Pictures are Worth a Thousand Words: Graphical Information and Investment Decision Making*

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Abstract

We show that in an experimental research setting individual mutual fund investors invest sub-optimally and suffer from behavioral biases when only provided with summarized textual and tabulated mutual fund information. They perceive the risk level of mutual fund incorrectly, follow return-chasing strategies and as a result incur unnecessary fees. Adding real-life graphical risk and returns representations to the disclosed information significantly de-bias individuals' investment decision. The incurred unnecessary fees drop by 7 to 24 percent relative to the control group depending on the treatment information, while funds' average perceived risk level improves and return-chasing strategies become less popular. Our results suggest that including graphical representations helps investors to make cheaper investment decisions and should therefore seriously be considered by financial regulators when deciding upon the disclosure policy of financial products.

Keywords: Information disclosure policy, heuristics and cognitive limitations, investment decision- making, economics and psychology, cues.

JEL-codes: G11, M31, D12, D91, G18

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1 Introduction

There is a growing body of research illustrating that individual investors take sub-optimal investment decisions which leads to insufficient stock market participation at the macro level (Campbell, 2006; Van Rooij et al., 2011), as well as the creation of under-diversified investment portfolios (Campbell, 2006) and portfolios with inappropriate risk-adjusted performance net of fees at the micro level.[1] With respect to the latter, there is ample empirical evidence that mutual fund investors buy funds with high fees (Gruber, 1996; Elton et al., 2004; Barber et al., 2005). Among others, these observations have been linked to the existence of search costs and investors' information acquisition and information processing techniques (Sirri and Tufano, 1998; Huang et al., 2007; Van Nieuwerburgh and Veldkamp, 2010). Previous research has demonstrated that, because of search costs, mutual fund investors' portfolio decisions are influenced by a fund's marketing efforts and other irrelevant characteristics (Sirri and Tufano, 1998; Jain and Wu, 2000; Elton et al., 2004; Barber et al., 2005; Cronqvist, 2006; Huang et al., 2007). In addition, mutual fund investors suffer from behavioral biases (Bailey et al., 2011) and in order to reduce the complexity of their investment decision they rely on heuristics[2] (Benartzi and Thaler, 2007). Overall, this empirical evidence supports the conjecture that in the investment decision process, the information environment matters and investors' information acquisition and processing in this decision process is not optimal.

There are two approaches advocated in the academic literature in order to de-bias investment decision-making. First, efforts to improve the investors' level of financial literacy. Second, efforts to improve financial information disclose. In the first approach the goal is to improve investors' understanding and processing of financial information so they can make more sensible portfolio choices. However, in recent papers the extent to which financial education might lead to improved financial capability and improved decision-making is questioned.[3] Even if financial education could have an effect, García (2013) and Bernheim et al. (2001) argue that financial

[1] On a related note, Frazzini and Lamont (2008) showed that mutual fund flows appear to be "dumb money" because flows and subsequent returns are negatively correlated.

[2] These are easily applied procedures, which are especially used when individuals perceive a task to be complex. As investment decisions are often perceived to be complex, investors often use heuristics.

[3] Willis (2011) argues that objective observers generally admit that research to date does not demonstrate a causal chain from financial education to higher financial literacy, to better financial behavior, to improved financial outcomes, in part due to biases, heuristics, and other nonrational influences on financial decisions.

education could be counterproductive if it fosters investor's overconfidence. Although we strongly believe that it remains important to further develop financial education initiatives for young people that have the potential to improve their financial decision-making upon reaching adulthood, we argue in this paper that initiatives that facilitate the understanding of financial information are very promising, especially in the short run. Instead of providing financial education aimed at enabling people to take investment decisions in a complex information environment, it is easier to disclose the financial information on which financial decisions are based in such a way that it is easier to understand for to the average retail investor.

By reducing the search costs and the burden of information overload, simplified, standardized and easily accessible investment information could result in more optimal portfolio choices (see e.g. Kozup and Hogarth, 2008; Hung et al., 2010). In the US, the SEC adopted this principle and issued guidelines that made it possible for funds to disclose a summary sheet which contains more condensed information compared to the statutory prospectus.[4] This guideline fits within a disclosure policy that aims at providing investors with the right information to make better portfolio choices instead of imposing information requirements that would only create better informed investors (Franco, 2009). In line with the evidence showing that the presentation format influences investors' use of information and subsequent investment decisions, disclosure policies are becoming less concerned with promoting very comprehensive disclosure guidelines (i.e. "more information is always better" principle) in favor of policies that are more attentive to the format in which information is presented.[5] Nevertheless, Beshears et al. (2011) show that with respect to mutual fund investment behavior, the summary sheet does not improve fund allocation despite the fact that it does reduce investors' search costs. In a similar vein, Choi et al. (2010) conclude that although better disclosure may be helpful, its effect on portfolio formation is likely to be modest. Therefore, further measures that move beyond the provision of simplified

[4] The statutory prospectus is the sheet which contains all the information of the fund and which individuals can use in their investment decision process. Since the statutory prospectus is usually very long and contains very detailed information, investors typically find it too complex and do not bother to read it carefully (see for example Beshears et al., 2011).

[5] At the introduction of SEC form N-1A, it was stated that because mutual fund prospectuses are too long and complex they are not effective disclosure documents for most investors (SEC, 1983). See also SEC (2009) for similar comments.

information formats appear to be necessary to ensure that investors make better investment decisions. In this paper we examine whether adding graphical information representations to a mutual fund's summary sheet helps investors to de-bias their investment decision and as a consequence create better (less costly) investment portfolios. To align the research design with current industry practices, our main focus in this paper is on graphical information representations that are being used in the field.

Graphical information can be an effective means for individuals to process investment information efficiently because it can reduce search costs and information overload (Tegarden, 1999). The fact that visual representations can dampen cognitive strain (Lohse, 1997) is relevant to our paper because many investor consider the mutual fund investment decision to be complex and consumers tend to limit their efforts in order to reach a decision when faced with complex decision taking (Payne et al., 1988). In addition, previous research demonstrates that graphical design influences the relative visual salience of attributes and the decision process (Jarvenpaa, 1989; Jarvenpaa, 1990). Visual salient information will attract people's attention and will therefore be considered first in the decision process and weighted more heavily in the final decision (Hogarth and Einhorn, 1992). Well-designed graphical representations thus have the potential to de-bias investment decisions by drawing attention to key information, thereby acting as a counterweight to behavioral biases related to investors' limited cognitive abilities to process information.

In view of the significant market size of the mutual fund market, improved mutual fund portfolio allocation decisions, even if these only lead to relatively small cost reductions, are economically relevant. Mutual funds are an important part of individual investors' investment portfolio (ICI, 2014c). In 2013, about 46% of all U.S. households owned mutual funds. Mutual funds account for about 50% of median U.S. households financial assets and the demand for mutual funds goes hand in hand with a decrease in direct stock market investment. In addition, with a market share of around 86% in 2013, individual investors dominate the mutual market. Hence, it is important to develop a good understanding of individual mutual fund investors' investment decision processes and the role of information (formats) in these decisions.

We designed an experimental survey to examine whether information treatments in the form of graphical representations help participants making improved portfolio choice decisions. In the control group, only textual and tabulated financial information was provided to the subjects. In each treatment group, graphical representation(s) of the financial information was added, in order to investigate the effect of visual representations of textual financial information. Similar to Choi et al. (2010), participants were asked to invest $10,000 in up to three different mutual S&P500 index funds that only differ by their fees. In this research design, we can assess easily whether they follow the optimal cost minimizing strategy by investing all the available wealth in the lowest cost fund. In addition, because all the index funds have the same level of risk, we can examine whether subjects accurately assess the risk level of the individual funds and whether or not they are aware of the similarity in risk level across the funds.

Inspired by the findings of Bertrand and Morse (2011) and Bertrand et al. (2010), we incorporated three information treatments with graphical representations related to the fund's risk, the fund's net expected return and a combination thereof. To ensure that the graphical representations used in our study are in line with current industry practices, they closely match the ones used in the mandatory Dutch Financial Leaflet for complex financial products since July 2002 and were developed by the Dutch financial regulator AFM. More specifically, the risk-related treatment consists of a graphical risk indicator consisting of a picture of a person tilting a barrel on its back which represents a fund's risk on a 5-point scale, by how much the barrel is filled. The second representation deals with a fund's expected return *net* of fees. Given that in both instances a similar representation is available for all funds, we argue that the information environment in which investors have to make an investment decision is improved because the comparison of risk, return and fees is facilitated. In the third treatment group, both graphical indicators were shown.

We want to stress that this paper's goal is to establish first and foremost whether the addition of existing graphical representations in mutual fund disclosure is beneficial for portfolio choice and not to compare various graphical representations in order to formulate guidelines on optimal graphical design. We acknowledge that other graphical representations or other means to limit

behavioral biases in retail investment decisions can be valuable as well and are interesting topics to be considered for further research.

Our main empirical results are summarized as follows. First, providing potential investors with graphical information representations substantially improves mutual fund portfolio decisions in our sample. The average unnecessary portfolio fees are reduced by 7-24 percent, depending on the treatment group considered. Second, participants in the risk indicator treatment group assess the fund's individual risk-level more accurately and better understand the similarity in risk across sample funds. This is not the case for net expected returns treatment group subjects and we argue that in absence of the risk indicator the similarities in risk-levels across funds were not salient enough for these subjects. Overall, participants that are exposed to graphical information representations improved their investment allocation substantially and rely less on heuristics. Third, the graphical representations do not completely de-bias participants' investment decisions because investors still incur unnecessary fees. Nevertheless, we conclude that including graphical designs in financial disclosures in order to de-bias investment decisions appear to be an easy and cost-effective approach to improve investors' portfolio choice decisions and policy makers should consider augmenting investment communication with visual nudges.

The remainder of this paper is organized as follows. In Section 2 we explore the possible advantages of the addition of graphical information to textual investment information in light of well-documented behavioral biases. In addition, we discuss the hypothesis development. Section 3 outlines the empirical methodology, while the main empirical findings are presented in Section 4. Potential explanations for our findings are explored in Section 5, while Section 6 concludes.

2 Background literature and hypothesis development

2.1 The mutual fund investment decision process

Potential mutual fund investors are confronted with a wide variety of funds in terms of investment style, risk and fee structure. In 2013, mutual fund investors could choose between 7,707 (34,743) funds on the U.S. (European) fund market (ICI, 2014b). For instance, 46.3% of U.S. households owned mutual funds in 2013. Worldwide the mutual fund market has grown strongly over the past decades (ICI, 2014a). Differences in the growth of the mutual fund

industry across countries have been explained by demand-side factors (such as a country's per capita income and the prevalence of DC pension plans) and supply-side factors (such as costs of, or time to establish, funds and distribution networks, as well as local stock and bond market's size, liquidity, and trading costs). According to Korana et al. (2005), these factors can explain half of the variation across countries in their relative use of mutual funds (measured as mutual fund assets to GDP).

More importantly, the growth of the mutual fund industry leads to higher search costs, thereby increasing perceived information overload (Agnew and Szykman, 2005). In case of information overload, people are overwhelmed with information because their information-processing capacity is too low in comparison with the information-processing requirements of the task considered which, in turn, results in poor decisions (see, e.g. Hwang and Lin, 1999). In addition, people may spend less effort on the decision-making process the more complex a task (Bettman et al., 1998). Empirical findings by Iyengar and Lepper (2000) suggest that individuals perceive the investment decision to be complex, which harms their motivation to use the provided information correctly. Illustrative in this case is the fact that a 2006 survey (ICI, 2006) reveals that the majority of mutual fund investors (66%) did not consult the fund prospectus at all before their last purchase of mutual fund shares.

According to ICI (2006), the three most important elements that mutual fund investors consider in making their investment decision are 'fees and expenses' (74 percent), 'historical performance' (69%), and 'fund risks' (61%). Unfortunately, it is well-established that due to behavioral biases, search costs and mutual fund marketing efforts, mutual fund investors do not use fund information efficiently (Sirri and Tufano, 1998; Hortacsu and Syverson 2004; Bailey et al., 2011). For example, they do not account properly for the impact of fees on net returns as expensive mutual funds still attract large money flows, while there is only scant evidence that these funds offset their higher fees by higher net returns (Gruber, 1996; Carhart, 1997). The magnitude and composition of mutual fund fees are important in the composition of future net returns on investments (see Elton et al., 2004) and therefore it is surprising that mutual fund investors still invest significantly in high-fee index mutual funds (Hortacsu and Syverson, 2004), although recently low-cost ETF's have gained in popularity. In addition, mutual fund investors

chase past returns (Gruber, 1996; Carhart, 1997; Zheng, 1999; Sapp and Tiwari, 2004) because they unjustly believe that past returns are a good indication of future returns (DeBondt, 1993). Such behavior could be fueled by return-framing behavior of mutual funds, mutual fund (advertising) practices or Morningstar rating policies assigned based on historical performance (Guercio and Tkac, 2008). Fund managers can for instance promote their fund by using the time horizon in which their fund performed well, or hide its real performance by going out of business or by merging with other funds (Damato, 1997). Mutual fund advertisements encourage the tendency to chase past returns by emphasizing fund's past performance thereby increasing its saliency (Johnson and Tellis, 2005; Jain and Wu 2000; Sapp and Tiwari, 2004; Cronqvist, 2006). Overall, many mutual fund investors are influenced by past return performance (Coval and Shumway 2005; Johnson and Tellis 2005; Hendricks et al. 1993; Sirri and Tufano, 1998). In terms of risk evaluation, mutual fund investors are for instance subject to the diversification heuristic, indicating that they tend to divide their money across all the available funds in order to decrease the level of portfolio risk. Benartzi and Thaler (2001, 2007) show that the contributions to retirement plans are made according to the principles of naïve diversification given that the proportion invested in stock reflects the number of stock funds offered in the investment plan. Participants presented with four equity funds and one fixed income fund allocate 68% to equities, while participants that have the choice between four fixed income funds and one equity fund allocate only 43% to equities.[6] Corroborating evidence is reported based on cross-sectional data on retirement saving plans. Mutual fund investment decisions that follow diversification heuristics could thus have a significant impact on portfolio allocation. The heuristic is costly because the fact that individual preferences are brushed aside may result into actual portfolios that are too safe and have too low pay-offs (Brennan and Torous, 1999), or vice versa into portfolios with unwarranted risk exposures. Vlaev et al. (2009) have shown that individuals can have such a mismatch due to their limited understanding of the overall risk level of funds.

