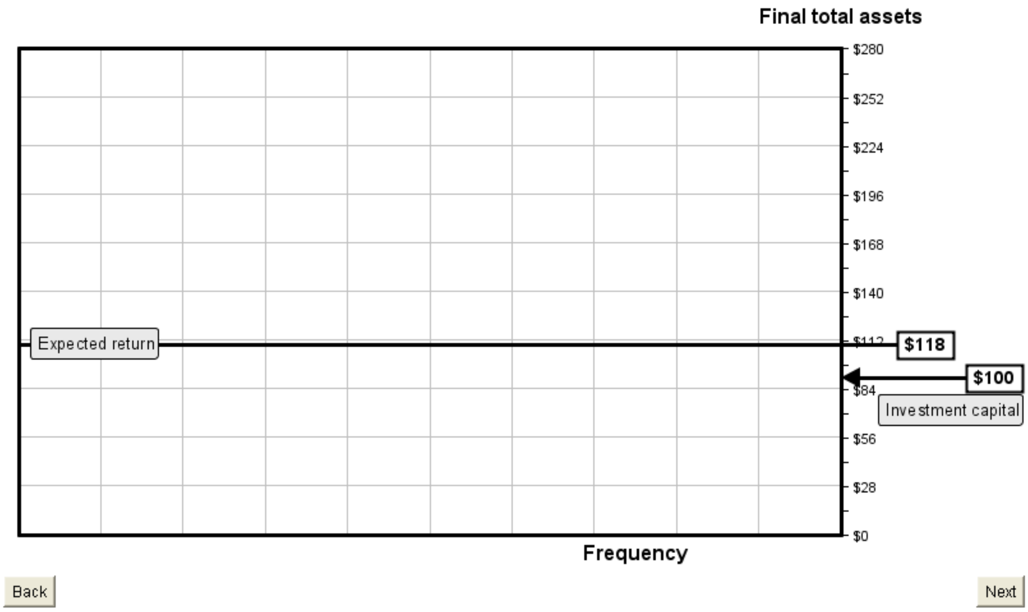
Experience sampling is used to build up the distribution of the risky fund based on the initial allocation:

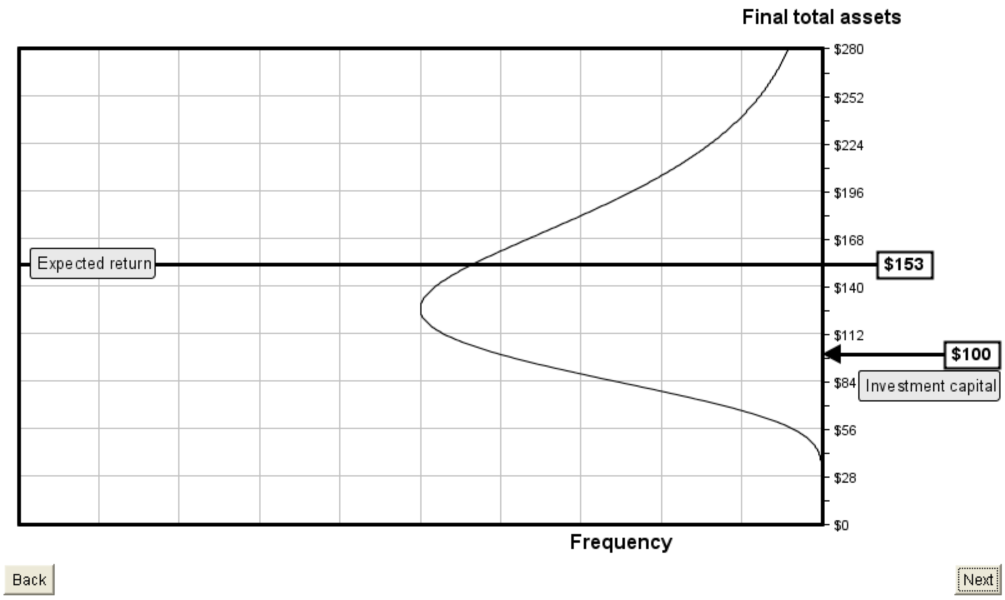


Participants can change their allocation and watch the simulation again as often as wanted until they decide on a final allocation.

