Journal of Behavioral and Experimental Finance 15 (2017) 38–51

Contents lists available at ScienceDirect

Journal of Behavioral and Experimental Finance

journal homepage: www.elsevier.com/locate/jbef

Past performance framing and investors' belief updating: Is seeing long-term returns always associated with smaller belief updates?

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HIGHLIGHTS

- Exposes subjects to different return information horizons and measures belief updates.
- Tests whether longer information horizons are associated with smaller updates in beliefs.
- Different from previous studies, experimental subjects can easily opt out of their default.
- Effectiveness of longer information horizons depends on whether subjects opt out of default.

ARTICLE INFO

Article history:
Received 22 March 2017
Accepted 12 July 2017
Available online 20 July 2017

JEL classification:
D14
D81
D83
D84
G02
G21

Keywords:
Default options
Framing
Household finance
Investor beliefs
Belief updating

ABSTRACT

Prior research shows that investors with smaller belief updates trade less actively, which positively affects their return performance. We examine the effect of different default frames of presenting past return information on investors' belief updating. In particular, we analyze whether presenting longer information horizons as a default is associated with smaller belief updates. In lab and online experiments, we expose subjects to different past return information defaults and measure updates in their beliefs. Different from previous research, our subjects can easily opt out of the default to obtain additional information. We find that presenting long-term return information is not effective in reducing belief updates on average. Whereas belief updates are reduced for subjects who remain in their default, for those who opt out, we observe the opposite.

1. Introduction

Prior research shows that updates in individual investors' beliefs, such as return expectations and risk perceptions, drive their investment decisions (Hoffmann et al., 2013). When updating their beliefs, individual investors often extrapolate past return experiences (Dominitz and Manski, 2011; Greenwood and Shleifer, 2014). In this paper, we examine how framing of past performance information affects individual investors' belief updating. In particular, we analyze whether presenting longer information horizons as a default option leads to smaller updates in investors' beliefs. Because smaller belief updates are associated with less active trading, effective framing of past performance information would have the capacity to positively affect investors' return performance (Barber and Odean, 2000; Hoffmann and Post, 2016). We find that the effectiveness of showing long-term returns on reducing updates in beliefs depends on whether investors can easily opt out of their assigned default or not.

Our paper builds on previous work that examines how different evaluation and/or reporting frequencies as well as information horizons influence individual investors' decision-making, such as Benartzi and Thaler (1995), Gneezy and Potters (1997), Fellner and Sutter (2009), Beshears et al. (2017), and Shaton (2015). These

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http://dx.doi.org/10.1016/j.jbef.2017.07.007
2214-6350/

other studies typically recommend longer evaluation and information horizons to improve individual investor decision-making in terms of overcoming myopic loss aversion, making fund flows less sensitive to past returns, or reducing trading volume. An important distinction of our paper compared to previous work is that we focus on the effect of different information horizon defaults on belief updates when investors have access to additional information. Prior studies analyze interventions which restrict access to information and make it cumbersome or even impossible for subjects to opt out of the default. Our setting more closely resembles individual investors' actual decision-making environment where individuals have immediate access to alternative information horizons and can easily opt out of the default.

We perform two experiments, one in the lab and one online, in which we place subjects in a situation resembling an online brokerage environment. We present them with a stock portfolio to assess their belief updates over six evaluation rounds. Subjects receive portfolio performance information after each round. Subjects are randomly assigned to three experimental conditions, which differ regarding the default information horizon that is shown to them (i.e., annual, monthly, daily). For each subject, this default information horizon is held constant over subsequent rounds of the experiment. We conduct our first experiment in a controlled laboratory environment. The lab experiment focuses on the effect of varying the default information horizon. Subjects can easily opt out of the default and obtain past performance information on each of the three information horizons in each round. To test the generalizability of our laboratory results to situations outside the lab and compare with past studies that restrict subjects' opportunity to view alternative information horizons, we conduct a second experiment online. This experiment includes both an exact replication of the original laboratory experiment, as well as an alternative version of the experiment in which subjects cannot opt out of the default and have to stay in the assigned default information horizon, consistent with previous studies on the effect of restrictive interventions by Beshears et al. (2017) and Shaton (2015).

We find that in the restrictive version of our experiment, a longer past return horizon reduces belief updating of subjects. In the non-restrictive version of our experiment, when subjects are able to opt out of the default they are assigned to, varying the default does not, on average, impact the magnitude of belief updating. However, an important result emerges when comparing subjects staying in the default versus those opting out of the default (about half of the subjects opt out of the default). Specifically, similar to the results for the restrictive version, subjects who stay in the default option reduce the magnitude of their belief updating when being shown returns over a longer information horizon. We find the opposite result for subjects opting out of the default. For subjects originally assigned to the longer information horizon, opting out presents them with returns over a *shorter* horizon, which are consequently associated with *larger* updates in their beliefs.

2. Related literature and predictions

We align and build on two streams of literature. The first stream of literature analyzes various interventions on the return information that investors receive and their impact on investor decision making. Most interventions address myopic loss aversion by manipulating the frequency by which investors either receive information or the investment horizon for which investors have to commit in advance. Benartzi and Thaler (1995) show that investors who evaluate their investment portfolios more frequently are less willing to invest in risky securities. Gneezy and Potters (1997) experimentally evaluate myopic loss aversion and show that a longer evaluation period puts subjects in a broader frame, which leads to increased risk-taking. They restrict the choices of their subjects by not allowing them to switch between evaluation frequencies. When subjects are allowed to choose the evaluation frequency, however, they display a preference for frequent feedback (Charness and Gneezy, 2010). Related, Fellner and Sutter (2009) find that longer investment horizons and less frequent feedback are associated with less myopic loss aversion. However, when given the choice, subjects prefer on average shorter investment horizons and more frequent feedback. Beshears et al. (2017) address myopic loss aversion using a field experiment in which subjects invest in mutual funds. They modify the degree of information given to subjects and observe the resulting equity allocation in a self-managed portfolio. Their results show that, in contrast to not providing any graphical past return information, presenting a graph of historical returns significantly increases the share of wealth allocated to equities. Looney and Hardin (2009) analyze default options for 401k retirement accounts. They employ simulations of retirement investments and investigate the effect of different information horizons, by modifying the horizon on which average historical stock-market performance information is provided to investors. Their results show that longer information horizons reduce conservatism in retirement portfolios. Looney and Hardin (2009) also impose restrictions on subjects' choices. The work closest to ours in terms of the intervention studied is Shaton (2015). She analyzes the impact of a regulatory change in Israel requiring retirement funds to report performance using at least a 12-month time horizon for past returns (whereas, previously, the default was one month). After this regulatory intervention was implemented, fund flows were less sensitive to past returns, investors reduced their trading volume, and they invested more in riskier funds. As the regulation applied to a broad range of information outlets, past return information on shorter horizons was, however, virtually no longer available to investors. Our experimental manipulation differs, in that investors can access the shorter-term return information horizons as well.

The second stream of literature that we build on analyzes how investor belief updating impacts trading decisions. In general, investors have a tendency to trade frequently, and because of that earn lower returns (Barber and Odean, 2000). Hoffmann et al. (2013) and Hoffmann and Post (2016) show that frequent trading can be traced back to investors' belief updating. These authors find that investors change their assessment of expected returns and risk frequently and by large amounts. Moreover, they find that larger updates in beliefs induce more trading, resulting in lower returns. Thus, for a typical individual investor, frequent and large updating of beliefs does not seem to be consistent with a normatively rational strategy. Investors update beliefs by using simple heuristics. In particular, beliefs are formed and updated by extrapolating past returns (Dominitz and Manski, 2011; Greenwood and Shleifer, 2014). Experiencing positive returns makes investors more optimistic about future returns (and vice versa) and larger return experiences are associated with larger belief updates.

In our paper, we reconcile the literature on framing and defaults regarding past return information horizons with the literature on belief updating induced trading. That is, we implement an intervention that is aligned to investors' tendency to update beliefs by extrapolating past returns and at the same time is feasible to implement. Prior studies have restricted subjects' access to return information. Doing so is an intervention that may often not be possible to mandate. A milder and easier to implement intervention is setting a default for the past return information shown, but not restricting access to different information. However, it is unclear whether previous results generalize to settings where subjects can easily opt out of a default. In consequence, we investigate how different default information horizons affect belief updating in a setting which is more ecologically valid. In a brokerage account, investors usually get to see some overview table of portfolio summary statistics. They have the ability to view their portfolio performance for different time periods, such as the last day, month, or year. Brokers generally decide which time horizon to present as the default. Different performance horizons are available with a few mouse clicks. One version of our experiment restricts choices regarding the default and measures the resulting belief updates. Another version sets a default for the information presented first, but does not restrict subjects' access to additional information.