[6] Note that when the number of options becomes very large, naïve diversification heuristics might no longer be used because they become impractical. Iyengar and Kamenica (2010) show that as the number of funds increased in retirement plans, investors reduced their allocation to equity funds in favor of money market and bond funds. For every 10 funds that were added, the allocation to the latter two fund categories increased with 3.28 percentage points at the expense of the equity fund allocation.

2.2 Information disclosure and the mutual fund investment decision process

In this section we present three factors that might positively influence the individual mutual fund investment decision. We limit the discussion to factors that are at least partially within the sphere of influence of financial regulators. These are (i) disclosed summary information, (iii) financial literacy level and (iii) the inclusion of graphical representations in the disclosed summary information.

2.2.1 Disclosed summary information

Summarizing disclosed information can help to reduce the time and effort needed to make an investment decision, and as a result, individuals can use the provided information more extensively (Stigler, 1961; Nelson, 1970; 1974). This viewpoint is also shared by financial regulators as for a long time the SEC has strived for greater simplification, standardization and accessibility of mandatory fund disclosure, all aimed at enabling the average mutual fund investor to make better informed decisions (Franco, 2009). More recently, the SEC issued summary sheet rules (SEC Release No. 33- 8998) that became effective on February 28th, 2009. Funds disclose a shortened information sheet, in the hope that investors would make more conscious investment decisions because they can locate relevant information more easily. This summary sheet contains key information about the fund, such as the fund's objectives, risk factors, fees, and past performance. Much information included in the statutory prospectus is left out in an attempt to decrease the complexity of the disclosed information. Because search costs are reduced, investors could evaluate choice alternatives more effectively, thereby decreasing the need to rely on heuristics. In addition, it could also reduce problems related to individuals' cognitive limitations.

The introduction of the summary sheet appears to have had a positive effect on search costs, but failed to effectively change consumer behavior. Search costs are reduced because investors do prefer the summary sheet in favor of the prospectus and the use of the summary sheet reduces the time spent on the investment decision (Beshears et al., 2011; Choi, et al. 2009; ICI, 2006). Nevertheless, its use does not seem to improve investor's portfolio choice (Beshears et al., 2011) because of several reasons. First, there is no improvement in the readability of the summary sheet because language used herein is not simplified. (SEC, ICI, 2006). Second, although the

summary sheet decreases search costs, it does not take into account investors' cognitive limitations. By making past returns more salient in the summarized prospectus, more individuals use this information in their decision (Kozup and Hogarth, 2008 and Beshears et al., 2011). Third, the summary sheet is not presented in a way that help investors to understand the impact of fees nor to better perceive the investment risk.

2.2.2 Financial literacy level

It is widely accepted that levels of financial literacy among mutual fund investors are low (see e.g., Kozup and Hogarth, 2008). This might fuel suboptimal investment decisions in view of the evidence that shows that, compared to financial illiterate investors; financial literate investors make better, but still not optimal, investment decisions. Financial illiterate people have been found to participate less in the stock market (Van Rooij et al., 2007), have lower retirement savings (Lusardi and Mitchell, 2007), and to be more subject to behavioral biases (Benartzi and Thaler, 1999; Foxall and Palister, 1998). Financial illiterate mutual fund investors also display less desirable investment behavior compared to their more literate peers. For instance, they invest more in high-fee index funds (Choi et al., 2010) and are less likely to invest passively (Müller and Weber, 2009). Nevertheless, financial literate investors' decisions also remain suboptimal (although to a lesser extent), as evidenced by the fact that they do not display better mutual fund selection abilities, do not fully rationally account for fees, and continue to chase returns (Müller and Weber, 2009; Choi et al., 2010).

In view of this evidence, simplified information and increased saliency of information which both could mitigate problems related to limited attention and information overload are important tools to help less-literate investors to arrive at better investment decisions (Hung et al., 2010). The 2006 ICI survey revealed that the mutual fund investors have more difficulty with reading the mutual fund prospectus the lower their educational level: 75% of investors without a college degree found the prospectus difficult to understand, compared to only 40% of investors with a graduate degree (ICI, 2006).

2.2.3 Addition of graphical representations to disclosed summary information

We argue that graphical representations could improve the quality of the investment decision process by facilitating information processing and increasing the salience of certain pieces of information. Well-designed graphical representations take advantage of the visual perception to make critical information easy and accurate to evaluate (Lipkus, 2007; Pieters and Wedel, 2012). Indeed, such information presentation formats minimize search costs and mitigate problems due to information overload (Payne, 1982). Tegarden (1999) argued that visual representation can lead to more efficient information processing enabling decision makers to process more information without being overloaded. Along the same lines, Stone et al. (1997) provide experimental evidence that visual representations can communicate (risk) information more effectively than numerical information. Besides the positive effects in terms of more efficient information processing, graphical representations can alter the relative salience of different pieces of data. Visual salient information is considered first and weighted more heavily. Used wisely, it thus could de-bias investment decisions by diverting investors' attention away from information (such as past returns) that is overexposed in the decision process due to behavioral biases or marketing efforts, (see also Hogart and Einhorn, 1992).

Our main focus in this paper is to examine whether the addition of graphical representations in summarized disclosed information can reduce mistakes in mutual fund portfolio choices. Given that Beshears et al. (2011) document that existing information interventions like the summary sheet does not lead to better portfolio decisions, we have chosen to investigate the value-added of actual visual representations currently applied by financial regulators. Hence, our focus is on real-life applications of visual representations by regulators and not on the optimal design of such representations.[7] To ensure that our experimental design is in line with current regulatory practices, we base our design on the Dutch Financial Leaflet[8], which is an excellent example of mandatory summarized information disclosure that makes the information that is important in making sound investment decisions salient. It is illustrative for the way in which financial

[7] The choice of the best visual design encompasses many dimensions (see also, Hung et al., 2010). First one has to choose whether to only present the visual information or present it together with contextual information (Stone, et al., 1997). In addition, one has to decide on which information of the mutual fund prospectus will be represented visually. Finally, the visual format, the effect scaling, time frame, etc. should all be considered.

[8] In the Netherlands this is known as the 'Financiële Bijsluiter'.

regulators try to deal with the cognitive limitation of individual investors, not only by providing adequate investment information, but by trying to deliver this information in the most appropriate information format. The Financial Leaflet contains a graphical representation of the risk level consisting of a picture of a person carrying a barrel on its back which represents a fund's risk on a 5-point scale, by how much the barrel is filled (see Figure 1). In addition, a time series graphs of expected fund returns is included. The latter are presented *net* of fees to facilitate return comparison across funds (see Figure 2). The items in the Financial Leaflet and the format in which they are represented (including text formats) are highly standardized and set by the Dutch Financial Regulator (AFM). The Financial Leaflet for complex financial products is mandatory since July 1st, 2002, while a revised version has been put in place on October 1st, 2006.[9]

To examine the incremental value of visual representations in summary (mutual fund) investment information, we develop an experimental survey design inspired by Choi et al. (2010), augmented with graphical representations treatments for the risk level and net expected returns. We argue that such an 'enriched' summary sheet alleviates the complexity of the asset allocation decision by facilitating the comparison of funds with similar investment objectives.

2.3 Hypothesis development

In this section we develop our hypotheses to test whether the addition of graphical representations to a fund's summary sheet facilitates the investment decision process and results in improved, cheaper, investment decisions. In all instances, we refer to settings in which supplemental graphical representations are added to existing summary mutual fund disclosure.[10]

[9] Since July 1st, 2012, all investment fund companies are required to provide a KIID, key investor information document. This document should be made available at no cost on the request of a potential client, either digitally or in hardcopy. Every KIID provides information on: (i) the fund objectives and investment policy, (ii) risk and reward, (iii) charges, (iv) past performance and (v) other practical information. It contains a more fine-grained risk indicator, based on a 7-point scale and also provides information about the charges (note that it does not refer to these as 'fees') and past performance. It does not contain any graphical representation of fees.

[10] Although one might argue that this additional information can lead to information overload, visual information is known to be the most salient and is therefore considered first and is weighted more heavily in the final decision (Hogarth and Einhorn, 1992). Hence, we assume (and show in this paper in Section 5.1) that the effect in terms of information overload is relatively small.

A standardized overall risk indicator could be particularly helpful because it reduces the time needed to assess risk and could mitigate biases in risk assessments as well. In addition, the high level of standardization facilitates accurate risk comparisons across funds. Finally, a risk indicator also lowers the level of complexity at which information is communicated, which is relevant given that about 60% (26%) of mutual fund investors find mutual fund prospectus difficult (very difficult) to understand (ICI, 2006).[11] Overall this will help investors to align a fund's perceived and actual risk level, resulting in investment decisions that also better represent their own risk preference. The first hypothesis is formulated as follows:

Hypothesis 1a*: Individuals who are faced with a graphical risk indicator have a perceived risk level that is closer to the disclosed risk level.*[12]

The use of the graphical risk indicator mitigates problems due to information overload because it decreases the cognitive load required to assess risk (Agnew and Szykman, 2005). Because investors are now faced with a less complex investment decision, they are likely to rely less on heuristics and have more time to consider the impact of other attributes like fees. Hence, we expect investors to which the risk indicator is disclosed to hold investment portfolios with lower fees. Therefore our next hypothesis is:

Hypothesis 1b*: Individuals who are faced with the graphical risk indicator more often choose to invest in funds with lower fees, thereby reducing overall portfolio fees.*

In addition to the risk indicator, a well-chosen graphical returns representation that presents the expected return net of fees can further reduce the allocation of means to high-fee funds. Such returns representations will incorporate the negative impact of fees on returns and will also facilitate the comparison between funds based on net returns instead of past average returns. It could also curtail the tendency of investors to chase past returns, a feature which might be

[11] Commensurable evidence is documented by GAO (2006) which reports that disclosure by issuers are often written well above the average reading level of U.S. adults.
[12] The disclosed risk level refers to the risk level disclosed in the fund's original Financial Leaflet. All funds in our sample are considered to be 'very high risk' funds (level 5 out of 5) in the risk indicator.

particularly helpful to financial knowledgeable investors because they are known to be prone to chase past returns.[13] Therefore our next hypothesis is formulated as follows:

Hypothesis 2a*: Individuals who are faced with a graphical net expected returns representation more often choose to invest in funds with lower fees, thereby reducing overall portfolio fees.*

When faced with the net expected return representation, subjects might form an opinion about the risk associated with the investment. We expect that investors associate funds with high expected returns with high levels of perceived risk. Nevertheless, although the net expected returns representation as such does not provide any information on the impact of fees on the expected return, some investors might believe that return differentials between funds are caused by risk instead of attributing them to fees (as they should do in our sample). Therefore we test the following hypothesis:

Hypothesis 2b*: Individuals who are faced with a graphical net expected returns representation perceive the fund with higher net expected return as more risky.*

When both the risk indicator and expected returns representations are provided, it is reasonable to assume that investors understand that differences in returns representations are due to fees and not due to assumed differences in fund risk levels. In this framework, the required cognitive load in the investment decision process is further reduced and thereby decreases the difference between the perceived risk and disclosed risk level, as well as a more accurate appreciation of the effect of fees. We test this argumentation in the following hypotheses:

Hypothesis 3a*: Individuals who are faced with both graphical representations have a perceived risk level that is closer to the disclosed risk level compared to individuals who receive no graphical representation or only the graphical net expected returns representation.*

[13] In our sample, financial knowledgeable investors refer to individuals with high levels of experience or education and who are enrolled in a program that includes an Economics or Business major.

Hypothesis 3b*: Individuals who are faced with both graphical representations invest more in funds with lower fees, thereby reducing overall portfolio fees in comparison with the other treatment groups and the control group.*

3 Research Design

We design an investment experiment to examine the impact of three information treatments on subjects' mutual fund investment decision. Individuals in the treatment groups are confronted with a graphical representation of risk, net expected return or both, while subjects in the control group only have the standard information in mutual fund summary disclosure, excluding the graphical representations. Participants were randomly assigned to the control group or treatment groups.