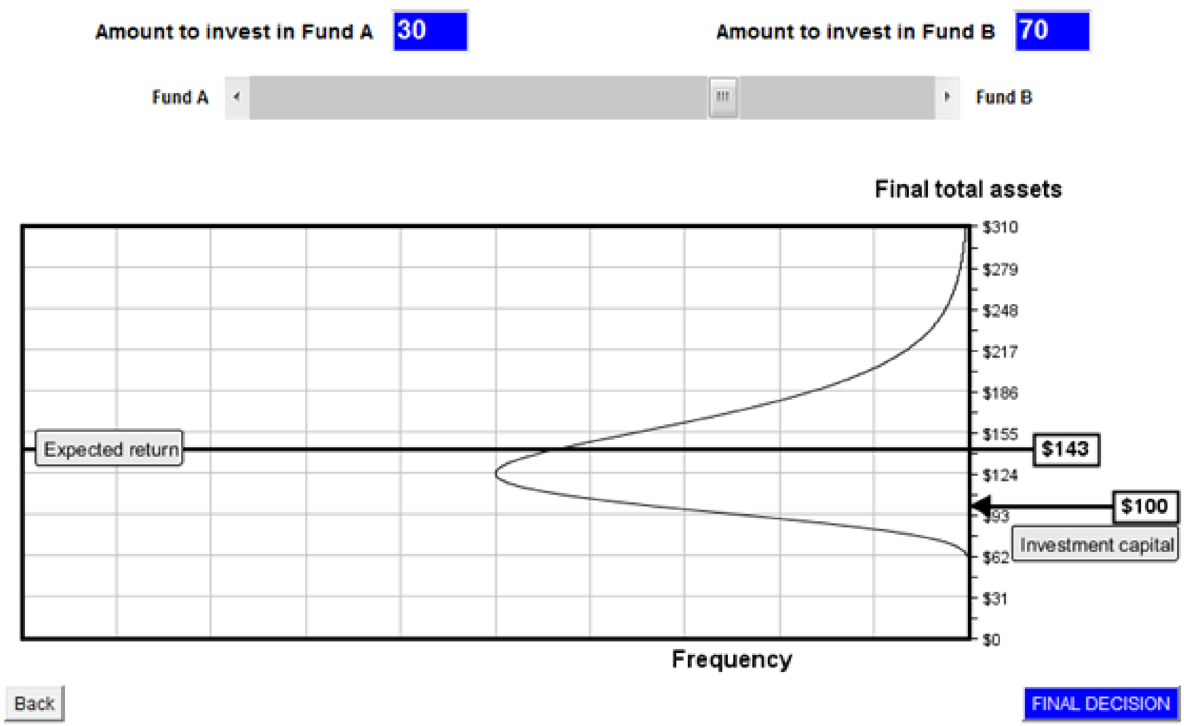
DISTRIBUTION CONDITION

A graphical display shows the return of the risk-free fund and then the risky funds:





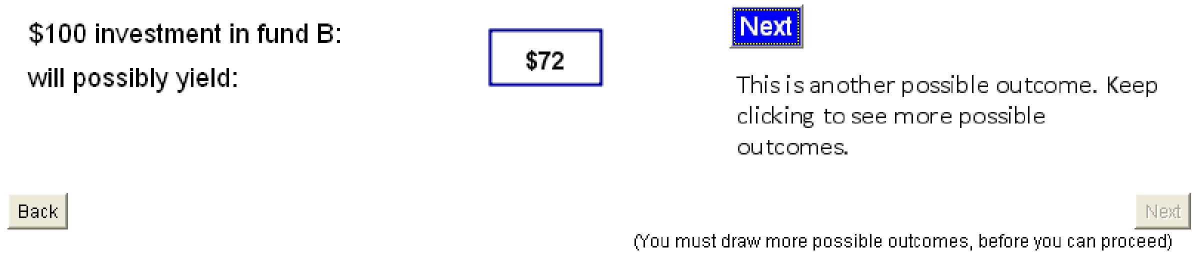
Participants choose an initial allocation that can be adjusted using a slider before making a final allocation decision:



EXPERIENCE CONDITION

Participants draw possible returns for the risk free fund (at least 3 draws):

Participants draw possible returns for the risky fund (at least 8 draws):



The allocation can then be adjusted via a risk slider and the corresponding expected return is sampled (at least 8 draws):