We expect that presenting longer portfolio evaluation horizons has a mitigating effect on individual investors' belief updating, at least when placing investors in a situation that restricts their choices by not allowing them to opt out of the default presentation format to view additional information on other return horizons. As returns appear less volatile in the longer-term, we expect subjects who are presented with portfolio performance over a longer information horizon to update their return expectations and risk perceptions less between the various evaluation rounds when compared to subjects who are presented with a shorter information horizon. When we introduce the opportunity to opt out of the default presentation format, we expect a different pattern. We expect the exact same pattern just described for subjects who remain in the default option and do not opt out. These subjects face the same scenario as those who were not given the choice to opt out of the default. In contrast, we expect the opposite pattern for subjects who opt out of the default. Subjects who opt out of the default are initially presented with a longer information horizon, but they retrieve additional information on a shorter return horizon when they opt out of the default, and vice versa. As argued above, returns over a shorter horizon appear more volatile and hence, subjects are expected to display an increase in belief updating when opting out of the default. On the contrary, if subjects are initially presented with a short return horizon and decide to opt out (thus viewing information on a longer horizon, which appears more stable), doing so will likely reduce belief updating.

3. Study 1

3.1. Experimental design

Our experimental setup resembles an online brokerage environment. We present subjects with the performance of a stock portfolio and analyze the updating of their beliefs (return expectations and risk perceptions) over six evaluation rounds. The experiment is conducted in a laboratory setting and is designed in a way that all subjects are able to opt out of the default. Before the first round, we randomly allocate subjects to one of three treatments. Over all six rounds, subjects stay in the same treatment. The treatments differ in their default information horizon regarding past portfolio performance. Specifically, each subject will either see the last day's return, the last month's return, or the last year's return of their portfolio as a default, together with the Euro-values of their holdings. This scenario is ecologically valid, as online brokerage interfaces and the periodical brokerage statements that banks send to investors, often summarize portfolio performance for individual securities on an aggregate level and across different time frames.

We recruit subjects from a pool of business students enrolled at a medium-sized European university who complete the experiment in exchange for partial course credit.[1] Before signing up, we informed subjects that the experiment would be about decision-making behavior. At the start of the experiment, subjects were seated in a cubicle equipped with a computer and were instructed not to interact with each other. If a problem came up or any instructions were unclear, subjects were instructed to remain seated, raise their hand, and wait for the assistance of a proctor. Completion of the experiment took seven minutes on average. In total, 339 subjects completed the experiment. One hundred-and-fourteen subjects (33.63%) were assigned to the daily condition, 113 subjects (33.33%) to the monthly condition, and 112 subjects (33.04%) to the yearly condition.

At the beginning of the experiment, subjects read an introductory text explaining that in the upcoming tasks they would be presented with a stock portfolio that they should imagine to be theirs. They were informed that they would be asked a series of questions about their beliefs and then shown their stock portfolio again. Subjects were instructed to assume that for each evaluation round, one month had passed since their last stock portfolio evaluation. To prevent subjects' beliefs being influenced by unobservable affective evaluation beyond mere financial returns (cf. Aspara and Tikkanen, 2010, 2011), the portfolio presentations do not contain any information about which individual stocks are contained in the portfolio. Likewise, returns are, regardless of their sign, presented in black font to avoid any impact on belief updates through displaying, for example, positive returns in green font and negative returns in red font (see e.g., Bazley et al., 2016). To rule out any possible identification effects in return patterns presented to subjects, we generate portfolio performance by simulating a random draw from a return distribution which mimics the first two moments of the Standard & Poor's 500 stock-market index over the 10-year period preceding the experiment (i.e., daily mean return of 0.03%, daily standard deviation of 1.26%).

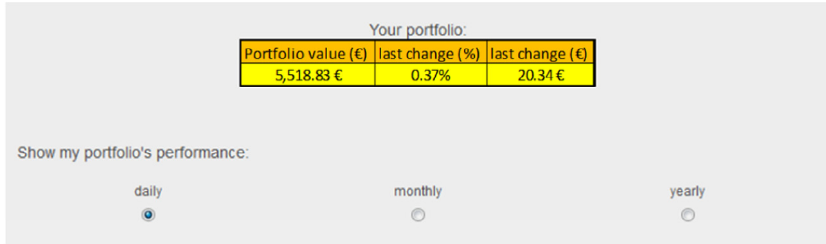
We present portfolio performance information to subjects in a table (Fig. 1) indicating the total portfolio value in Euro, the last percentage change, as well as the last Euro change. This reflects a "typical" online brokerage interface where investors are able to see an overview table with summary statistics related to their portfolio when accessing their account. A real-world example is given in Fig. 2.

We focus on an overview table which is easier to comprehend since it is reduced to the most important information. In our setup, the initial information horizon of the "last" percentage and Euro change in portfolio value refers to a subject's respective experimental treatment group. Thus, each subject gets to see performance of either the last day, last month, or last year. Percentage changes shown reflect the relative change in value of the portfolio within the respective information horizon, that is, they are not scaled to the same terms (e.g., annual). Within one round of the experiment, the returns shown to subjects within each information horizon (i.e., daily, monthly, yearly) are the same across subjects. Even though displaying benchmark returns is required for the prospectus of certain financial products, such as mutual funds, online brokers typically do not add benchmark returns for comparison purposes on an overview page of their client's portfolio. Hence, we also decide to not display any benchmark returns.

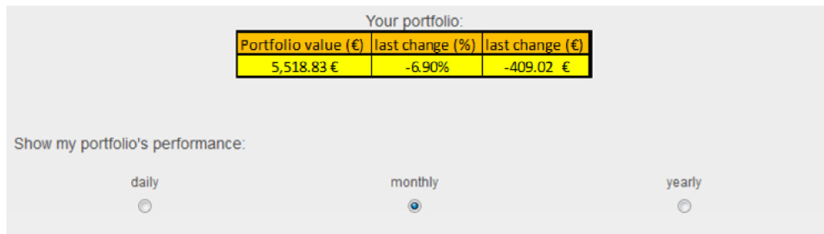
Below the table summarizing the portfolio, subjects see three radio buttons enabling an easy switch between the three different information horizons. Upon clicking on one of the buttons, the table provides return information about the corresponding horizon. We track subjects who opt out of the default. We also monitor the information horizon last viewed by each subject.

Below the table summarizing portfolio performance, we ask each subject to respond to two statements adapted from previous research measuring investor beliefs by Hoffmann et al. (2013). These belief measures predict trading behavior and have been shown to be reliable and cross-validated measures of a subject's return expectations and risk perceptions. Hoffmann and Post (2016)

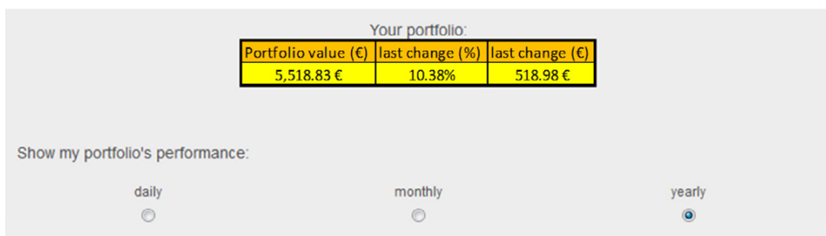
[1] On purpose, subjects are not incentivized based on performance. Whether returns follow, for example, a random walk, exhibit momentum or mean reversion is up to debate. Therefore, there is no clear objective answer to what would constitute a right or wrong belief update.



(a) Daily information horizon.



(b) Monthly information horizon.



(c) Yearly information horizon.

Fig. 1. Examples of returns presented in different treatments.

use brokerage account data of actual individual investors to show that higher absolute updates in these beliefs lead to higher portfolio turnover. The first statement measures subjects' return expectations and asks how much a subject agrees with the following statement: "I expect my investment portfolio to have good returns next month". We measure risk perceptions by the second statement: "I consider investing to be risky next month". Answers are recorded on a seven-point Likert scale, anchored at 1 ="totally disagree" and 7 ="totally agree".[2]

After each subject answers the statements measuring beliefs, that particular round of the experiment is complete and the subject will move on to the next round. Each subsequent round represents a one-month time lapse from the previous round. Subjects are again presented with the same screen with an overview table, radio buttons, and the statements measuring beliefs. The only difference from the previous round is that the corresponding returns and portfolio values are updated based on the monthly returns data. This procedure is repeated six times until we have elicited six subsequent beliefs in terms of return expectations and risk perceptions.