Subjects were given the task to invest a hypothetical amount of $10,000 in three existing S&P500 index funds. The funds considered are the Invesco S&P 500 Index Fund, the Ishares S&P 500 Index Fund and the Vanguard S&P 500 Index Fund.[14] Such funds are increasingly used by investors because they are relatively cheap and highly diversified. All funds track the S&P 500 index and are passively managed. As shown in Table 1, these funds are highly comparable and only differ in terms of the fees charged. Measured by total fees paid on a $10,000 investment, given a one-month investment horizon, the Invesco fund is the most expensive fund with a fee of $555, compared to $252 for the Vanguard fund which is the cheapest fund in our sample. This setting is well-suited to examine whether or not the subjects risk assessment is accurate. As the funds track the same index, their overall risk level is identical and they all have been labeled 'very high risk' funds (i.e. risk indicator of 5 on a 5-point scale) in their official Dutch Financial Leaflet. The rational optimal strategy is therefore a cost-minimizing strategy in which all wealth is allocated to the lowest-cost index fund. Because the risk level of all funds is identical, risk comparison across funds should also be straightforward for the subjects. Note that the experimental setting also eliminates the influence of nonportfolio services.

[14] In the survey, the name Vanguard 500 Index Fund was changed into Vanguard S&P 500 Index Fund to make it more salient that funds are tracking the same index.

[Insert Table 1 about here]

The basic standardized summary fund investment information presented to all subjects consists of an overview with general information on S&P500 index funds, presented in the form of a Frequently Asked Question (FAQ) sheet, a return summary table and a summary sheet with textual and tabulated information on fees and risks for each fund. This basic fund information set that is presented to all participants is standardized as much as possible to reduce the influence of possible noise factors. It is constructed in line with the Dutch financial regulator's guidelines, and differences in presentation are minimized by presenting information in a similar presentation format and font. We have tried to minimize search costs by including a simplified fees sheet/table. In addition, a FAQ sheet is included to mitigate possible problems due to subjects' lack of financial knowledge. Subjects were also confronted with the average fund return since inception date in order to distinguish between individuals who optimally minimize fees and those who use harmful heuristics. The inception dates were set in such a way that the amount of fees is positively related with average past returns, a feature which is in line with how fund managers might manipulate the presentation of average past returns (Damato, 1997). As a result, individuals who chase past returns are incurring unnecessary fees which harm future returns. Since all three funds have similar risk properties, a naïve diversification strategy is not optimal because one would incur unnecessary fees. Subjects of the control group only had access to this set of basic fund information. Subjects in each treatment group had access to exactly the same information, supplemented by one or two graphical representations related to a fund's risk or net expected returns. Compared to the basic information set, these graphical representations do not contain any new information but only changes the saliency of certain pieces of investment information.

In view of our objective to test graphical treatments that are applied by financial regulators in mutual fund disclosure, the information treatments that are presented to the treatment groups

closely match the ones in the Dutch Financial Leaflet for complex financial products.[15] The *first* treatment provides participants with a graphical risk indicator as illustrated in Figure 1. It represents a picture of a person carrying a barrel on its back that represents a fund's risk. The risk level of the fund is indicated on a 5-point scale, with three principal risk levels. For these principal risk levels, a textual indication of the risk (very high; medium and very little risk) is also provided on the left-hand side. The risk level of the fund is indicated by the extent that the barrel is filled. The saliency of the risk is stressed by the fact that the posture of the man is adapted to the level of risk: his position is more weighed down the higher the risk level. The *second* treatment is a graphical representation of the expected wealth of an initial investment of $10,000 over different time horizons up to two years based on the fund's expected return *net* of fees (see Figure 2). In addition, the initial investment is depicted by means of a gray rectangle so it becomes more salient as reference point. Subjects in the third information treatment group are confronted with both graphical representations at once.

[Insert Figures 1 and 2 about here]

Given that both the graphical risk and returns representations are standardized and increase the saliency of risk and net expected returns, it should be easier for subjects in the treatment groups to compare funds and select the best investment opportunity. In addition, given that in our research design all funds have the same risk, these returns representations should make it easy for subjects in the treatment group to compare fees and select the cheapest investment opportunity. We are aware that including both representations together in the third treatment might raise concerns regarding problems related to information overload, but our findings show that in our sample at least this is not the case.[16]

[15] The returns representation is not used for index funds in the Netherlands due to European regulation as mentioned above. Therefore we used the Dutch Financial Leaflet of complex financial products as an example of how to construct the returns representation. For the scenario analysis, every fund is expected to have an annual gross return of 5 percent, as set by the Financial Regulator. Every returns representation uses the 5 percent gross return while the cost of buying and selling and the fees holding the funds are incorporated.

[16] Visual information is known to be the most salient and is therefore considered first and is weighted more heavily in the final decision (Hogarth and Einhorn, 1992).

Subjects are students at Tilburg University in the Netherlands, KU Leuven in Belgium and the University of Johannesburg in South Africa, recruited by means of a digital survey. In case of Tilburg University, a hardcopy survey was also made available to a limited number of subjects (55). In order to align participants' motives with the experimental design a lottery was held.[17] Two winners were given the one-month net return of their $10,000 investment allocation (up to a maximum of $100). The short one month investment horizon is more tempting for participants, while it also increases the impact of fees. Furthermore, the survey participants also received feedback on the empirical results. Individuals who (i) spent less than 2 minutes on the investment decision (for digital surveys only) or (ii) are older than 30 year are excluded to avoid that our sample contain non-motivated subjects whose indiscriminate responses could bias results, and to ensure that our sample is homogeneous in terms of subjects' working experience. In total, our main empirical findings are based on a sample of 357 subjects. In Section 5 we discuss the robustness of our results if we alleviate these restrictions. Sample summary statistics are provided in Table 2.

[Insert Table 2 about here]

The average age of the participants is just below 22 years old and 61% of the subjects in our sample is male. The level of education is quite mixed, but most participants fail to understand basic financial concepts.[18] Note that participants on average perceive themselves as knowledgeable, but inexperienced. We argue that our sample is very well suited to test our hypotheses because the subjects' financial knowledge level is in line with real-life investors facing mutual fund investment decisions. In comparison, our subjects' level of financial literacy is above the average level of American citizen (Hancock, 2002), but below the financial literacy level of Harvard staff and students who participated in the surveys of Beshears et al. (2011) and Choi et al. (2010). The latter is not surprising as our sample participants are much younger on average and do not have a lot of working experience.

[17] We did not have sufficient financial means to promise all participants their one-month net portfolio return. We therefore consider our empirical results to be a 'lower bound' of the effects in similar real-life circumstances because subjects might be less motivated to make the best decision possible in our research setting.
[18] The financial literacy questions can be found in the survey in the appendix.

Table 1 also shows that the graphical representations facilitate the decision process: the average time spent on the investment decision by subjects in the treatment groups is much lower compared to the control group. While subjects in the control group needed about 8 minutes to decide how to invest their money, participant in the third treatment group decided in about half that time.

4 Main empirical results

4.1 The money allocation decision

Table 3a shows the main results regarding the average portfolio fees for the control group and per treatment group. Despite the fact that all subjects received investment information to reduce search cost and increase their financial awareness, on average, they fail to invest their money efficiently. Subjects in the control group perform the worst: they incur about $203 ($455−$252) in unnecessary fees compared to the Vanguard fund which is the lowest-cost fund in our sample. Note that a naïve diversification strategy in which wealth is invested equally over the three index funds would have been less costly.[19] It follows from Figure 3 that control group subjects chase past returns: on average 42% is allocated to Invesco, the fund with the highest historical performance but also the most expensive fund. The investment decision of the subjects is however influenced by other motives besides historical performance because not all wealth is allocated to the best-performing fund. Instead, investors choose to hold significant positions in all funds, indicating that the asset allocation decision is also influenced by the willingness to diversify. On average, the lowest proportion of wealth is allocated to Vanguard, the lowest-cost fund (27%).

[Insert Tables 3a and 3b and Figure 3 about here]

Table 3a shows that the graphical representations introduced in the treatment groups result in better asset allocation decisions (recall also from Table 1 that, on average, it takes less than half the time to make these better decisions). For all treatment groups, the average portfolio fees are significantly smaller compared to the control group. Table 3b presents the relative differences in

[19] This is in line with earlier findings of Choi et al. (2010) and Beshears et al. (2011).

terms of unnecessary portfolio fees[20] between treatment groups, and between each treatment group and the control group. Participants in the risk treatment group on average decrease unnecessary portfolio fees with 12.3% compared to the control group. The risk indicator especially helps subjects to reduce the amount of money allocated to the Ishares fund. In addition, less money is allocated to the Invesco fund in favor of money invested in the Vanguard fund. A similar pattern is observed when subjects receive the risk indicator in addition to the returns representation (a 7.2% drop in unnecessary fees, but not significant). These findings confirm our Hypothesis 1b.

Participants in the returns treatment group have on average 18.2% lower unnecessary portfolio fees, mainly due to the fact that fewer participants chase past returns. To a lesser extent, fewer investors seem to diversify naively as well. There is a similar impact of the returns representation when added to the risk indicator (a 13.5% decrease in unnecessary fees, mainly due to fewer individuals chasing past return). Overall, we find that, in line with Hypothesis 2a, the graphical returns representation helps investors to rely less on heuristics and invest more in the lowest-cost fund.

The third treatment group that is exposed to both graphical representations has the largest reduction in fees (24%) compared to the control group. In line with Hypothesis 3b, both graphical representations help the treatment group subjects to make better (cheaper) investment decisions. Although the effect on optimal portfolio allocation produced by the addition of graphical representations is substantial and significant, investors still do not allocate all of their wealth to the cheapest fund and still diversify their investment over the funds. Of all subjects in the third treatment group, 59% invests in three funds, while 23% of the participants invest in two funds. We suspect that such an investment strategy might be explained against the economic background that was present at the moment the experiment was conducted (in April 2012). In the experimental design, we use the names of actual fund suppliers. In the aftermath of the financial crises, subjects might be more aware of the fact that financial intermediaries might default and consider this element in their investment decision (despite the fact that we do not include

[20] The unnecessary fees are calculated as the dollar value of fees above the $252 fee associated with an investment in the lowest-cost Vanguard fund.

information on default rates in our research setup). In this instance, a diversification strategy instead of allocating all funds to the lowest-cost fund might not be suboptimal anymore. In sum, although the currently applied graphical representations appear not to provide the complete answer, they resort a significant positive effect on subjects' asset allocation decision and in view of the fact that they can be implemented easily by financial regulators, it is advisable that they are considered.

4.2 Risk evaluation

Table 4 presents the differences in risk evaluation between all information groups. Participants indicated their perceived risk level of each individual fund on a 5-point scale, where 5 is the highest level. All funds received the highest risk level (level 5) in in the original Dutch Financial Leaflet. The table shows the average perceived risk level of each individual fund and the aggregate perceived risk level over all funds, together with the cross-sectional standard deviation of the perceived risk level. A low standard deviation would indicate that subjects understood that all funds have the same risk level.

[Insert Table 4 about here]

For the control group, the average perceived risk level of the funds are far away from the disclosed risk level, while the standard deviation of 0.77 is high as well. This demonstrates that control group subjects have difficulties to perceive the accurate disclosed risk level based on the available textual information. With respect to perceived risk assessment of individual funds, it is noticeable that control group subjects perceive funds with higher past returns as riskier. The results for the returns representation treatment group are to some extent even worse. The cross-sectional standard deviation is with 0.84 even higher than the one reported for the control group, indicating that return group subjects are even less aware that sample funds have comparable risk levels. In addition, the average perceived risk level is also further away from the correct level. Similar to the control group, return representation treatment group subjects also perceive funds with higher past realized returns as risky funds. We argue that these results indicate that subjects do not fully grasp the fact that differences in the expected returns representation are solely due to the differences in mutual fund fees. Overall, these results are in line with Hypothesis 2b.

In line with Hypothesis 1a, the table shows that risk indicator treatment group subjects have on average a more accurate risk perception of the funds. Compared to the control group (and the returns representation treatment group for that matter) all measures of perceived risk levels increase, while the standard deviation decreases. Nevertheless, it should be noted that only about 15% of the subjects that were presented the risk indicator in the digital survey, assign the correct risk level of 5 to each of the funds. This could be explained by the fact that there is uncertainty regarding the risk measure. For example, 26% of the subjects indicate that they did not understand the risk indicator representation. We explore this issue further in Section 5.2 (Table 8) below.

Further evidence on the effect of the risk indicator follows from an analysis of the risk & returns treatment group where both representations are presented together. The subjects in this treatment group have an average perceived risk level that is more in line with the correct level and report smaller deviations in risk level across the funds. The previous section showed that including the graphical returns representation reduces average portfolio fees, but in order to help participants perceive mutual fund risk levels that are more in line with the correct risk levels, adding the risk indicator is necessary. Overall, these findings are in line with Hypothesis 3a.

In sum, the empirical results confirm all our hypotheses. Contrary to previous research that concludes that the summary sheet does not result in improved asset allocation decisions, we document that the addition of graphical representations can be effective in generating such an effect. Moreover, the potential gains for the economy as a whole is considerable. According to the 2013 Investment Company Fact Book (ICI, 2013), in 2012, $10,048 billion of investments under management were invested in equity and hybrid index funds. The fact book does not provide detailed information about how much money exactly is invested by retail investors, not about the exact fees of mutual index funds. However, it does state that in 2012 the average front end load for equity and hybrid funds was 100 basis points; the expense ratio of index equity funds was 13 basis points and that the total net assets of long-term mutual funds with no loads for retail or general purpose investors was $3,385 billion. Based on these figures, we want to

make a very conservative back of the envelope calculation in order to have a rough estimate of the dollar amount savings that can be obtained by retail investors in the economy as a whole.

In case we consider the market for retail or general purpose investors for no-load index funds, take into account the expense ratio of 13 basis points and consider that the optimal amount of fees. Our empirical findings of the control group show that the gross fees incurred by its subjects are about 80% higher: 23.4 basis points. This would result in total fees of 23.4 bp × $3,385 billion = $7.92 billion. Our empirical findings imply that, at the low end, when taking adding the risk indicator to the same information as the control group, a 12.3% reduction in unnecessary fees would result in a saving of $415 million. At the high end, when taking both representations into account, a 24.1% reduction in unnecessary fees would imply a $813 million saving.

Given the fact that that adding visual representations to information disclosure presents a low-cost disclosure strategy for financial regulators, we conclude that it is advisable that, similar to the Dutch Financial Regulator, they should consider the implementation of such a strategy and further explore its optimal design and possible applications. In the next section we explore some potential explanations for our empirical findings and also investigate the relationship between information treatment effects and other determinants of mutual fund investment decisions.

5 Potential explanations

5.1 Information overload

The fact that the graphical representations are effective can be interpreted as evidence that the addition of these representations to the summary sheet do not lead to information overload. We examine the relationship between the representations and information overload in more detail here. Subjects were asked to rate a statement related to the necessary time to make an investment decision and one statement related to the perceived complexity of the presented information. The findings presented in Table 5 show that, although subjects from all treatment groups experienced higher levels of information load compared to the control group, differences are very small and not statistically significant. Hence, we conclude that participants perceive the graphical representations as additional information, but the extra cognitive load is small and does not lead to real problems in terms of information overload.

[Insert Table 5 about here]

5.2 Perceived importance of funds characteristics

To provide further insight into the way that subjects arrived at their investment decision, subjects were asked to rate the extent to which their investment decision was affected by seven potential determinants besides the graphical risk and returns representations. Ratings were expressed on a 5-point Likert scale, where 1 corresponds to "not important at all" and 5 corresponds to "very important". Table 6 reports the average factor rating and the ordinal ranking for the various information groups. Based on the relatively low ratings, brand recognition, subjects' past experience with fund companies, customer service and to a lesser extent quality of the prospectus receive relatively can be considered to be rather unimportant factors that we therefore will not discuss in further detail here.[21]

Participants in the control group actually rate fund fees as the most important factor, while as a group they incurred the highest average portfolio fees. The latter was mainly caused by participants who chased past returns, in line with the observation that past performance was considered to be the second most important factor by the control group in Table 6. Moreover, on average, the desire to diversify is the fourth most important factor for the control group which is consistent with the finding that subjects attempt to diversify their wealth over funds, even in the cases where their decision is influenced by the tendency to chase past returns.

[Insert Table 6 about here]

A puzzling observation is that although the inclusion of the risk indicator results in a better investment decision (i.e. lower fees and less return chasing behavior), subject assign relatively low importance to the risk indicator. Its ordinal ranking is 4 in the risk treatment group while it obtains only a fifth place in the risk and return treatment group that is exposed to both representations. In sum, the impact of the inclusion of the risk indicator on perceived importance

[21] Similar findings for the control group are reported by Choi et al. (2010) and by Beshears et al. (2011).

of past performance is quite small. In the risk treatment group, the average score is 3.21, ranked fourth in importance, while in the other treatment group where the risk indicator was shown, the average score is 3.24, ranked fifth in importance.

Overall, only a strikingly low 6.8% of the subjects that were faced with the risk indicator had a perceived overall risk level that was equal to the one communicated by the risk indicator. To explore this issue further, we examine why subjects assigned a lower risk to the funds based on the responses from the digital sample. Table 7 shows that 26% of the 150 subjects for which we can examine this, did not understand the risk indicator representation, while 27% indicated that index funds can be considered to be rather safe investments because the hold diversified portfolios.

[Insert Table 7 about here]

Taking into account all available information on the risk indicator as given to us by the survey participants, we conclude that there appears to be significant room to improve the risk indicator. Note that in an attempt to increase its effectiveness, the risk indicator that is currently in use is a simple horizontal bar, not a person carrying a barrel, indicating the risk level on a more fine-grained 7-point scale. Nevertheless, even with its apparent faults, the positive contribution of the investigated 'imperfect' risk indicator on improving the asset allocation decision underlines the potential of such an approach and is encouraging to continue developing further initiatives in this area. Indeed, even if a large number of subjects did not completely understand or fully exploited the disclosed risk information enclosed in the risk indicator, they already made significantly better investment decisions.

Compared to the risk indicator, the subjects' appreciation of the net expected returns representation is very clear, both in case it is presented as a stand-alone addition or in the case that it is presented together with the risk indicator. In the two treatment groups it is perceived as the most important characteristic for the investment decision. Overall, our results indicate that the returns representation helps subjects in comparing funds. Average portfolio fees are reduced mainly because fewer participants chase past returns, which is corroborated by the fact that the

importance of the past return factor decreases in the cases that the graphical returns representation is shown. The results for the risk & return treatment group demonstrate the incremental value of the returns representation over the risk indicator. The tendency to chase past returns or to diversify decreases further for this group compared to the risk treatment group, illustrating that subjects in the group with both representations use information embedded in both representations to reduce their reliance of heuristics. The fact that the fund fees factor for this last group is lower than the value for the risk treatment (and control group) however indicates that subjects in this treatment group are nevertheless not fully aware of the fact that in the presence of the risk indicator the returns representation signals the impact of fees in our sample.

Table 8 shows the multiple regression results of the effect of factor importance ranking on total portfolio fees. Not surprisingly, participants that highly value past performance and diversification incur high portfolio fees, while participants that assign a high importance to fees have lower portfolio fees.

[Insert Table 8 about here]

5.3 The relationship between portfolio fees and subject characteristics

Table 9a shows multivariate regression results regarding the effect of subject characteristics on incurred portfolio fees. Model 1 controls for the treatment effects, investment experience, education level, gender and major at the university.[22] Ceteris paribus, the graphical representations reduce unnecessary portfolios fees by 13-25 percent, which is very similar to the findings presented in Table 3b. In addition, more knowledgeable participants have lower portfolio fees on average. In Model 1, we also document a gender effect in the sense that male subjects incur significantly lower portfolio fees than female subjects.

[Insert Table 9a about here]

[22] We do not control for financial literacy as it is correlated with education and experience and because the impact of financial literacy on portfolio fees is very small. When we do control for financial literacy, results on graphical representations are very similar.

Model 2 includes perceived information overload, as well as perceived importance of past performance and the desire to diversify as additional control variables. As explained before, the additional representations could increase cognitive load, which in turn, might impact the investment decision. The other two factors are added in view of the conclusion in Section 5.2 that these factors are relevant. Based on the regression results for Model 2, we conclude that all of these factors matter as higher levels of perceived past return or diversification are associated with higher portfolio fees. Regarding information overload, unreported regressions reveal that high information overload is significant when the factor importance of past performance and desire to diversify are not included in the regression, because these factors are correlated. Medium overload has a surprisingly large effect on unnecessary fees. Finally, estimates of the treatment effect dummies are very similar to Model 1.

In Model 3 we investigate whether the effect of the risk and returns representations depends on subjects' perceived level of experience. The regression results indicate that highly knowledgeable investors benefit more from the graphical representations. On top of the standalone effect of the representations, they reduce the incurred portfolio fees of highly experienced subjects by an additional $57- $85 depending on the information condition considered. In addition, the coefficients of the male and finance major dummies remain highly significant. To finalize, Model 4 is the most extensive model and includes all control variables. Overall the estimates are in line with the other models, but the interaction effects of highly experienced subjects with the representation treatments are no longer significant. Hence, it appears the effect of perceived experience is dominated by subject's willingness to diversify.

To conclude this subsection, Table 9b presents the relative differences in portfolio fees between treatment groups. The table confirms that the risk & return treatment group incurs the lowest portfolio fees with a reduction of almost $51 in unnecessary fees compared to the control group. In sum, we conclude that the impact of the representations on the incurred portfolio fees is strong and robust.

[Insert Table 9b about here]

5.4 Risk perception and subject characteristics

In this section we investigate the relation between subject characteristics and the perceived mutual fund risk level. Table 10a presents the estimation results of multivariate regressions with the risk perception measure as the dependent variable. We only present the impact of the representations on the average risk perception and its standard deviation because results for the individual funds' risk level perception are very similar. We control for differences in risk aversion (taken from Barsky et al. 1997) because more risk averse individuals are more likely to have a higher risk perception. We further include the level of education, gender and education major as control variables.[23]

[Insert Table 10a about here]

Model 1 in Table 10a shows that for the risk indicator treatment group subjects the average risk perception is about 7% higher than in the control group. For the risk and return treatment group subjects, the average risk perception is about 6% higher. Because all funds in the sample are in the highest risk category (i.e. risk category 5), this indicates that the mutual fund risk perception of subjects in the treatment groups is better compared to the control group. The impact of the returns representation on the average risk perception is negative, but not significant.

In Model 2, we investigate the impact of representation treatments on the standard deviation of the fund's perceived risk level. As before, the lower the standard deviation, the better subjects understand that sample funds have a similar risk level. Regarding the treatment groups, only the risk and returns treatment group dummy is significant (−0.12), illustrating that information of both the risk and returns representation is needed in order to allow subjects to better assess the similarity in risk across sample funds. Besides this effect, only the educational dummy exerts a similar effect on the participant's ability to assess fund risk similarity, although in absolute terms the effect is not that strong (−0.08 compared to −0.12).

[23] In non-reported results we also included experience as a control variable, but the effect was negligible and was therefore excluded in the main analysis.

Model 3 and Model 4 also consider the perceived fund risk level standard deviation as dependent variable. Model 3 also includes perceived information overload dummies which have a significant positive effect, illustrating that increases in cognitive load decreases subjects' ability to detect the similarity in riskiness. To conclude, Model 4 includes highest level of education and treatment group interaction effects. The estimates confirm that better educated and more knowledgeable participants get more benefit from their exposure to the returns representation or the exposure to the risk & return representations. Because the returns treatment dummy is significantly positive, it implies that the harmful effect of the returns representation is alleviated for highly-educated participants.

Table 10b shows the results of tests on differences in average risk perception between treatment groups. One can observe that participants report a substantially improved average risk perception when they are confronted with the risk indicator on top of the returns representation, but not vice versa, illustrating the value of the risk indicator as a tool to align perceived and actual risk levels and as a means to minimizes the harmful impact of the returns representation. The tests results presented in Table 10c use the same control variables as in Model 3 of Table 10a. The findings show that the risk & return treatment in which both representations are presented does help to reduce the cross-sectional standard deviation of the risk perception. Adding the risk (return) representation to the return (risk) treatment significantly decreases the risk perception standard deviation, corroborating earlier findings that both representations should be added to the summary sheet.

[Insert Tables 10b and 10c about here]

5.5 Confidence and knowledge

Choi et al. (2010) show that participants that are not so confident about their investment decision, have low levels of knowledge, or did not understand the type of assets management by a money market fund, have portfolios with higher fees. In the previous subsections we already presented empirical evidence that the self-reported level of experience was negatively related to portfolio fees. Table 11 further explores this line of research and reports our findings regarding the impact of financial literacy, self-reported knowledge and confidence on incurred portfolio

fees. The second column shows the distribution of participants' responses to different questions while the third column shows the average amount of fees paid conditional on the provided answer.

[Insert Table 11 about here]

There is a negative relation between incurred portfolio fees and investor confidence. Participants that are more likely to change their mind about the allocation of funds if a professional investment advisor was consulted, incur higher portfolio fees. In addition, Table 11 reveals that fees are negatively related with confidence, self-reported knowledge and investor skill. Overall these findings are in line with our expectations.

5.6 Robustness tests

We test the robustness of our results if we ease the restrictions imposed on the initial sample selection. Hence, we investigate whether the exclusion of (i) individuals who are older than 30 years, or (ii) spent less than 2 minutes on the investments survey affect our main conclusions. In addition, we test whether results are driven by Dutch students, given the fact that these students could be more familiar with the graphical illustrations in the Financial Leaflet issued by the Dutch financial regulator AFM.

The age restriction does not really influence our results as shown in Table 12. Older respondents seem to be influenced a bit more by the representations, which is in line with earlier findings showing that older individuals are often better educated and more experienced.