Once subjects finished the six rounds, further questions and scales are administered. We measure risk aversion with a single-item question from Dohmen et al. (2011). To measure financial literacy and the degree of a subject's financial sophistication, we use eight questions. A correct answer to each question counts as one point on a financial literacy scale. We use three basic financial literacy questions from Lusardi and Mitchell (2007a, b). Because the subjects in our lab experiment are business students and we expect them to uniformly score high on basic financial literacy, we also include five advanced financial literacy questions from the list

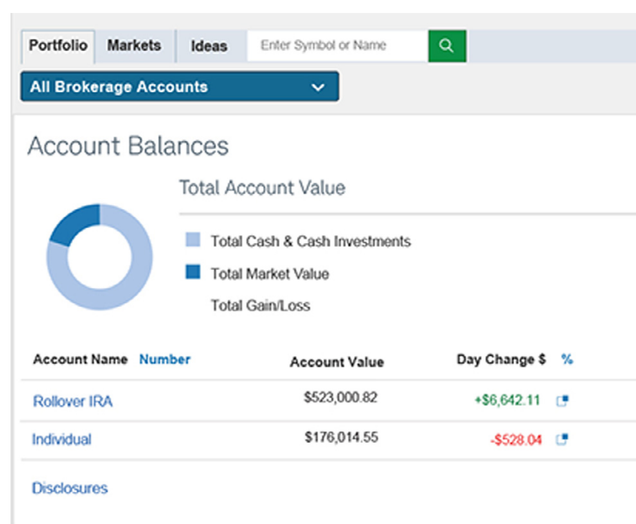


Fig. 2. Example of a typical brokerage interface. Notes: This figure presents a screenshot from the Internet advertisement materials of a leading US online brokerage service provider.

2 As we are interested in within-subject changes in belief updates (i.e., changes in beliefs from one evaluation round to the other) we do not need to define what constitutes a "good return" or what is "risky". Each subject will have their own reference points in mind when participating in the experiment and as long as this reference point is stable during the experiment, we can consistently analyze changes in beliefs in our experimental setting.

Table 1
Question wordings.

Variable	Definition
Age	Age in years
Gender	Indicator variable: 1 = subject being female, 0 = otherwise
Financial literacy	Aggregate financial literacy score ranging from 0 to 8, based on the number of correctly answered questions
Basic financial literacy	Aggregate basic financial literacy score based on three basic questions from Lusardi and Mitchell (2011)
1	Suppose you had 100€ in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? [More than 102€] [Exactly 102€] [Less than 102€] [Do not know] [Refuse to answer]
2	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? [More than today] [Exactly the same] [Less than today] [Do not know] [Refuse to answer]
3	Please tell me whether this statement is true or false. 'Buying a single stock usually provides a safer return than a stock mutual fund'. [True] [False] [Do not know] [Refuse to answer].
Advanced financial literacy	Aggregate advanced financial literacy score based on five advanced question from Van Rooij et al. (2011)
1	Which of the following statements is correct? If somebody buys the stock of firm B in the stock market: [He owns part of form B] [He has lent money to firm B] [He is liable for B's debts] [None of the above] [Don't know]
2	Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return? [Savings accounts] [Bonds] [Stocks] [Don't know]
3	Normally, which asset displays the highest fluctuations over time? [Savings accounts] [Bonds] [Stocks] [Don't know]
4	When an investor spreads his money across different assets, the risk of losing money: [Increases] [Decreases] [Stays the same] [Don't know]
5	If the interest rate falls, what should happen to bond prices? [Rise] [Fall] [Stay the same] [None of the above] [Don't know]
Risk aversion	Risk aversion based on response to the following question: "Are you generally a person who is willing to take risk or do you try to avoid taking risks?" 1 = completely unwilling to take risks … 11 = fully prepared to take risks (Dohmen et al., 2011)
Click	Indicator variable: 1 = subject expressed beliefs in different treatment than default, 0 = otherwise
Time	Time needed to complete experiment (in minutes)
Nationality	Dummy variables taking the value 1 if subject's nationality is either Dutch, German, or another nationality ("Other")
Treatment	Subject's randomly assigned treatment group (daily, monthly, or yearly) (determines default return horizon presented)
Return Expectation	Return expectation, based on the statement "I expect my investment portfolio to have good returns next month". (1 = totally disagree …7 = totally agree) (adopted from Hoffmann et al., 2013)
Risk Perception	Risk Perception, based on the statement "I consider investing to be risky next month". (1 = totally disagree …7 = totally agree) (adapted from Hoffmann et al., 2013)
Returns	Portfolio returns

Notes: This table presents variable definitions and an overview of the questions posed to subjects. Possible answers to multiple choice questions are shown in brackets, the correct answer is underlined.

of Van Rooij et al. (2011). Finally, we ask subjects to indicate their age, gender, and nationality.

3.2. Descriptive statistics and data quality

Table 1 defines all variables used in our analyses. Table 2 provides summary statistics. The mean age of subjects is 22.1 years. The mean financial literacy score is 6.15 out of a maximum of 8 points. Fifty-two percent of subjects opt out of the default return information horizon and click to view a different return information horizon. The three treatment groups do not differ significantly regarding age, gender, or financial literacy, indicating that the random allocation of subjects to the different experimental conditions was successful.

To confirm the ecological validity of our experiment, we verify whether the experimental subjects behave similarly to actual individual investors who tend to update their beliefs by extrapolating past returns (Dominitz and Manski, 2011; Greenwood and Shleifer, 2014). Table 3 summarizes random-effects panel regressions using belief updates as dependent variables. Belief updates are defined as the difference between beliefs expressed in one round and the previous round of the experiment. In model 1, the dependent variable is updates in return expectations, in model 2 updates in risk perceptions are the dependent variable. According to model 1, returns have a strong and significant positive effect on updates of return expectations. Higher past returns lead to increased expectations about future returns. Thus, our experimental results are consistent with real investor behavior. Subjects update their beliefs by extrapolating past returns.

Model 2 shows that returns are significantly negatively related to updates in risk perceptions. Thus, a stock portfolio is regarded as less risky if returns were higher in the preceding round. This finding is consistent with the stylized fact that individuals implicitly assume a negative risk–return relationship (Fischhoff et al., 1978; Ganzach, 2000; Shefrin, 2001), which defies standard economic theory, but is consistent with reliance on affect and the representativeness heuristic.

Fig. 3 plots subjects' beliefs for each experimental version over the different evaluation rounds of the experiment. Return expectations are shown in the left panel and risk perceptions in the right panel. Each panel contains a separate graph for the different default information horizons. Each graph plots the returns specific to each treatment group. The positive association between past returns and updates of return expectations can be seen in the left panel, whereas the negative relationship between past returns and risk perceptions is visible in the right panel. Overall, the experimental subjects behave in line with previously reported findings on individual investors' belief updating (Hoffmann et al., 2013).

3.3. Results

3.3.1. Belief updating across treatments

Panel A of Fig. 4 highlights differences in belief updating for the entire sample across treatments. We use absolute changes in beliefs as the dependent variable of interest, as both positive and negative belief updates provide reason to trade and have been shown to predict portfolio turnover in samples of actual investors (Hoffmann and Post, 2016). That is, belief updates are defined as the absolute value of the difference between the beliefs expressed in one evaluation round compared to the previous round. The graph on the left refers to updates in subjects' return expectations, the one on the right depicts updates in their risk perceptions.

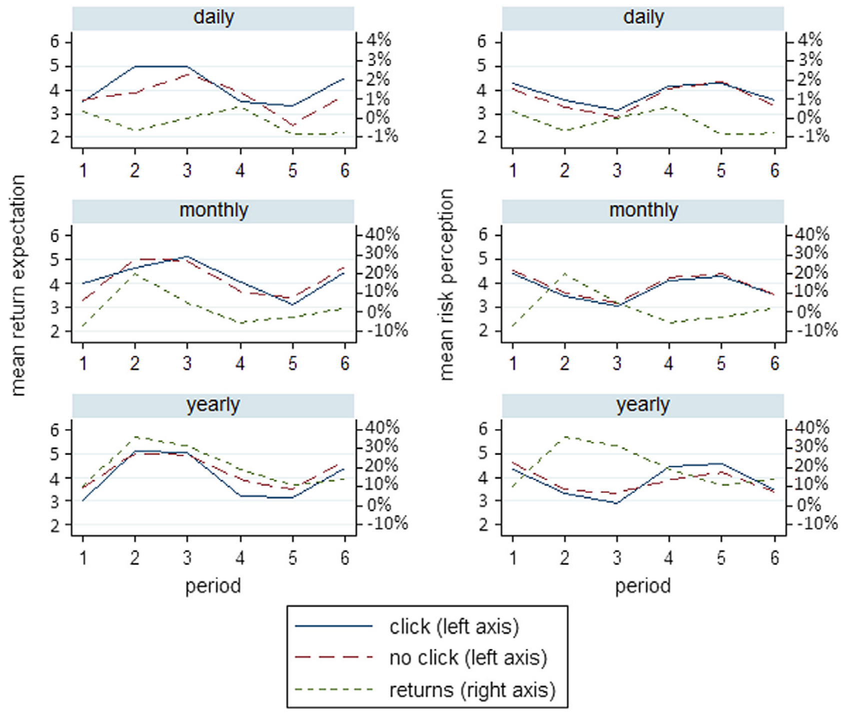


Fig. 3. Study 1: Return expectations and risk perceptions. Notes: This figure presents subjects' beliefs over the six experimental rounds. The left panel presents mean return expectations and the right panel shows mean risk perception. "Click" and "no click" refers to subjects who did or did not opt out of the default information horizon, respectively. Returns shown for each treatment in each round are summarized on the right-hand scale.