[Insert Table 12 about here]

We also provide sensitivity testing regarding the minimum time that subjects should observe to take the investment decision in order to be included in our final sample (Table 13). Regarding the effect on portfolio fees, results for the risk indicator are no longer significant if we include subjects with a decision time below 2.5 minutes. The effect of the graphical returns representation is less sensitive, only if subjects with a decision time below one minute are added

to the sample, the findings become insignificant. For the average risk perception, time is less of an issue in the sense that we also find strong effects for quick decision-makers. The graphical returns representation turns out to be particularly useful for the quick decision-makers. For the assessment of the similarity of funds (Panel C), we document the same pattern for the risk indicator as observed in our analysis of total fees, while the return representation is not helpful for any specific time bucket. For all three independent variables (portfolio fees, average risk perception and standard deviation), presenting both graphical representations together yield strong effects over the various time buckets.

[Insert Table 13 about here]

When taking into account the nationality of the respondents, the only difference is observed for the risk indicator. For Dutch respondents only, its inclusion does lead to a decrease in portfolio fees relative to the control group, but it is no longer significant. The largest decreases in portfolio fees also occur in the returns treatment group and the risk & returns treatment group. The same holds when taking into account the full sample of all respondents when no restrictions have been put in place on for example age, or investment decision time.

For the sample with all respondents (not taking into account any restrictions) the findings are very much in line with the main sample. Although the effects on portfolio fees in each treatment group are lower compared to the control group, relative to the main sample (and the Dutch sample), all effects are significant. The findings for the average risk perception and its standard deviation are almost indistinguishable from the findings of the main sample.

[Insert Table 14 about here]

5.7 Generalization of our findings

In this subsection, we discuss three elements that are related to the extent that our result can be generalized. First, our sample appears to be representative compared to other studies in the field. The control group subjects' results reveal similar behavioral patterns as reported by Choi et al. (2010) and Beshears et al. (2011). Second, incentives in the experiment are aligned with

incentives in case of real-life investments by offering potential payments related to the investment decision. Overall, all our robustness tests are also in line with the main findings.

Finally, in our experimental setting we use index mutual funds with similar gross returns and risk levels. This setup is ideal to investigate the impact of adding graphical risk and net expected returns representations to the summary sheet. However, we acknowledge that this setting is rather restrictive in view of the wide range of mutual funds that can be considered, and we intend to pursue further research that relaxes some of these restrictions. Moreover, in line with findings that investors' reliance on heuristics increases with task difficulty, investors might benefit even more from graphical representations in more realistic and more complex information environments than in our experimental setting.

6 Concluding remarks

Due to the growth of the mutual fund sector, mutual fund investors are confronted with significant search costs given the wide range of funds to choose from and the large amount of fund information that is made available. As a result, the probability that problems related to information overload occur has increased as well. Financial regulators have reacted by promoting financial literacy initiatives on the one hand, and by considering the amount or quality of the information that is disclosed on the other hand. Although we acknowledge that all methods could be valuable, previous research has casted doubts with respect to the effectiveness of these two approaches (see Garcia, 2013, on the effectiveness of financial literacy programs and Choi et al, 2010, on the effectiveness of the summary sheet to change consumer behavior). In this paper, we have investigated the effect of another approach, improving the quality of the disclosed information. More specifically, we studied the effect of the addition of graphical representations for risk and net expected returns to a mutual fund summary sheet.

We show that adding simple graphical representations that make pieces of textual and tabulated information more salient to investors, leads to better portfolio allocation decisions. In a simple investment setting where investors have to choose between three index funds, unnecessary portfolio fees are reduced by up to 24.1%. In addition, subjects' perceived fund risk level is more accurate and the cross-sectional comparison of fund risk is improved as well. Moreover,

investors rely less on heuristics as evidenced by the fact that in cases where the graphical representations are available, return-chasing behavior decreases in favor of the allocation of more wealth to the cheapest fund.

Overall, this paper shows that, financial regulators should focus on information quality in general and specifically on graphical representations thereof, as a lever to help investors to improve the investment decision making process. More so, because such policies can be implemented rather quickly and at low cost. The documented positive effects of the graphical representations on investment decision in this paper are strong and robust, although unnecessary portfolio fees are not completely eliminated. Still, the economic impact of our findings is potentially very large. We acknowledge that this paper is just a first step, given that we have not investigated the best graphical format for risk and return representations, nor have we investigated the relative effectiveness of graphical representations compared to other information treatments. Taking together, our results on the possible benefits of real-life graphical representations should encourage further research on the optimal design of information representation formats. Nevertheless, our findings show that financial regulators should include representations in summary sheets that make risk, return and fee attributes more salient for potential investors. In addition, we advise that they should continue to explore possible applications of graphical representations in other policy domains, such as mortgage loans and credit card debt, as well.

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Appendix: Tables

Table 1: Characteristics of sample index funds

This table shows the properties of the index funds in our sample that could be considered by the subjects in their investment decision. The information is taken from the fund prospectuses that were available at the start of the experiment. In order to have a fair comparison a small fee of 20$ is included for buying the Vanguard 500 Index Fund, because its prospectus mentioned that the agency that sells the fund could charge an extra fee. Yearly expense is the percentage of the investment which has to be paid every year for holding the fund (besides loads). Front-end load (back-end) load are the fees to be paid in case an investor buys (sells) a fund. The inception dates are set by us in such a way that these correlate positively with the average annual return and do not necessarily correspond to the actual inception date. The inception date (column 3) is positively correlated to the amount of fees you have to pay. The approximate fee on a $10,000 investment (last column) considers all type of fees over a one-month investment horizon.

Mutual fund	Inception date	(Annual) return since inception date	(Annual) expense	Front-end load	Back-end load	Approximate fee on a $10k investment
Invesco S&P 500 Index Fund	2003/1/1	7.47%	0.60%	5.50%	0%	$554.73
iShares S&P 500 Index Fund	2004/1/1	5.43%	0.09%	3%	2%	$495.51
Vanguard 500 Index Fund	2005/1/1	2.35%	0.17% + $20	1.25%	1.25%	$251.97

Table 2: Subject characteristics

This table shows the subject characteristics for the participants in each information effect group. For each information effect group, the 'Whole Sample' column shows the group average over all subjects, while the 'Digital Sample' group excludes participants that used the hardcopy version of the survey. Every individual receives a set of basic investment information consisting of the summary sheet, a return sheet and a FAQ sheet. Control group subjects only receive this information set. On top of this information, the risk treatment group and returns treatment group receive the risk indicator and the graphical returns representation, respectively. The risk & returns treatment group receives both graphical representations in addition to the written information. To get an idea about the subjects' financial knowledge, we asked them several questions related to financial markets. These were whether they knew the meaning of a stock market beta and diversification. We also asked what assets are held by a money market fund (all yes/no questions). In addition, we asked respondents to denote their perceived risk level (on a 5-point scale) for a stock or an equity mutual fund. Risk aversion is measured on a 1-4 scale, where 1 indicates least risk averse and 4 indicates most risk averse (taken from Barsky et al., 1997). Time spent is the time in seconds (recorded by the software) that investors need to process all investment-related disclosed information and arrive at their investment decision, which is different from the overall time to complete the survey.

	Control group		Risk Treatment		Return Treatment		Risk & Return Treatment	
	Whole Sample	Digital Sample	Whole Sample	Digital Sample	Whole Sample	Digital Sample	Whole Sample	Digital Sample
Average age	22	21.8	22	21.9	22.2	21.8	21.8	21.5
Percent male	62	64	58	55	63	64	62	62
Highest education								
Finished High school	25%	29%	22%	26%	31%	36%	28%	33%
First year of college	12%	14%	17%	13%	11%	12%	14%	14%
Second year of college	17%	13%	19%	19%	17%	12%	14%	11%
College degree	27%	27%	23%	20%	21%	18%	27%	25%
Graduate degree	19%	17%	19%	22%	20%	21%	17%	17%
Educational Major								
Finance	15%	14%	19%	19%	10%	12%	14%	14%
Econometrics	6%	6%	4%	3%	7%	6%	5%	4%
Economics	21%	22%	25%	26%	27%	30%	26%	27%
Business Studies	26%	24%	26%	23%	23%	23%	28%	30%
Other	32%	34%	27%	29%	32%	29%	26%	26%
Beta question correct	47%	48%	49%	52%	38%	42%	43%	43%
Diversification correct	80%	78%	88%	88%	79%	85%	81%	81%
Knows what a money market fund holds	11%	10%	9%	10%	14%	15%	11%	12%
Average risk rating								
- A stock	3.2	3.2	3.3	3.2	3.2	3.1	3.3	3.2
- An equity mutual fund	3.7	3.8	3.5	3.7	3.7	3.8	3.9	3.9
Risk Aversion	2.5	2.4	2.4	2.4	2.6	2.6	2.3	2.4
Time spent (in seconds)	–	481	–	397	–	304	–	194
Sample size	100	86	81	69	81	66	95	81

Table 3a: Average Portfolio Fees Paid across Treatment Groups

The top panel of the table presents the average portfolio fees paid per information effect group. The bottom panel of the table reports two-sided *p*-values of *t*-tests for the equality of means in fees, allowing for each group to have a different variance. The null hypothesis is listed in the second column, and the third column reports the p-value for this test. The first column indicates the graphical representation effect that is examined. For example, the third column containing " Control=return Treatment" tests whether the average fees for the group that receives the graphical return representation is equal to the average fees incurred by the control group that only receive the standard set of information without any graphical representations. Bold numbers indicate significance at the 5%-level.

	Average Portfolio Fees
Control Group	\$455
Risk Treatment Group	\$430
Returns Treatment Group	\$418
Risk & Return Representation Group	\$406

Two-sided p-values from t-tests of equality of means (unequal variances)		
Risk Representation Effect	Control group = Risk treatment	**0.03**
	Return treatment = Risk & return treatment	0.36
Return Representation Effect	Control group = Return treatment	**<0.01**
	Risk treatment = Risk & return treatment	0.06
Risk & Return Representation Effect	Control group = Risk & return treatment	**<0.01**
Risk vs. Return Representation Effect	Risk treatment = Return treatment	0.36

Table 3b: Relative Differences in Unnecessary Fees Paid across Treatment Groups

The table reports in the second column the unnecessary fee for each information effect group, compared to the total fee incurred in case of an investment in the lowest cost Vanguard index fund. Columns 3-5show the relative differences in incurred unnecessary fees between information effect groups. The information conditions indicated on top of the table serves every time as the base level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Unnecessary Fees	Control Group	Risk Treatment	Return Treatment
Control Group	\$203	-	-	-
Risk Treatment	\$178	−12.3%**	-	-
Return Treatment	\$166	−18.2%***	−6.7%	-
Risk & Return Treatment	\$154	−24.1%***	−13.5%*	−7.2%

Table 4: Perceived Riskiness across Treatment Groups

The top panel of the table presents the average perceived risk level of the individual funds, the average risk perception and the average standard deviation per information effect group. Risk is indicated on a 1-5 point scale. The average risk perception is the average of the three individual funds, while the standard deviation is calculated based on the individual funds' risk perception. The bottom panel of the table reports two-sided *p*-values of *t*-tests for the equality of means, allowing for each group to have a different variance. The first column reports the graphical representation that is examined, the null hypothesis is listed in the second column. Bold numbers indicate statistical significance at the 5% level.

		Perceived Risk Invesco	Perceived Risk Ishares	Perceived Risk Vanguard	Average Risk Perception	Standard Deviation
	Control Group	3.51	3.33	2.86	3.23	0.77
	Risk Treatment Group	3.74	3.54	3.06	3.45	0.68
	Returns Treatment Group	3.20	3.22	3.00	3.14	0.84
	Risk & Return Treatment Group	3.41	3.46	3.36	3.41	0.67
Two-sided p-values from t-tests of equality of means (unequal variances)						
Risk Representation Effect	Control group = Risk treatment	0.09	0.06	0.16	**0.02**	0.16
	Return treatment = Risk & return treatment	0.13	**0.02**	**0.02**	**<0.01**	**0.02**
Return Representation Effect	Control group = Return treatment	**0.03**	0.27	0.34	0.19	0.28
	Risk treatment = Risk & return treatment	**0.02**	0.49	0.06	0.72	0.88
Risk & Return Representation Effect	Control group = Risk & return treatment	0.45	0.22	**<0.01**	**0.02**	0.12
Risk vs. Return Representation Effect	Risk treatment = Return treatment	**<0.01**	**<0.01**	0.72	**<0.01**	**0.02**

Table 5: Perceived Information Overload across Treatment Groups

This table examines differences in information overload among information conditions. Two questions are asked: "The investment task took me a lot of time" and "It was difficult to comprehend all of the information available to me". Individuals could rate this question on a scale from 1 to 5. 1 is "I strongly disagree", while 5 is "I strongly agree". Information overload is increasing in rating. The top panel reports the average rating as a measure for perceived information overload. The bottom panel reports two-sided *p*-values of *t*-tests for the equality of means among information conditions, allowing for each group to have a different variance.

		Average Perceived Information Overload
	Control Group	3.03
	Risk Treatment Group	3.14
	Returns Treatment Group	3.16
	Both Representations Group	3.13
Two-sided p-values from t-tests of equality of means (unequal variances)		
Risk Representation Effect	Control group = Risk treatment	0.34
	Return treatment = Risk & return treatment	0.78
Return Representation Effect	Control group = Return treatment	0.25
	Risk treatment = Risk & return treatment	0.93
Risk & Return Representation Effect	Control group = Risk & return treatment	0.33
Risk vs. Return Representation Effect	Risk treatment = Return treatment	0.87

Table 6: Importance of various factors in subjects' investment decision process

Each cell reports the perceived average importance the factor had on subjects' investment decision, as elicited in the survey. There were five possible responses, from "not important at all" to "very important". The integers are assigned such that higher numbers correspond to greater importance. Each factor's ordinal rank is in parentheses, with lower integers corresponding to greater ordinal importance.

	Control group		Risk treatment		Returns treatment		Risk and Returns treatment	
Quality of prospectus	3.42	(3)	2.95	(5)	3.10	(5)	3.05	(6)
Brand recognition	2.60	(6)	2.25	(8)	2.20	(8)	2.07	(9)
Past experience with fund companies	2.62	(5)	2.47	(6)	2.43	(7)	2.21	(7)
Fund fees, expenses and loads	3.70	(1)	3.73	(2)	3.59	(2)	3.38	(3)
Past performance	3.63	(2)	3.75	(1)	3.54	(3)	3.44	(2)
Customer service of fund	2.51	(7)	2.42	(7)	2.47	(6)	2.17	(8)
Desire to diversify across funds	3.36	(4)	3.30	(3)	3.38	(4)	3.13	(4)
Risk indicator	-	-	3.21	(4)	-	-	3.24	(5)
The net expected return representation	-	-	-	-	4.06	(1)	3.98	(1)
Sample size	100		81		81		95	

Table 7: Reasons for deviations between subjects' perceived risk and the risk indicator

This table shows the percentage of subjects for which the perceived risk level deviates from the risk indicator. For these subjects, the table also presents the reasons listed by subjects to explain why their perceived risk level was different from the risk indicator. This question was only asked in the digital version of the survey. 176 (81+95) respondents were faced with the risk indicator, while 26 (12+14) respondents filled in the hardcopy survey and were not questioned. Overall, 127 respondents out of 150 respondents in the digital sample (=84.7%) deviated at least once in their answer from the disclosed risk level.

Why do subjects' perceived risk deviates from the risk indicator?	
Did not understand the risk indicator	26.0%
Fund is diversified over many stocks, and hence safer	26.8%
Summary info gave me another conclusion	14.2%
Did not trust the risk indicator	9.4%
Did not see this risk level of the risk indicator	5.5%
Other	18.1%

Table 8: Effect of factor importance ranking on portfolio fees

This table shows the results of a multivariate regression of individual portfolio fees on individual importance factors indicating the perceived importance the factor had on subjects' investment decision as presented in Table 6 above. The individual importance factors are coded as integers from 1 to 5, where 1 corresponds to the response "not at all important" and 5 to the response "very important". Model 2 also includes the risk, returns and risk & returns treatment effects indicating whether the risk indicator, the net expected return representation or both were shown to the subjects, respectively. Standard errors are in parentheses, with *, **, and *** indicating statistical significance at the 10%, 5%, and 1% level, respectively.

	Model 1	Model 2
Constant	−347.71	389.13
	(21.23)	(22.77)
Risk treatment	-	−24.47**
	-	(11.35)
Returns treatment	-	−34.63***
	-	(11.28)
Risk & returns treatment	-	−47.11***
	-	(10.92)
Quality of prospectus	7.13*	6.07
	(4.17)	(4.12)
Brand recognition	3.00	0.76
	(4.4)	(4.33)
Past experience with fund companies	−1.9	−1.67
	(4.04)	(3.94)
Fund fees, expenses and loads	−10.02**	−12.04***
	(4.14)	(4.08)
Past performance	22.37***	22.63***
	(3.88)	(3.81)
Customer service of fund	−8.43*	−8.48*
	(4.58)	(4.49)
Desire to diversify across funds	9.61***	9.27***
	(3.5)	(3.42)
R-square	0.1731	0.2183
Adjusted R-square	0.1565	0.1957
Sample size	357	357

Table 9a: Demographic correlates of portfolio fees (continued on next page)

This table report regression results where the dependent variable is portfolio fees. Risk treatment, returns treatment and risk & return treatment are dummies that indicate that the subject was part of that particular treatment group. Male is a dummy for the male gender. Importance of past performance and importance of diversification are factors capturing the extent to which subjects rated these factors to be important in their investment decision process. For the factor importance of diversification, we used dummies to measure the effect of each level of importance. We also control for subjects' education major, with economic major as base level because the majority of subjects follow this major. We divided subjects into three groups according to their perceived level of information overload and we use dummies for medium information overload and high info overload in Model 2 and 4. In Model 3 and 4 we use interaction terms between high experience and the three treatment groups. In addition, we have constructed three dummy variables for the experience variable: low experience, medium experience and high experience level, where the first is the reference category. Subjects are assigned to these three groups based on their self-reported level of investment experience. In Model 3 and 4 we only interact the high experience level with the treatment effect dummy, as the interaction with medium experience level is negligible. Standard errors are in parentheses, with *, **, and *** indicating statistical significance at the 10%, 5%, and 1% level, respectively.

	Model 1	Model 2	Model 3	Model 4
Constant	501.68	361.01	484.45	353.79
	(16.04)	(23.25)	(14.87)	(22.07)
Risk treatment	−26.00**	−29.13***	−13.33	−22.87*
	(11.92)	(10.94)	(12.71)	(11.79)
Returns treatment	−40.57***	−40.26***	−26.82**	−32.27***
	(11.82)	(10.88)	(12.76)	(11.84)
Risk & returns treatment	−50.8***	−48.55***	−38.79***	−42.36***
	(11.3)	(10.47)	(12.5)	(11.64)
Experience	−6.2	−4.64	–	–
	(4.36)	(4.08)	–	–
Highest level of education	−5.38*	−2.42	−5.7*	−2.77
	(3.2)	(2.96)	(3.19)	(2.98)
Male	−17.98**	−13.45	−18.03**	−14.5
	(9.16)	(8.51)	(9.03)	(8.46)
Finance major	−39.16**	−22.76	−35.7**	−22.91
	(15.3)	(14.41)	(15.57)	(14.71)
Medium info overload	–	32.83***	–	33.25***
		(12.52)		(12.62)
High info overload	–	10.35	–	13
		(15.18)		(15.18)
Importance past performance	–	17.23***	–	16.56***
		(3.48)		(3.51)
Importance diversification - level 2	–	40.02***	–	38.67**
		(15.99)		(16.1)
Importance diversification - level 3	–	52.42***	–	49.92***
		(13.72)		(13.86)
Importance diversification - level 4	–	49.61***	–	48.37***
		(12.69)		(12.76)
Importance diversification - level 5	–	28.64**	–	28.33*
		(15.05)		(15.15)

Table 9a (continued): Demographic correlates of portfolio fees

	Model 1	Model 2	Model 3	Model 4
Medium experience	–	–	−14.92	−11.25
			(12.22)	(11.35)
High experience	–	–	28.77	15.83
			(19.66)	(18.41)
High experience × risk treatment	–	–	−78.95**	−32.06
			(37.17)	(34.79)
High experience × returns treatment	–	–	−84.87**	−49.97
			(35.48)	(32.94)
High experience × risk & returns treatments	–	–	−57.79**	−29.66
			(28.5)	(26.61)
Controlled for Education Majors	Yes	Yes	Yes	Yes
R-square	0.1314	0.2935	0.1528	0.2986
Adjusted R-square	0.1037	0.2559	0.1156	0.2524
Sample size	357	357	357	357

Table 9b: Influence of graphical representations on fees paid across treatment groups

This table reports the results of a multivariate regression with portfolio fees as dependent variable. Control variables are the same as the ones used in Model 1, Table 8, but the information treatment group that is used as base level differs in each instance. The base level group is indicated in the column header. Standard errors are in parentheses, with *, **, and *** indicating statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable: Portfolio fees

	Control group	Risk treatment	Returns treatment
Risk treatment	−26.00**	–	–
	(11.92)		
Returns treatment	−40.57***	−14.57	–
	(11.82)	(12.47)	
Risk & returns treatment	−50.8***	−24.8**	−10.23
	(11.3)	(12.02)	(11.95)

Table 10a: Subjects' characteristics and risk perception

This table report regression results where the dependent variable is a measure of risk perception. Risk treatment, Returns treatment and Risk & return treatment are dummies indicating that a subject was part of that particular treatment group. Risk aversion is taken from Barsky et al. (1997), the higher the level, the more risk averse a subject is. Male is a dummy for the male gender. We also control for subjects' education major, with economic major as base level given that most subjects follow this major. We divided subjects into three groups according to their perceived level of information overload and we use dummies for medium information overload and high info overload in Model 3 and 4. Model 3 and 4 includes interaction terms between highest level of education and the three treatment groups. Standard errors are in parentheses, with *, **, and *** indicating statistical significance at the 10%, 5%, and 1% level, respectively.

	Average risk perception	Standard deviation	Standard deviation	Standard deviation
Model	1	2	3	4
Constant	2.72	0.94	0.79	0.57
	(0.18)	(0.14)	(0.16)	(0.18)
Risk treatment	0.23***	-0.09	-0.10	0.12
	(0.08)	(0.07)	(0.07)	(0.15)
Returns treatment	–0.09	0.05	0.04	0.27*
	(0.08)	(0.07)	(0.07)	(0.15)
Risk & returns treatment	0.2**	–0.12*	–0.13**	0.19
	(0.08)	(0.06)	(0.06)	(0.14)
Risk aversion	0.08**	0.00	0.00	0.00
	(0.03)	(0.03)	(0.03)	(0.03)
Highest level of education	0.03	–0.08***	–0.07***	0.00
	(0.02)	(0.02)	(0.02)	(0.05)
Male	0.08	0.00	0.01	0.00
	(0.06)	(0.05)	(0.05)	(0.05)
Medium information overload	–	–	0.15**	0.17**
			(0.07)	(0.07)
High information overload	–	–	0.16*	0.18**
			(0.09)	(0.09)
Highest level of education × risk treatment	–	–	–	–0.07
				(0.05)
Highest level of education × returns treatment	–	–	–	–0.08*
				(0.04)
Highest level of education × risk & returns treatment	–	–	–	–0.11**
				(0.04)
Controlled for education majors	Yes	Yes	Yes	Yes
R-square	0.0926	0.1412	0.1521	0.169
Adj. R-square	0.061	0.1113	0.1174	0.1273
Sample size	357	357	357	357

Table 10b: Influence of graphical representations on average risk perception across treatment groups

This table reports the results of a multivariate regression with risk perception as dependent variable. Control variables are the same as the ones used in Model 1, Table 10a, but the information treatment group that is used as base level differs in each instance. The base level group is indicated in the column header. Standard errors are in parenthesis, with *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable: Risk perception

	Control group	Risk treatment	Returns treatment
Risk treatment	0.23***	–	–
	(0.08)		
Returns treatment	–0.09	–0.32***	–
	(0.08)	(0.09)	
Risk & return treatment	0.20**	–0.04	0.29***
	(0.08)	(0.09)	(0.09)

Table 10c: Influence of graphical representations on the standard deviation of individual risk perception across treatment groups

This table reports the results of a multivariate regression with the cross-section standard deviation of fund risk perception as dependent variable. Control variables are the same as the ones used in Model 3, Table 10a, but the information treatment group that is used as base level differs in each instance. The base level group is indicated in the column header. Standard errors are in parenthesis, with *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable: Cross-section standard deviation of fund risk perception

	Control group	Risk treatment	Returns treatment
Risk treatment	–0.10	–	–
	(0.07)		
Returns treatment	0.04	0.14**	–
	(0.07)	(0.07)	
Risk & return treatment	–0.13**	–0.03	–0.17**
	(0.06)	(0.07)	(0.07)

Table 11: Portfolio fees and the influence of subjects' confidence and investment knowledge

This table reports the frequency of responses to four survey questions related to confidence and investment knowledge, together with the average portfolio fees (weighted by dollar allocation) per answer.