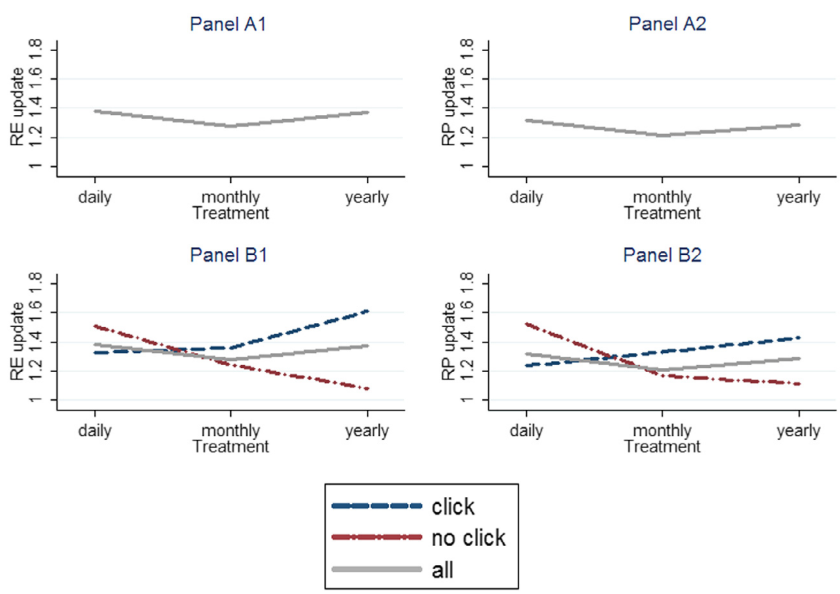


Fig. 4. Study 1: Belief updating across treatments. Notes: This figure presents subjects' belief updating based on the three treatment groups. Analysis is based on subjects who completed the experiment in a laboratory environment. The graphs on the left summarize updates in return expectations ("RE"), whereas the graphs on the right show updates in risk perceptions ("RP"). Updates are calculated as the absolute difference between expressed beliefs and their counterpart from the previous evaluation round, leaving the figure to be an average of five individual assessments of belief updating. The three lines correspond to the group of all subjects as well as splitting them up based on whether they decided to opt out of the default in any given round ("click") or not ("no click").

As Fig. 4 (Panel A) illustrates, differences between treatment groups for updates in return expectations and risk perceptions are very small across all experimental subjects (i.e., including those that opt out of the default information horizon and those that do not opt out). The monthly treatment group appears to express slightly lower belief updates than the daily and yearly groups. However, this difference is insignificant. Table 4 shows statistics on belief updating across treatments. Panels A1 and B1 summarize belief updating in terms of mean absolute changes in return expectations (Panel A1) and risk perceptions (Panel B1), respectively. The first two columns give an overview of the treatment groups and their respective sizes. The third column provides mean values for the entire sample and confirms that differences between treatments are very small. This finding illustrates that belief updating is not different when comparing the treatment groups across all experimental subjects. As an alternative measure of belief updating, Panels A2 and B2 contain the within-subject standard deviation

Table 2
Study 1: Summary statistics.

Variable	Mean	Fraction	Std	Median
Age	22.1		2.71	23
Gender	0.42			
Financial literacy	6.15		1.66	7
Basic financial literacy	2.61		0.65	3
1		97%		
2		89%		
3		75%		
Advanced financial literacy	3.54		1.23	3
1		84%		
2		56%		
3		84%		
4		88%		
5		42%		
Risk aversion	6.59		2.28	7
Click		52%	0.38	0.5
Time	6.9		1.77	7
Nationality				
Dutch		32%		
German		43%		
Other		24%		
Treatment				
Daily		34%		
Monthly		33%		
Yearly		33%		
Return Expectation	4.13		1.49	4
Risk Perception	3.83		1.49	4
N		339		

Notes: This table presents summary statistics of selected key questions from Study 1. Standard deviation is abbreviated by "std". Percentages correspond to the fraction of correct answers for financial literacy questions and to the fraction of respondents who select a certain answer or belong to a certain group (for click, nationality and treatment).

of belief updating. The results using this measure are in line with mean absolute changes, which indicates that our results are robust to alternative measures.

Extending previous literature on default information horizons, we find that the default displayed for past return information has, on average, no effect on investor belief updating when opting out is easy. Next, we analyze if opting out of the default impacts a subject's belief updating. Besides the treatment itself, belief updating might be influenced by whether subjects remain in the default or opt out to see another information horizon.

3.3.2. Opting out of the default information horizon and belief updating

The bottom panel of Fig. 4 plots subjects' belief updates based on whether or not they decide to opt out of the default information horizon. For both return expectations and risk perceptions, a new result emerges. First, belief updating for subjects who opted out of the default information horizon is positively associated with the length of the information horizon. For the yearly group, belief updates are larger than for the monthly group, which are again larger than for the daily group. That is, opting out of the default treatment increases updates of return expectations for the yearly group as compared to the monthly and daily group. Second, when looking at subjects who did not opt out of the default information horizon, the pattern reverses. For those staying in the default, there is a negative relation between belief updating and length of information horizon. That is, subjects in the yearly treatment update their beliefs less than those in the shorter information horizon treatments. All these differences, summarized in Table 4, columns (4)–(8), are statistically significant. Column (4) contains values for subjects who opted out of the default ("click"), Column (5) presents the corresponding values for those who did not opt out ("no click"). Columns (6)–(8) show the difference in means between columns (4) and (5) as well as the t-statistic and p-value.

We find a mitigating effect of a longer information horizon on the magnitude of belief updating for subjects who remain in their default information horizon. Subjects who do not opt out of their default, update their return expectations by 0.43 points less on the 1–7 return expectations scale when shown yearly versus daily returns for their stock portfolio. This decrease corresponds to slightly less than a one-third smaller update of return expectations. The effect reverses for subjects who do not stay in their default information horizon. For these subjects, being originally assigned to a default information horizon presenting yearly returns and subsequently viewing different return horizons increases return expectations by 0.28 points or one-fifth, as compared to those subjects who opted out of the shortest (daily) horizon. Whereas opting out of the default reduces belief updating for subjects assigned to the daily treatment by 0.18 points ($t = 2.63$, $p < 0.01$), belief updating is increased by 0.53 points for those subjects who opted out of the yearly information horizon default condition ($t = 9.22$, $p < 0.001$).

Overall, on average, presenting subjects with longer return horizons does not have an effect on subjects' belief updating (see Fig. 4). However, when we compare subjects who opt out of the default with those who do not, we find important differences in belief updating. Note that a mitigating effect due to a longer evaluation period is present, but only for the subsample of subjects who decide to remain in the (long) default information horizon. However, if subjects opt out of their default information horizon, belief updating exhibits the opposite effect: Subjects have larger belief updates, both for return expectations and risk perceptions. Looking at the subsample of subjects who were randomly allocated to the daily default group, the pattern reverses compared to the yearly group. That is, those viewing the shortest information horizon update less when they decide to switch to a different (i.e., longer) information horizon.

An important question regarding the above mentioned effects is whether subjects who do not opt out of the default are simply "clicking through" the different rounds of the experiment without paying attention, often giving the same or almost the same response to the questions. Such behavior would lead to incorrectly classifying subjects who did not take the experimental task seriously as having little or no belief updates. Column (3) in Table 5 shows that the amount of time taken to complete the experiment is significantly and positively associated with a subject's tendency to opt out of the default. The data on belief updates, however, are not consistent with such a concern. When comparing subjects assigned to the different treatment groups, those who opt out of their treatment exhibit similar or even slightly higher (for the daily treatment group) variation in levels of beliefs (see Fig. 3). Furthermore, Fig. 4 shows that subjects in the daily treatment who decide to remain in the default, actually express larger belief updates compared to subjects who opt out of the treatment. Finally, we find no statistically significant differences between the fractions of subjects in each treatment who do not update their beliefs at all. For return expectations, this fraction is 28.2% (S.E. = 0.019) for the daily group, 32.6% (S.E. = 0.020) for the monthly group, and 30.5% (S.E. = 0.020) for the yearly group.