	Frequency	Average portfolio fees
How likely is it that you would change your decision if you consulted a professional investment advisor		
1. Very likely	20.7%	$432.34
2. Relatively likely	45.4%	$435.50
3. Somewhat likely	24.9%	$431.59
4. Less than likely	5.3%	$385.38
5. Not at all likely	3.6%	$348.88
How confident are you that the decision you made is the right one for you?		
1. Not at all confident	8.4%	$416.04
2. Less than confident	22.1%	$432.56
3. Somewhat confident	44.8%	$431.57
4. Relatively confident	21.8%	$429.22
5. Very confident	2.8%	$362.82
How knowledgeable do you consider yourself to be as an investor		
1. Not at all knowledgeable	13.4%	$439.37
2. Less than knowledgeable	28.9%	$437.01
3. Somewhat knowledgeable	38.7%	$432.92
4. Relatively knowledgeable	17.9%	$405.63
5. Very knowledgeable	1.1%	$251.97
Which of the following types of investments are found in a money market fund?		
Correct answer (short- term U.S. government bond)	11%	$399.92
Incorrect answer (corporate bonds, stocks, none of the above)	89%	$431.60

Table 12: Robustness tests for subjects' age

This table presents our main regression results regarding the effect of the treatment groups in case we apply different age restrictions to construct our sample. For Panel A, control variables are the same as the ones used in Model 1 of Table 8, while for Panel B, the same control variables as in Model 3 of Table 10a are used. As comparison, the results based on our main sample that is used in the main empirical part of this paper is presented in the column labeled 'Main Sample'. Standard errors are in parenthesis, with *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Main sample	All ages	Excluding >24 years
Panel A: Portfolio fees			
Risk treatment	–26.00**	–30.68**	–21.9*
	(11.92)	(11.96)	(12.22)
Returns treatment	–40.57***	–51.5***	–32.62***
	(11.82)	(11.43)	(12.43)
Risk & returns treatment	–50.8***	–51.5***	–43.65***
	(11.3)	(11.43)	(11.5)
Panel B: Average risk perception			
Risk treatment	0.22***	0.23***	0.23***
	(0.08)	(0.08)	(0.09)
Returns treatment	–0.09	–0.08	–0.11
	(0.08)	(0.08)	(0.09)
Risk & returns treatment	0.20**	0.22***	0.15*
	(0.08)	(0.08)	(0.08)
Panel B: Standard deviation of risk perception			
Risk treatment	–0.10	–0.11	–0.07
	(0.07)	(0.06)	(0.07)
Returns treatment	0.04	0.06	0.08
	(0.07)	(0.06)	(0.07)
Risk & returns treatment	–0.13**	–0.13**	–0.09
	(0.06)	(0.06)	(0.07)
Sample size	357	379	314

Table 13: Robustness tests for investment decision time

This table presents our main regression results regarding the effect of the treatment groups in case we apply different investment decision time restrictions to construct our sample. The column headings indicated the investment time to be considered in the sample. For Panel A, control variables are the same as the ones used in Model 1 of Table 8, while for Panel B, the same control variables as in Model 3 of Table 10a are used. As comparison, the results based on our final sample that is used in the main empirical part of this paper in which we include all subjects with an investment decision time of at least 2 minutes is presented in the column labeled 'Main Sample'. Standard errors are in parenthesis, with *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Main sample >2 min.	No restriction	>1 min.	>1.5 min.	>2.5 min.	>3 min.	>4 min.	< 2 min. > 15 min.	< 2 min. > 10 min.
Panel A: Portfolio fees									
Risk treatment	−26.00**	−3.50	−7.57	−15.51	−30.9**	−32.66**	−31.92**	−23.35*	−25.54*
	(11.92)	(9.72)	(10.13)	(10.81)	(13.6)	(14.73)	(14.81)	(12.55)	(13.84)
Returns treatment	−40.57***	−13.27	−17.69*	−24.3**	−51.84***	−51.41***	−53.03***	−37.82***	−39.8***
	(11.82)	(9.68)	(10.13)	(10.84)	(13.19)	(14.26)	(14.37)	(12.44)	(13.79)
Risk & returns treatment	−50.80***	−25.05***	−29.22***	−36.12***	−61.5***	−56.77***	−77.59***	−48.29***	−50.03***
	(11.3)	(9.6)	(10.01)	(10.6)	(12.85)	(14.42)	(23.43)	(11.99)	(13.32)
Panel B: Average risk perception									
Risk treatment	0.22***	0.10	0.12*	0.17**	0.21**	0.21**	0.22**	0.26***	0.25**
	(0.08)	(0.07)	(0.07)	(0.07)	(0.09)	(0.1)	(0.1)	(0.09)	(0.1)
Returns treatment	−0.09	−0.17***	−0.15**	−0.13*	−0.07	−0.07	−0.07	−0.06	−0.08
	(0.08)	(0.07)	(0.07)	(0.08)	(0.09)	(0.1)	(0.1)	(0.09)	(0.1)
Risk & returns treatment	0.2**	0.12*	0.14**	0.17**	0.23**	0.25**	0.47***	0.24***	0.23**
	(0.08)	(0.07)	(0.07)	(0.07)	(0.09)	(0.1)	(0.16)	(0.09)	(0.1)
Panel C: Standard deviation of risk perception									
Risk treatment	−0.10	−0.08	−0.08	−0.08	−0.14*	−0.16**	−0.16*	−0.12*	−0.09
	(0.07)	(0.05)	(0.05)	(0.06)	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)
Returns treatment	0.04	0.04	0.05	0.06	−0.03	−0.04	−0.05	0.03	0.05
	(0.07)	(0.05)	(0.06)	(0.06)	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)
Risk & returns treatment	−0.13**	−0.12**	−0.12**	−0.12**	−0.16**	−0.15**	−0.18	−0.14***	−0.11
	(0.06)	(0.05)	(0.06)	(0.06)	(0.07)	(0.08)	(0.13)	(0.07)	(0.08)
Sample size	357	394	389	378	306	275	216	338	312

Table 14: Robustness tests for Dutch nationality and no restrictions

This table presents our main regression results regarding the effect of the treatment groups when we consider only the Dutch respondents in the main sample and we consider all respondents when no restrictions have been put in place. For Panel A, control variables are the same as the ones used in Model 1 of Table 8, while for Panel B, the same control variables as in Model 3 of Table 10a are used. The results based on our main sample including subjects at Tilburg University (The Netherlands), KU Leuven (Belgium) and University of Johannesburg (South Africa) that is used in the main empirical part of this paper is presented in the column labeled 'Main Sample' for comparison reasons. Standard errors are in parentheses, with *, **, and *** indicating statistical significance at the 10%, 5%, and 1% level, respectively.

	Main sample	Dutch respondents	All respondents
Panel A: Portfolio Fees			
Risk treatment	–26.00**	–13.87	–18.13*
	(11.92)	(14.5)	(10.8)
Returns treatment	–40.57***	–41.87***	–31.66***
	(11.82)	(13.8)	(10.76)
Risk & returns treatment	–50.8***	–53.7***	–43.65***
	(11.3)	(13.07)	(10.54)
Panel B: Average risk perception			
Risk treatment	0.23***	0.26***	0.24***
	(0.08)	(0.1)	(0.08)
Returns treatment	–0.09	–0.04	–0.06
	(0.08)	(0.09)	(0.08)
Risk & returns treatment	0.20**	0.24***	0.22***
	(0.08)	(0.09)	(0.07)
Panel C: Standard deviation of risk perception			
Risk treatment	–0.10	–0.04	–0.11
	(0.07)	(0.08)	(0.06)
Returns treatment	0.04	0.05	0.05
	(0.07)	(0.07)	(0.06)
Risk & returns treatment	–0.13**	–0.10	–0.15**
	(0.06)	(0.07)	(0.06)
Sample size	357	261	411

Figure 1: Graphical risk representation: the risk indicator

The risk indicator that is used as the information treatment provides the level of risk of the investment in the mutual fund on a 5-point scale. The left part of the figure is the risk indicator with (the highest) level 5 (very high risk), while the right part of the figure is the risk indicator with level 2 (little risk).

Figure 2: Graphical returns representation: expected return net of fees

The figure was accompanied with a text explaining the content of the graph. The text explained that the picture indicates the expected value of the fund for different time horizons (in months) incorporating expected returns minus the cost of investing and holding the fund. The maximum possible investment amount of $10,000 is used to create the picture and the gray background indicates the initial investment amount.

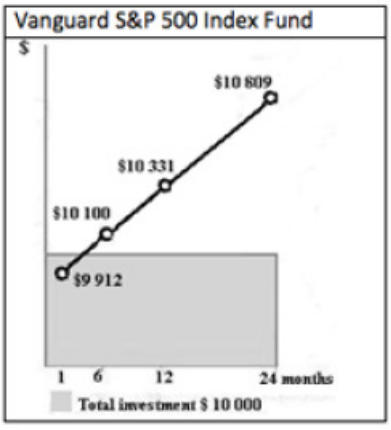
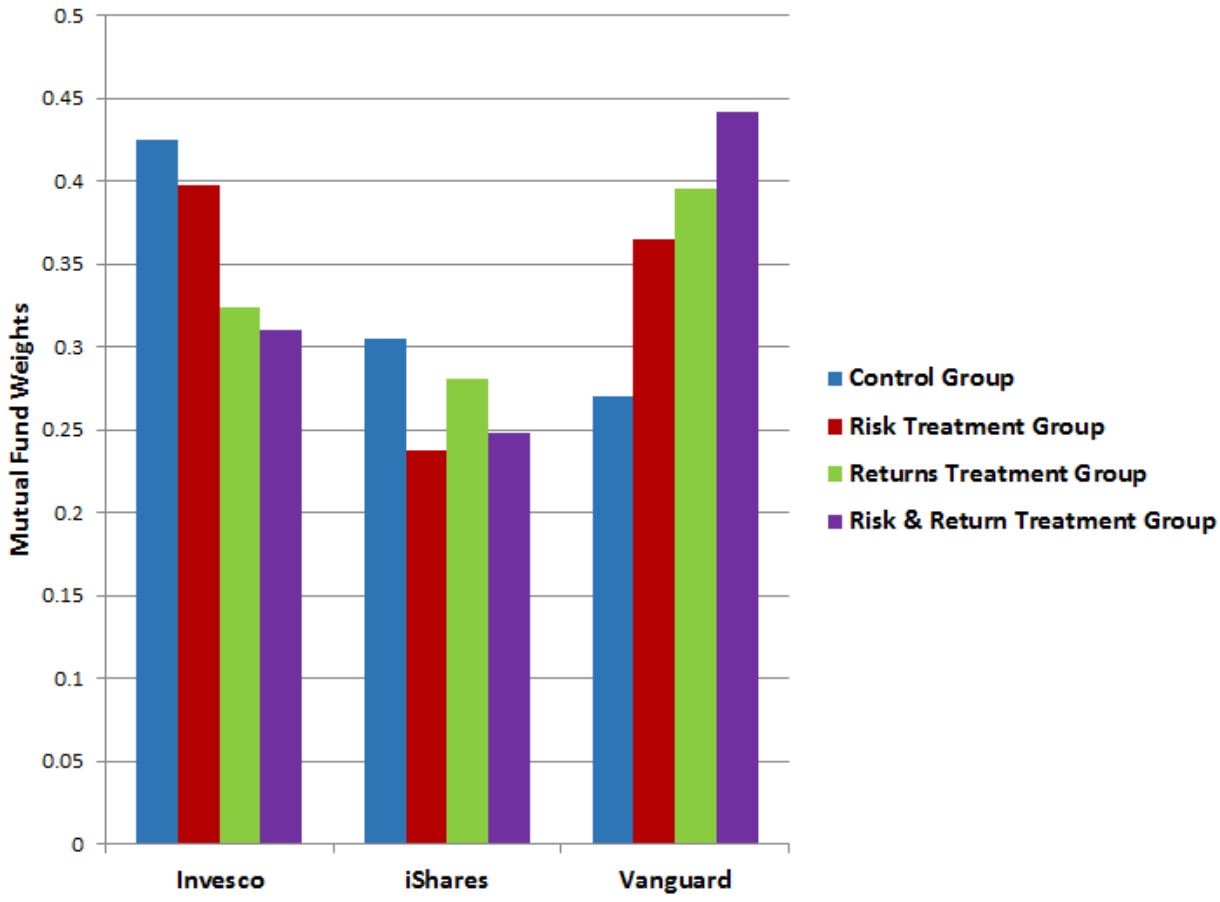


Figure 3: Average fund allocation distribution per information condition



Appendix: The hardcopy version of the survey

Welcome!

Thank you for participating in this survey, which provides you with the possibility of earning up to US$100 (around 70 euro). This survey will be used to investor's decision making and important to note is that you don't have to be experienced with investing.
The survey will take you around 10 minutes to complete and it consists of 3 main parts
Part 1: Some introduction questions
Part 2: The investment decision, you are asked to invest US$ 10 000 in up to 3 funds. You have to make this investment decision based on the information that is provided
Part 3: Some debriefing questions and personal characteristics are asked
Note: Results will be kept anonymous

Before starting the survey we will give you some basic information by giving a Question/ Answer sheet

What is a mutual fund?
It is a fund which invests money on your behalf. Your return will be the return of the mutual fund minus the fees which the fund charges for its services.
What is an S&P 500 Index Fund?
It is a mutual fund that tries to make its pre-fee investment return approximate the S&P 500 Index's investment return. In part 2 you have to make an investment decision between three different S&P 500 Index funds.
What is the S&P 500 Index
The index measures the total stock market value of the 500 largest U.S. companies, and the returns is the percent change of the total value of the 500 companies.

Part 1: Introduction questions

Q 1.1 How knowledgeable do you consider yourself to be as an investor?

❍ Very knowledgeable ❍ Relatively Knowledgeable ❍ Somewhat knowledgeable ❍ Less than knowledgeable ❍ Not at all knowledgeable

Q 1.2 I am experienced with investing in financial instruments in for example stocks and bonds.

❍ Strongly Disagree ❍ Disagree ❍ Neither Agree or Disagree ❍ Agree ❍ Strongly Agree

Q 1.3 How risky would you rate the following investments? (Note there is no wrong or right!)

	Very little risk	Little risk	Medium risk	High risk	Very high risk	Don't know
Equity Mutual Fund	❍	❍	❍	❍	❍	❍
Stock	❍	❍	❍	❍	❍	❍

Q 1.4 How many years of working experience do you have? Include full- or part-time experience, internship, co-op, summer jobs etc.?

If you have experience, than you can continue to question 1.4A and 1.4B below , otherwise you can skip them, and go to the next part.

❍ None ❍ Less than 2 years ❍ Two to less than 4 years ❍ Four to less than 6 years ❍ Six years or more

Q 1.4 A Have you worked full-time?

❍ No ❍ Yes

Q 1.4B Was a part of this working experience in the financial industry?

❍ No ❍ Yes

Part 2: The investment decision: Sheet A to D are added for this part

- You will have to invest a (fictive) amount of US $10 000 in up to 3 different mutual funds.
- The investment horizon is one month, from May 15th till June 14th 2012
- **You can use all information from sheet A to D, which comes from the different fund's prospectuses and is checked by financial authorities**
- A lottery will be held to pick 2 participant who will receive the net return of their personal investment (with a max. of 100 dollar for each participant)
    - **Net return= return on the investment during one month – cost of the investment**

Rules:

- You can freely divide the $10 000 between the funds
- Investing in only one fund is allowed, it is your own choice
- Negative investment amounts are not allowed
- All the money has to be spend; the sum of the investments needs to be US 10 000

Q2.1 So how would you divide the $10,000 among the three funds?

Mutual Fund	Your allocation in dollars
Invesco S&P 500 Index Fund	
Ishares S&P 500 Index Fund	
Vanguard S&P 500 Index Fund	

Total must be 10 000

Q 2.2 How risky would you rate the different investment options

	Very little risk	Little risk	Medium risk	High risk	Very high risk
Invesco S&P 500 Index Fund	❍	❍	❍	❍	❍
Ishares S&P 500 Index Fund	❍	❍	❍	❍	❍
Vanguard S&P 500 Index Fund	❍	❍	❍	❍	❍

Q 2.3 How risky do you rate the total investment which you just made?

❍ Very little risk ❍ Little risk ❍ Medium risk ❍ High risk ❍ Very high risk

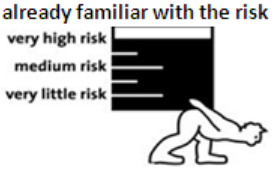
Q 2.4 I had enough information to form an opinion about the risk

❍ Strongly Disagree ❍ Disagree ❍ Neither Disagree nor Agree ❍ Agree ❍ Strongly Agree

Q 2.5 Earlier you were asked to allocate $10 000 among three different mutual funds.
How important were the following factors in shaping your final investment decision.

	Not important at all	Only slightly important	Somewhat important	Quite important	Very important
Quality of prospectus	❍	❍	❍	❍	❍
Brand recognition	❍	❍	❍	❍	❍
Past experience with fund companies	❍	❍	❍	❍	❍
Fund fees, expenses and loads	❍	❍	❍	❍	❍
Past performance	❍	❍	❍	❍	❍
Customer service of fund	❍	❍	❍	❍	❍
Desire to diversify across funds	❍	❍	❍	❍	❍
The expected return analysis	❍	❍	❍	❍	❍
The risk indicator	❍	❍	❍	❍	❍

Q 2.6 Were you already familiar with the risk indicator (example below)?

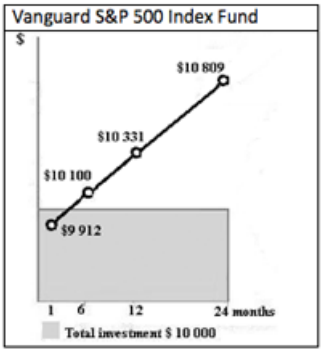


❍ No ❍ Yes ❍ Don't know

Q 2.7 The meaning of the risk indicator (example above), was clear to me

❍ Strongly Disagree ❍ Disagree ❍ Neither Agree nor Disagree ❍ Agree ❍ Strongly Agree

Q 2.8 The meaning of the expected return analysis (example below) was clear to me



❍ Strongly Disagree ❍ Disagree ❍ Neither Agree nor Disagree ❍ Agree ❍ Strongly Agree

Part 3: The debriefing questions

Q 3.1 How likely is it that you would change your decision if you consulted a professional investment advisor?

○ Not likely ○ Somewhat likely ○ Very likely

Q 3.2 In general the amount of information provided was enough to make the investment decision

○ Strongly Disagree ○ Disagree ○ Neither Agree nor Disagree ○ Agree ○ Strongly Agree

Q 3.3 It was difficult to comprehend all of the information available to me

○ Strongly Disagree ○ Disagree ○ Neither Agree nor Disagree ○ Agree ○ Strongly Agree

Q 3.4 When an investor spreads his money among different assets, what happens to the risk of losing money?

○ Increase ○ Stays the same
○ Decrease ○ Don't know

Q 3.5 How confident are you that the investment decision you made is the right one for you?

○ Not at all confident ○ Less than confident ○ Somewhat confident ○ Relatively confident ○ Very confident

Q 3.6 The investment task took me a lot of time

○ Strongly Disagree ○ Disagree ○ Neither Agree nor Disagree ○ Agree ○ Strongly Agree

Q 3.7 What types of securities do you find in a money market fund? (Multiple answers are possible)

☐ Short term government bonds ☐ None of the above
☐ Corporate bonds ☐ Don't know
☐ Stocks

Q 3.8 A stock fund's beta rating can best be described as a

○ Measure of relative volatility of the fund vs. S&P 500 index
○ Measure of relatively growth vs. the S&P index
○ A measure of the relative capital outflow of the fund vs. the S&P 500 Index
○ I don't know.

Q 3.9 My English was not a problem when making this survey

○ Strongly Disagree ○ Disagree ○ Neither Agree nor Disagree ○ Agree ○ Strongly Agree

Q 3.10 Suppose you are the only income earner in your family. Your doctor recommends you to move, because of certain allergies. You have to choose between 2 possible jobs.

○ 100% chance that the job pays your current income for life. Go to question A, and do not answer question B, and continue the survey.
○ 50% chance that the job pays twice your current income for life and 50% chance that the job pays 2/3 your current income for life. Go to question B, and skip question A and continue the survey.

Q3.10 A: Which job would you choose if the choices were instead

○ 50% chance that the job pays twice your current income for life and 50% chance that the job pays 4/5 of your current income for life
○ 100% chance that the job pays your current income for life

Q 3.10 B: Which job would you choose if the choices were instead

○ 50% chance that the job pays twice your current income for life and 50% chance that the job pays 1/2 your current income for life
○ 100% chance that the job pays your current income for life

Part 4: Personal characteristics

Q4.1 Age_____

Q 4.2 Gender

- ❍ Male
- ❍ Female

Q 4.3 Ethnicity

- ❍ White
- ❍ African descent
- ❍ Hispanic
- ❍ Asian
- ❍ Middle-Eastern
- ❍ Other _____
- ❍ Private

Q4.4 Country of birth

- ❍ The Netherlands
- ❍ Belgium
- ❍ South-Africa
- ❍ United States
- ❍ China
- ❍ Turkey
- ❍ Other _____

Q 4.5 What is your highest level of education (finished)?

- ❍ High school
- ❍ First year of college
- ❍ Second year of college
- ❍ Third year of college (earned a bachelor degree)
- ❍ College graduate (earned a master degree)

Q 4.6 What is your study/ major? (choose one which is closest to your study/ major)

- ❍ Finance
- ❍ Econometrics
- ❍ Financial planner
- ❍ Economics
- ❍ Business studies
- ❍ Science/ engineering
- ❍ Other

LAST question:

Like mentioned a lottery will be hold among the participants to give away the return on your investment. For that we need your email address. Note that we don't use this for advertising purposes and together with the results it will be held confidentially. Thank you for your cooperation, and if you have filled in your email address we will contact you if you have won a price.

Email address_____

Sheet A: Summary information:

Option 1: Invesco S&P 500 Index Fund

Expenses, fees and charges:

Sales charge (paid directly from your starting investment)	5,50%
Redemption fee (paid from your investment if you sell)	0%
Annual fees (paid every year)	0,60%

Principal Risks:

Equity Risk; The risk because the Fund invests in stocks. Stocks can fluctuate in response to firm specific, market, economic and political conditions

Index risk: The Fund operates as a passively managed index fund. Funds ability to correlate it's performance with the index can be affected by timing, cash flows and the valuation of the fund and index.

Management risk. The investment techniques and risk analysis used by the Fund's portfolio manager may not produce the desired result.

Option 2: Ishares S&P 500 Index Fund

Expenses, fees and charges:

Sales charge (paid directly from your starting investment)	3,00%
Redemption fee (paid from your investment if you sell)	2,00%
Annual fees (paid every year)	0,09%

Principal risks:

Asset Class Risk: Securities in the underlying index or in the Funds's portfolio may underperform in comparison to the general security market.

Market Risk: The Fund could lose money over short periods due to market movements or over longer periods due to market downturns.

Passive Investment Risk: The Fund isn't actively managed and doesn't take defensive positions under any market conditions.

Tracking error risk: The performance of the Fund may diverge from that of the underlying Index.

Option 3: Vanguard S&P 500 Index fund

Expenses, fees and charges:

Sales charge (paid directly from your starting investment)	1,25%
Redemption fee (paid from your investment if you sell)	1,25%
Annual fees (paid every year)	0,17%+$20*

*The $20 is a fixed amount which is yearly deducted from the investment.

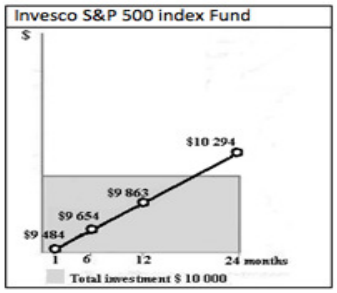
Principal risks:

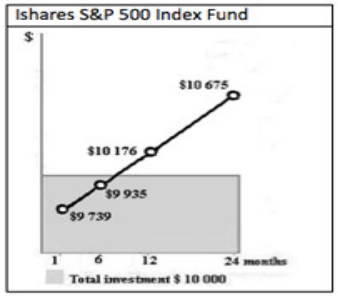
Stock market risk: Risk that overall stock prices will decline. Stock markets tend to move in cyclus, with cycles of rising or falling prices. Furthermore can the index become focused in a particular sector, and as the Fund tracks the index, this can result in underperformance compared to the overall stock market.

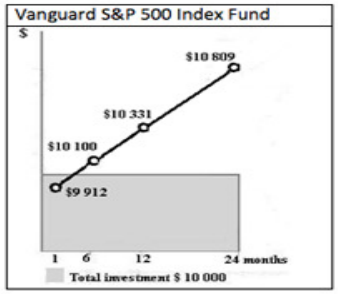
Investment style risk: The risk that large-capitalization stocks don't trail the overall stock market. Large cap stocks tend to go through cycles of doing better or worse than the stock market in general.

Sheet B: Expected return analysis

- The pictures below indicate the expected value of the different funds among different time horizons (in months), incorporating expected returns minus the cost of investing and holding the specific fund
- The maximum possible investment amount is used, and the grey background indicates this initial investment amount.

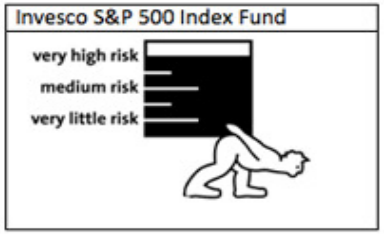


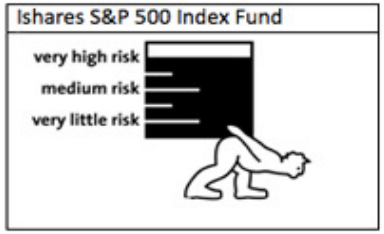


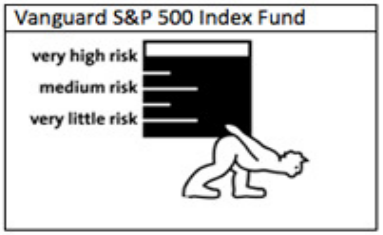


Sheet C: Risk level indicator

The 5-point indicator shows the overall risk for each fund. This is checked by financial authorities







Sheet D: Returns summary

The average annual returns since the start of each fund(so since inception), holding fees are already subtracted

Mutual Fund	Average annual return * (since inception date)	Inception date
Invesco S&P 500 Index Fund	7,47%	1-1-2003
Ishares S&P 500 Index Fund	5,43%	1-1-2004
Vanguard S&P 500 Index Fund	2,35%	1-1-2005

*Yearly returns are calculated from inception date till 31-12-2011

Past performance is no guarantee for future results