3.3.3. Determinants of opting out of the default

The analysis of our subjects' opting out behavior over the six evaluation rounds for the different treatment groups is graphically summarized in Fig. 5. Across all evaluation rounds and treatment conditions, more than half of the subjects (51.47%) opt out of their default and view different information horizons. Of the subjects in the monthly treatment, on average 27.14% opt out of their default, which is less than in the daily (71.35%) or yearly (55.80%) treatment.

As there are differences in belief updating between subjects who opt out of the default information horizon versus those who

Table 3
Study 1: Impact of returns and clicking behavior on belief updating.

	(1)	(2)
	Dependent variable: updates of return expectations	Dependent variable: updates of risk perception
Returns	2.56***	−1.74***
	(0.36)	(0.35)
Constant	−0.012	−0.03
	(0.05)	(0.05)
Observations	1695	1695
N	339	339

Notes: This table presents random-effects panel regression results with robust standard errors (in parentheses) clustered at the individual level. The dependent variables are updates of return expectations (model 1) and updates of risk perceptions (model 2). Updates are defined as the difference between beliefs in round t and round $t+1$. Due to analyzing the data as panel, and having six evaluation rounds, we have five belief updates per subject, which is why the number of observations is five-times the number of subjects.

*** Denote statistical significance at the level 1%.

Table 4
Study 1: belief updating across treatments.

	N	all	click	No click	Difference	*t*-stat	*p*-value
Panel A1: mean absolute changes in return expectations							
Daily	114	1.38	1.33	1.51	−0.18	−2.63	0.01***
Monthly	113	1.27	1.36	1.24	0.12	1.88	0.06*
Yearly	112	1.38	1.61	1.08	0.53	9.22	0.00***
Panel A2: average within subject standard deviation of return expectations							
Daily	114	1.21	1.16	1.32	−0.16	−3.07	0.00***
Monthly	113	1.18	1.26	1.15	0.11	2.22	0.03**
Yearly	112	1.24	1.40	1.05	0.35	7.42	0.00***
Panel B1: mean absolute changes in risk perceptions							
Daily	114	1.32	1.24	1.52	−0.29	−4.14	0.00***
Monthly	113	1.21	1.33	1.17	0.16	2.60	0.01***
Yearly	112	1.29	1.43	1.11	0.31	5.20	0.00***
Panel B2: average within subject standard deviation of risk perceptions							
Daily	114	1.21	1.16	1.31	−0.15	−2.68	0.01***
Monthly	113	1.12	1.23	1.08	0.14	2.86	0.00***
Yearly	112	1.25	1.36	1.10	0.26	5.18	0.00***

Notes: This table provides an overview of belief updating across treatment groups. "Click" refers to subjects deciding to opt out of the default treatment imposed on them, whereas "no click" captures those subjects who do not opt out of the default presentation format. "Difference" refers to the difference between "click" and "no click". T-statistics and p-values shown refer to t-tests for difference in means between "click" and "no click" subgroups for each treatment group. Updates are defined as the difference between beliefs in round t and round $t+1$.

* Denote statistical significance at the level 10%.

** Denote statistical significance at the level 5%.

*** Denote statistical significance at the level 1%.

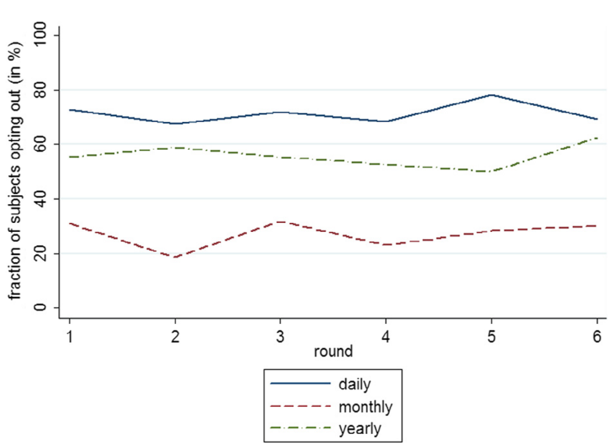


Fig. 5. Study 1: Opting out of the default information horizon. Notes: This figure presents laboratory subjects' opting out behavior based on the three treatment groups over the six experimental rounds. "Daily", "monthly", and "yearly" correspond to the default information horizon.

do not, an important follow-up question is: Who opts out? To identify determinants of opting out of the default, we summarize the opting-out behavior of all evaluation rounds for each subject creating the dependent variable "average click", and regress it on subject-specific attributes. Average click is constructed as the average within-subject decision to opt out of the default over the evaluation rounds. As it is constructed as the average, it varies between 0 (for subjects who never opt out of the default) and 1 (for subjects who opt out of the default every single round). Results in Table 5 indicate that risk aversion is slightly negatively associated with a subject's decision to opt out of the default information horizon, while financial literacy is positively related to opting out. As the insignificant interaction effects in column (2) indicate, it is financial literacy that influences the decision to opt out of the default and not merely realizing that another information horizon might be needed to form beliefs about the portfolio.

The effect of financial literacy is consistent with findings by Van Rooij and Teppa (2014). These authors find that financial literacy is positively related with the tendency to opt out of default options in economic decision-making. One potential reason is that more financially literate individuals have lower costs of information processing, whereas less literate individuals are more likely to shy away from these decisions. This explanation is consistent with Agnew and Szykman (2005), who show that for complicated tasks, financial literacy is associated with a more pronounced tendency

Table 5
Study 1: Determinants of opting out.

	Average click (1)	Average click (2)	Average click (3)
Age	−0.01	−0.01	−0.01
	(0.01)	(0.01)	(0.01)
Gender	−0.05	−0.05	−0.05
	(0.04)	(0.04)	(0.04)
Risk aversion	−0.02*	−0.01*	−0.02*
	(0.01)	(0.01)	(0.01)
Financial literacy	0.03**	0.04*	0.04*
	(0.01)	(0.02)	(0.02)
Treatment: daily	0.44***	0.52***	0.51***
	(0.04)	(0.16)	(0.16)
Treatment: yearly	0.28***	0.40**	0.41**
	(0.04)	(0.17)	(0.17)
Financial literacy ∗ Treatment: daily		−0.01	−0.01
		(0.03)	(0.03)
Financial literacy ∗ Treatment: yearly		−0.02	−0.02
		(0.03)	(0.03)
Time (min)			0.02**
			(0.01)
Constant	0.49***	0.42**	0.20
	(0.16)	(0.19)	(0.21)
Observations	339	339	339
Adjusted R^2	0.24	0.24	0.27

Notes: This table presents Ordinary Least Squares regression results. The dependent variable is the average within-subject clicking behavior over the six experimental rounds. Thus, "average click" indicates the fraction of total rounds a subject decided to opt out of the default.
* Denote statistical significance at the level 10%.
** Denote statistical significance at the level 5%.
*** Denote statistical significance at the level 1%

to opt out of the default, and Brown et al. (2016), who find that individuals with higher self-assessed investment skills are less likely to choose a default retirement plan. Finally, being assigned to either the daily or yearly treatment increases a subject's likelihood to opt out of the default. Subjects in the monthly default information horizon, which matches the time horizon specified by each evaluation round, are less likely to switch to another information horizon. Additionally, we asked subjects after the last evaluation round whether they had observed a trend in the portfolio returns by selecting one of four answer choices: "upward", "sideways drift", "downward", or "no trend". Responses to this question (i.e., the fraction of experimental subjects selecting each particular answer) do not differ significantly by treatment. Neither do we observe significant differences when comparing subjects that never opted out versus those that opted out at least once.

3.4. Discussion

Consistent with previous studies, we find that subjects extrapolate past returns when updating beliefs. Extending prior literature, we find that when opting out is easy, displaying returns over longer information horizons has no effect on belief updates, on average. Analyzing the subsamples of subjects who choose to opt out of the default and those that do not, however, yields new results as the treatment default information horizon implies different reactions for the two groups. Subjects in the short default horizon group who opt out of the default, reduce belief updating while subjects in the long default information horizon who stay in the default also reduce their beliefs. Regression results show that financial literacy is positively associated with the tendency to opt out of the default. Given prior evidence that smaller updates in investor beliefs are associated with lower trading activity, which ultimately has positive return consequences, these experimental results are relevant to consider when choosing a default to present to investors.

4. Study 2

4.1. Experimental design

The second experiment is an online study using a subject pool recruited from Amazon Mechanical Turk (henceforth, MTurk). MTurk gives access to a large and diverse subject pool, and results from traditional samples have been replicated with MTurk subjects (cf. Casler et al., 2013; Buhrmester et al., 2011; Paolacci et al., 2010). In order to ensure comparability with Study 1, the experimental design of Study 2 is identical to the lab version, except for a few necessary changes. First, because MTurk is a US-based platform and the majority of subjects are from the US, monetary values presented in the overview tables throughout the experimental rounds are given in US Dollars instead of Euros. Second, to allow better comparison of our results with previous work which did not allow subjects to opt out of the default, we implement two experimental versions in Study 2. In one version it is possible to opt out of the default, in the other version it is not possible to opt out. Subjects in the version that does not give the option to opt out see just a single radio button that informs them of the information horizon they are viewing. None of the subjects in this version of the experiment are informed about the existence of other treatments. Thus, these subjects do not know about other information horizons, nor do they know that other subjects have the option to opt out of the default. Subjects are randomly allocated to one of the two versions. Third, we add an attention check at the end of the experiment. Since subjects completed the experiment outside a controlled lab, the attention check can serve as an exclusion criterion to ensure sufficient attention. We employ an instructional manipulation check (Oppenheimer et al., 2009), which entails a short text in which subjects are instructed to answer a question in a specific way, disregarding the actual content of the question. Subjects who follow instructions and read the text will pass the attention check, while those who do not pay attention to the text and only read the question will fail the attention check. On purpose, we included the instructional manipulation check at the end of the experiment to avoid any differences in the actual experiment. Hence, the sequence of rounds and screens shown to online subjects is the same as for the lab subjects.

In total, 613 subjects completed the experiment, of which 29 (4.7%) failed to pass the attention check. These subjects are excluded from further analysis and the remainder of the paper focuses on the 584 subjects which passed the attention check. Of those 584 subjects, 284 (48.63%) completed the experiment in the non-restrictive setup, allowing them to opt out of the default, and the remaining 300 (51.37%) subjects were allocated to the restrictive version, which did not allow opting out of the default. Mean completion time is 6 min. Subjects given the opportunity to opt out of the default take slightly longer (6.2 min). Subjects not given the option to opt out of the default take, on average, a shorter length of time to complete the experiment (5.9 min). We paid $1 to each subject completing the experiment, resulting in an average hourly wage of $10.

Subjects participating in either version of Experiment 2 were again randomly allocated to one of three default treatment groups. Of the 284 subjects allowed to opt out of the default, 96 (33.80%) subjects were placed in the daily treatment, 95 (33.45%) were placed in the monthly treatment group, and 93 (32.75%) completed the experiment viewing yearly returns by default. The random division of the subgroup of 300 subjects who did not have the option of opting out of the default resulted in 102 (34.00%) subjects in the daily, 100 (33.33%) in the monthly treatment, and 98 (32.67%) subjects in the yearly treatment group.

4.2. Descriptive statistics and data quality

Table 6 presents summary statistics. Forty-six percent of the subjects are female. Mean age is 35.3 years. Subjects have a mean score of 5.83 for the financial literacy questions. Of those subjects having the option to opt out of the default, 53% opt out of their default information horizon. Recall that one experimental version has by 0% of subjects opting out, since they are not given the option to do so. There is no significant difference in age, gender, or financial literacy within each experimental version of the three treatment groups. Hence, the random allocation of subjects to the experimental conditions was successful.

Table 7 replicates Table 3 from Section 3.2, but using data gathered from subjects who completed the online experiment, allowing us to compare the samples of Study 2 and Study 1. Model specifications in Table 7 are identical to those in Table 3. The setup used in models (1) and (2) (once each for the experimental version in which opting out of the default is possible vs. not possible) show a similar picture as for the lab sample in Study 1. A higher past return leads to increased expectations about future returns. In comparison to Study 1, the coefficients are only slightly different, and the significance and sign of effects, as well as interpretation of the results remain the same. Also, when looking at columns (3) and (4), which focus on risk perceptions, the interpretation is the same as in Study 1. Higher returns are associated with lower risk perceptions. In conclusion, the lab experiment as well as both versions of the online experiment yield results in line with real investor behavior. That is, subjects update their beliefs by extrapolating from past returns.

Figs. 6A and 6B plot the beliefs of our subjects over the different evaluation rounds of the experiment for both experimental versions of Study 2. Return expectations are shown in the left panel, while the right panel presents risk perceptions. Fig. 6A reveals a similar pattern as Fig. 3 did for Study 1. Again, updates of return expectations are positively associated with past returns. Updates of risk perceptions are negatively associated with past returns. Hence, Fig. 6A shows that subjects in both the lab as well as online experiment exhibit similar belief updating behavior. Fig. 6B contains

Table 6
Study 2: summary statistics.

Variable	Mean	Fraction	Std	Median
Age	35.5		11.06	33
Gender	0.46			
Financial literacy	5.83		1.8	6
Basic financial literacy	2.44		0.84	3
1		89%		
2		78%		
3		77%		
Advanced financial literacy	3.39		1.21	4
1		76%		
2		57%		
3		90%		
4		82%		
5		36%		
Click		53%	0.50	1
Time	6.05		2.64	5.48
Experiment version				
Opt out possible		49%		
Opt out not possible		51%		
Treatment				
Daily		34%		
Monthly		33%		
Yearly		33%		
Return Expectation	4.30		1.55	4
Risk Perception	3.98		1.54	4
N		584		

Notes: This table presents summary statistics of selected key questions from Study 2. "std" abbreviates "standard deviation". Percentages correspond to the fraction of correct answers for financial literacy questions and to the fraction of respondents who select a certain answer or belong to a certain group (for click, experiment version, and treatment). All values are based on the total number of subjects, except for click, which is based on those 300 subjects who were assigned to the experiment version in which opting out was possible, since for the remaining subjects, the value of click is by definition zero, as they are not granted the possibility to opt out of the default.

two lines per graph, because in this version of the experiment, subjects could not opt out of their default and therefore there are no observations for opting out of the treatment. Nonetheless, when comparing the two versions of Study 2, beliefs from the version where opting out was not possible closely resemble the pattern yielded by those subjects who were granted the possibility to opt out, but did not do so (compare the light dashed lines in Fig. 6A with the solid line in Fig. 6B). Thus, subjects in both experiments display similar beliefs, which provides additional support to the validity of our experiment and makes it unlikely that results are driven by the fact that subjects were exposed to a controlled laboratory environment in Study 1 as compared to the online environment of Study 2.

4.3. Results

4.3.1. Belief updating when opting out is possible

Fig. 7 replicates Fig. 4 from Section 3.3.1, but using data gathered from subjects who completed the online experiment and were allowed to opt out of the default information horizon presented to them. Again, Panel A refers to return expectations and Panel B to risk perceptions. Once more, we find that there are only small differences in the magnitude of belief updates across treatment groups, and the differences are not statistically significant. The corresponding tests are given in Table 8. Column (3) contains mean values for the three treatment groups.

The bottom panels of Fig. 7 split up the total sample of online subjects into the two subgroups of subjects who decide to opt out of the default and those that do not. Subjects who decide to opt out of the default information horizon (called "click") show a slight increase in belief updating with increasing return horizons. Subjects who do not choose to opt out of their treatment exhibit

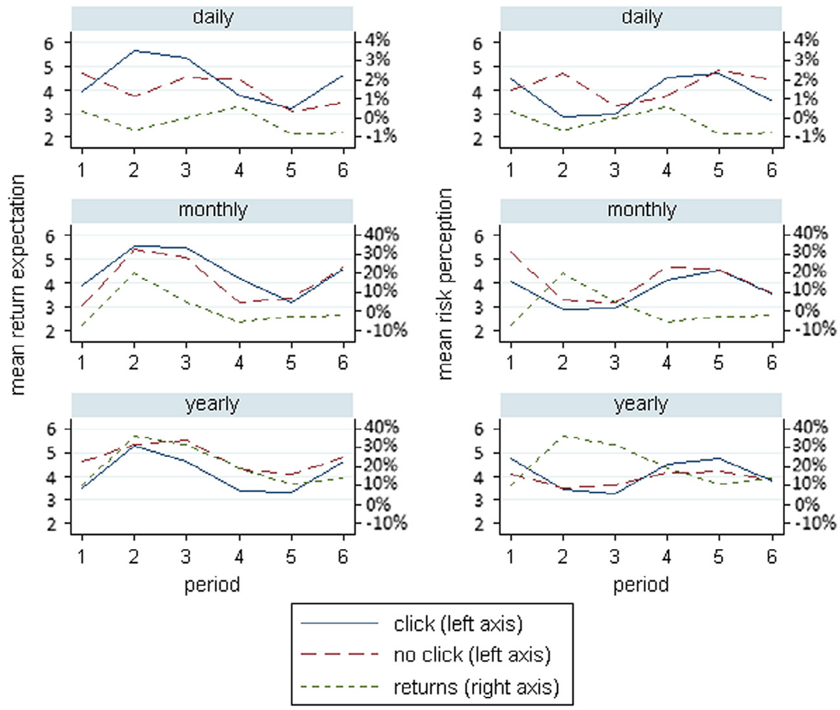


Fig. 6A. Study 2: Opting out possible: Return expectations and risk perceptions.

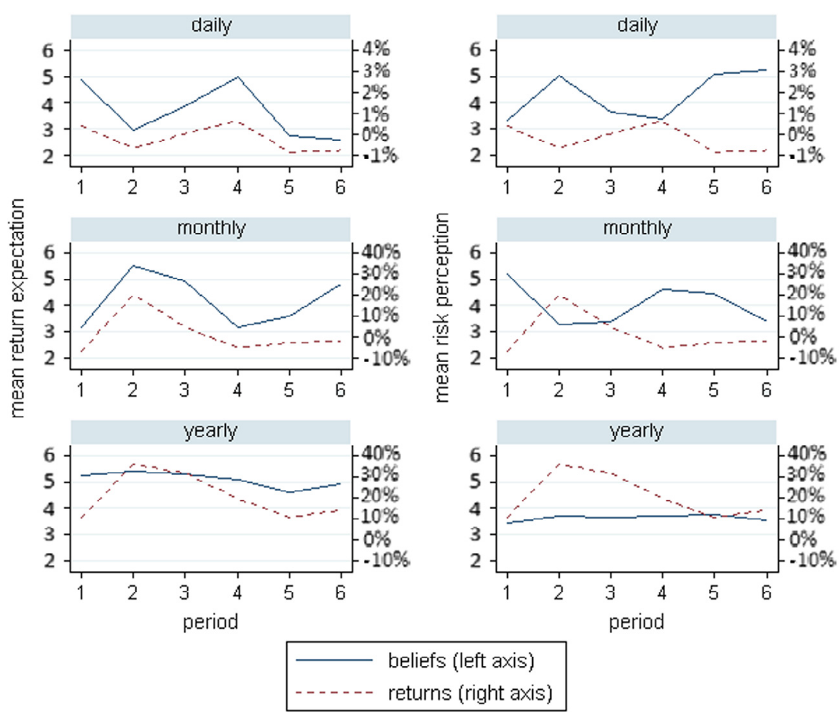


Fig. 6B. Study 2: Opting out not possible: Return expectations and risk perceptions. Notes: These figures present subjects' beliefs over the six experimental rounds. The header explains which experimental version the graphs are based on. The left panel presents mean return expectations and the right panel shows mean risk perception. "Click" and "no click" refers to subjects who did or did not opt out of the default information horizon, respectively. Returns shown for each treatment in each round are summarized on the right-hand scale.

almost no difference in their belief updating (both for return expectations, as well as for risk perceptions), no matter whether they are presented daily or monthly returns. As soon as subjects who do not opt out of the treatment are shown yearly returns, however, their belief updating is reduced. Table 8 contains statistical tests for differences in means between those subjects who decide to opt out and those who elect not to do so. The differences are insignificant for both the daily and monthly treatment group. However, for the yearly treatment, differences are statistically and economically significantly, as not opting out decreases belief updates by 0.39 points, which amounts to more than one quarter of the size of the updates.

Overall, when we compare the results of the online experiment with those of the lab experiment, the yearly treatment group has

Table 7
Study 2: Returns and clicking behavior.

	(1)	(2)	(3)	(4)
	Dependent variable: updates of return expectations		Dependent variable: updates of risk perception	
	Opt out possible	*Opt out not possible*	*Opt out possible*	*Opt out not possible*
Returns	2.42***	2.47***	−1.98***	−1.66***
	(0.40)	(0.37)	(0.40)	(0.37)
Constant	−0.05	−0.27***	−0.02	0.15***
	(0.06)	(0.06)	(0.06)	(0.06)
Observations	1420	1500	1420	1500
N	284	300	284	300

Notes: This table presents random-effects panel regression results with robust standard errors (in parentheses) clustered at the individual level. The dependent variables are updates of return expectations (models 1 and 2) and updates of risk perceptions (models 3 and 4).Updates are defined as the difference between beliefs in round t and round $t+1$. Due to analyzing the data as panel, and having six evaluation rounds, we have five belief updates per subject, which is why the number of observations is five-times the number of subjects. "opt out possible/not possible" refers to the experimental version of experiment 2—for "opt out possible", subjects had the possibility to opt out of the default; for "opt out not possible", opting out of the default was impossible.
*** Denote statistical significance at the level 1%.

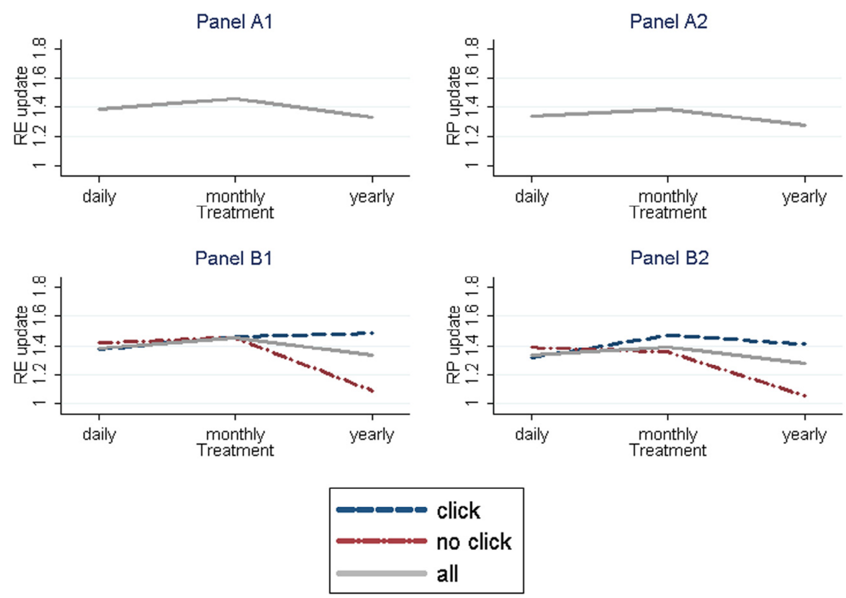


Fig. 7. Study 2: Opting out possible: Belief updating across treatments. Notes: This figure presents subjects' belief updating based on the three treatment groups. Analysis is based on subjects who completed the online experiment and were allocated to the experimental version in which they had the option to opt out of the default information horizon presented to them. The graphs on the left summarize updates in return expectations ("RE"), whereas the graphs on the right show updates in risk perceptions ("RP"). Updates are calculated as the absolute difference between expressed beliefs and their counterpart from the previous evaluation round, leaving the figure to be an average of five individual assessments of belief updating. The three lines correspond to the group of all subjects as well as splitting them up based on whether they decided to opt out of the default in any given round ("click") or not ("no click").

identical patterns. The patterns for the shorter return horizons (daily and monthly) allow for a similar interpretation, but the differences are less pronounced and mostly not statistically significant.

Subjects in Study 2 also behave similarly to those in Study 1 in terms of their decision to opt out of the default. Fig. 8 plots the percentage of subjects who decide to opt out of their treatment over the six rounds of the experiment. Over all rounds and across all three treatments, 53.29% of online subjects decide to opt out of the default shown to them. Similar to Study 1, the numbers differ based on the exact treatment. Whereas subjects assigned to the daily condition opt out most frequently (70.31%), those randomly selected to view yearly returns as a default opt out slightly less (62.01%). A monthly return horizon makes subjects opt out of the default less, as only 27.54% show such behavior.

4.3.2. *Belief updating when opting out is not possible*

Fig. 9 summarizes belief updating across treatments for those subjects who were allocated to the experimental version in which they had no option to opt out of the default. The organization of the figure is the same as before: The left panel refers to return expectations, whereas the right panel depicts risk perceptions.

Subjects in the daily and monthly treatments display similar belief updating, both for return expectations and risk perceptions. The yearly treatment group, however, displays significantly reduced belief updating. The downward slope for belief updates in the yearly treatment group is comparable to the subgroup of subjects not opting out in Panel B in Fig. 7. Thus, in conjunction with Fig. 7, Fig. 9 shows that subjects update beliefs less when they face *only* a long information horizon, resembling the findings of previous literature from restrictive settings.

4.4. *Discussion*

Study 2 supports the generalizability of the experimental results of Study 1. Switching from a lab environment to an online setting did not change the results obtained in Study 1. In Study 2, when our subjects are allowed to opt out of the default, they

Table 8
Study 2: Belief updating across treatments.

	N	All	Click	No click	Difference	t-stat	p-value
Panel A1: mean absolute changes in return expectations							
Daily	96	1.39	1.37	1.42	−0.05	−0.69	0.24
Monthly	95	1.46	1.46	1.46	0.00	0.07	0.53
Yearly	93	1.33	1.48	1.09	0.39	5.94	0.00***
Panel A2: average within subject standard deviation of return expectations							
Daily	96	1.29	1.28	1.33	−0.05	−0.84	0.20
Monthly	95	1.32	1.31	1.32	−0.01	−0.10	0.46
Yearly	93	1.21	1.31	1.03	0.28	5.33	0.00***
Panel B1: mean absolute changes in risk perceptions							
Daily	96	1.34	1.32	1.39	−0.07	−1.00	0.16
Monthly	95	1.39	1.47	1.35	0.12	1.57	0.06*
Yearly	93	1.28	1.41	1.05	0.36	4.92	0.00***
Panel B2: average within subject standard deviation of risk perceptions							
Daily	96	1.24	1.23	1.25	−0.02	−0.34	0.37
Monthly	95	1.26	1.31	1.24	0.07	1.10	0.14
Yearly	93	1.18	1.29	1.00	0.29	4.91	0.00***

Notes: This table provides an overview of belief updating across treatment groups. "Click" refers to subjects deciding to opt out of the default treatment imposed on them, whereas "no click" captures those subjects who do not opt out of the default presentation format. "difference" refers to the difference between "click" and "no click". T-statistics and p-values shown refer to t-tests for difference in means between "click" and "no click" subgroups for each treatment group. Updates are defined as the difference between beliefs in round t and round $t+1$.

* Denote statistical significance at the level 10%.

*** Denote statistical significance at the level 1%.

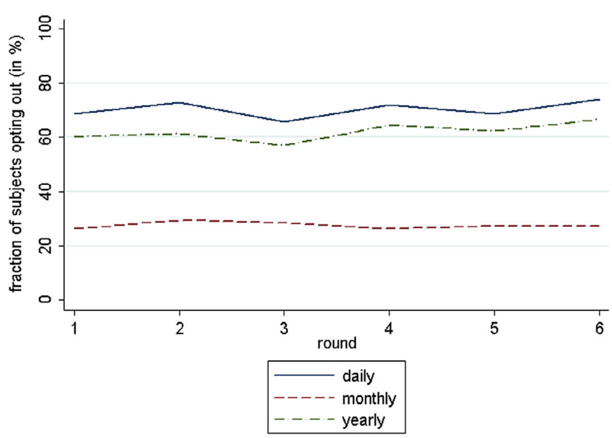


Fig. 8. Study 2: Opting out of the default information horizon. Notes: This figure presents online subjects' opting out behavior based on the three treatment groups over the six experimental rounds. "Daily", "monthly", and "yearly" correspond to the default information horizon.

exhibit a similar pattern of belief updating found in Study 1. The differences in belief updating are most pronounced in the yearly default, where opting out increases belief updates as compared to staying in the longer horizon. Results for the shorter horizons are similar to the lab experiment. The version of Study 2 where opting out is not permitted, highlights that in this type of setting, a longer information horizon is to be recommended, as this is associated with reduced belief updates, which attenuates trading activity (Hoffmann and Post, 2016).

5. Conclusion

In two experimental designs resembling an online brokerage environment, we present subjects with the performance of a stock portfolio over six evaluation rounds. We measure their beliefs in terms of return expectations and risk perceptions and analyze the effect of different default information horizons on the magnitude of their belief updates. When subjects have the possibility to opt out of the default, we find that the default information horizon does not, on average, impact the magnitude of belief updating. An important result emerges, however, when we divide the sample into subjects staying in the default vs. those opting out of the default. For subjects who stay in the default condition, showing returns over a longer information horizon reduces the magnitude of their belief updating. For subjects who opt out of their default treatment, we find the opposite result.

Our results extend previous work that examines how different information horizons influence the decision-making behavior of individual investors (e.g., Beshears et al., 2017; Shaton, 2015). These studies typically recommend longer information horizons to improve individual investor decision-making (e.g., to increase their stock-market participation or equity allocations in retirement funds). The results of these previous studies, however, are based on restricting access to information and making it very cumbersome or even impossible for subjects to opt out of the default. Our findings support previous results in the sense that when subjects do not have the possibility to opt out, a longer default presentation format indeed reduces belief updates and thus seems beneficial for investors. However, based on our experiments, we find that when subjects have immediate access to alternative information horizons and can easily opt out of the default, presenting returns over a longer information horizon is not always beneficial. Presenting portfolio performance over a longer horizon benefits only those subjects who choose to stay in their default information horizon. For these subjects, the longer horizon has a mitigating effect on the magnitude of their belief updates.

Since we find that financial literacy is positively related to subjects' likelihood of opting out of the default, our findings suggest that showing long information horizon returns is an effective default only if investors have low financial literacy. In order to set an appropriate information horizon default for past returns, it is thus crucial to understand and assess the personal characteristics of investors that lead to a tendency for remaining in a default condition. Investment mistakes are most detrimental for investors with low financial literacy because of their higher level of vulnerability (cf. Financial Conduct Authority, 2014). Accordingly, public policy makers may find it particularly worthwhile to consider long information horizons as a default option for this group of investors.

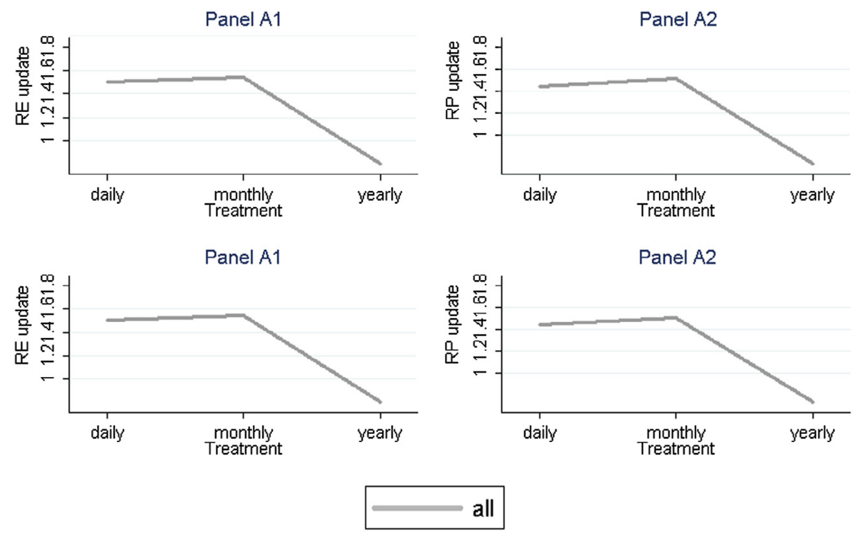


Fig. 9. Study 2: Opting out not possible: belief updating across treatments. Notes: This figure presents subjects' belief updating based on the three treatment groups. Analysis is based on subjects who completed the online experiment and were allocated to the experimental version in which they were not given the option to opt out of the default information horizon. The graphs on the left summarize updates in return expectations (''RE''), whereas the graphs on the right show updates in risk perceptions (''RP''). Updates are calculated as the absolute difference between expressed beliefs and their counterpart from the previous evaluation round, leaving the figure to be an average of five individual assessments of belief updating. As subjects could not opt out of the default, by definition the line plot for the entire subsample used coincides with the line plot of those who did not opt out, as there are no subjects who were able to opt out of the default.

Acknowledgments

For comments on previous versions of this paper, we thank Armin Falk, Leo de Haan, Alex Imas, Peiran Jiao, Moritz Lukas, Maarten van Rooij, Kim Peijnenburg, Rogier Quaedvlieg, Stefan Zeisberger as well as seminar and conference participants at Maastricht University, the Annual Congress of the European Economic Association, the TIBER Symposium on Psychology and Economics at Tilburg University, the Netspar Pension Day, the University of Kent, the Netspar International Pension Workshop, the Federal Reserve Bank of New York and ESRC Research Centre on Micro-social Change (MiSoc) Workshop on Subjective Expectations, the Maastricht Behavioral and Experimental Economics Symposium, the Experimental Finance Conference, SERVSIG, the Behavioural Insights in Research and Policy Making SABE/IAREP Conference, and the Research in Behavioral Finance Conference. Any errors are our own.

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