What Makes Investors Optimistic? What Makes Them Afraid?

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Abstract: Based on a combination of monthly survey data and matching trading records, we identify the drivers of individual investors' optimism, as expressed by their return expectations, and fear, as expressed by their risk tolerance and risk perceptions. We find that past returns positively impact investors' return expectations and risk tolerance, and negatively impact their risk perceptions. The risk associated with these past returns, however, does not effectuate changes in investors' return expectations, risk tolerance, or risk perception. The tendency to look primarily at past returns is especially pronounced among less experienced and sophisticated, and more overconfident, investors. These investors seem to find it difficult to evaluate and interpret portfolio risk, and use portfolio returns as a more easily available and salient performance metric.

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1. Introduction

Individual investor behavior influences asset prices (Lee, Shleifer, and Thaler 1991; Hirshleifer 2001; Kumar and Lee 2006), return volatility (Foucault, Sraer, and Thesmar 2011), and even the macro economy (Korniotis and Kumar 2011a). Central determinants of investor behavior, such as choices of when and how to invest, are return expectations, risk tolerance, and risk perceptions (Nosic and Weber 2010; Dominitz and Manski 2011). Changes in these variables drive key aspects of trading and risk-taking behavior, such as trading frequency, turnover, and the buy-sell ratio (Hoffmann, Post, and Pennings 2010). Debated, however, is how individual investors *form* their return expectations, risk tolerance, and risk perceptions. In particular, the evidence on the directional impact that individual-level risk and return experiences have on the formation process of these variables is mixed.

Using a combination of monthly survey data and matching brokerage records, we resolve this controversy in the existing literature. We provide a comprehensive study of the determinants of changes in individual investors' optimism, as expressed by their return expectations, and fear, as expressed by their risk tolerance and risk perceptions. The results show that in a real decision context past returns are a powerful driver of investor optimism *as well as* fear: past returns positively impact return expectations and risk tolerance, and negatively impact risk perceptions. The risk associated with these past returns, however, does not effectuate changes in investors' return expectations, risk tolerance, or risk perception. The tendency to look primarily at past returns is especially pronounced among less experienced and sophisticated, and more overconfident, investors. These investors seem to find it difficult to evaluate and interpret portfolio risk, and use portfolio returns as a more easily available and salient performance metric.

This paper makes several contributions to the literature. First, we examine the impact of past portfolio returns *as well as* past portfolio risk on subsequent changes in investors' return

expectations, risk tolerance, and risk perceptions. Much prior work focuses on the impact of past returns (Dominitz and Manski 2011; Hurd, van Rooij, and Winter 2011), but does not study the effect of the riskiness of these returns. Yet, according to standard finance theory, risk should be as important as returns in investor decision making (Markowitz 1952; Sharpe 1964). Second, prior research typically studies return expectations, risk tolerance, and risk perceptions in isolation. For example, Dominitz and Manski (2011) and Hurd, van Rooij, and Winter (2011) study the impact of past returns on changes in return expectations. Glaser and Weber (2005) examine the effect of past returns on changes in risk perceptions. Malmendier and Nagel (2011) show the influence of past returns on changes in risk tolerance. In contrast, we study all three together: that is, return expectations, risk tolerance, and risk perceptions. Doing so is important, as these variables affect different aspects of investor trading and risk-taking behavior (Hoffmann, Post, and Pennings 2010). Third, we study the impact of individual investors' *personally experienced* returns and risks. Previous research focuses on how *aggregate* market returns influence return expectations, risk tolerance, and risk perceptions. In so doing so, however, these studies do not examine the effects of the underlying heterogeneity in investors' individual-level risk and return experience. Fourth, we study how investors' return expectations, risk tolerance, and risk perceptions adapt in a *real* investment decision context as opposed to examining these variables within a general sample of household survey or experiment participants who may or may not invest in the stock market.

The remainder of this paper is organized as follows. Section 2 presents related literature and develops the hypotheses. Section 3 describes the data. Section 4 sets out descriptive results. Section 5 tests the hypotheses. Section 6 presents robustness checks and evaluates alternative explanations. Section 7 concludes the paper and discusses its implications.

2. Related Literature and Hypotheses

In this section we review the related literature we use to develop hypotheses regarding the impact of past returns and past risk on subsequent changes in investors' optimism, as expressed by their return expectations, and fear, as expressed by their risk tolerance and risk perceptions.

2.1 Investor Optimism

Research in behavioral finance demonstrates a persistent effect of investor psychology on trading and risk-taking behavior (Barber and Odean 2001; Bailey, Kumar, and Ng 2011). In particular, previous work in cognitive psychology (Gilovich, Vallone, and Tversky 1985) and studies on how individuals form forecasts (De Bondt 1993) suggest that investors' past returns can impact their future expectations in two major ways. On the one hand, individual investors might be susceptible to the gambler's fallacy effect, which occurs when people misinterpret the law of averages (Tversky and Kahneman 1971). Because of representativeness (Kahneman and Tversky 1972), such individuals belief that the law of large numbers applies to small as well as to large samples. In an investment context, this implies that after a run-up in stock prices, investors tend to expect below-average returns (Shefrin 2002). On the other hand, when making investment choices, individual investors often bet on what they perceive as trends in prices and believe in "hot" ("cold") hands after observing positive (negative) outcomes, that is, they expect the trend to continue (Gilovich, Vallone, and Tversky 1985; De Bondt 1993; Johnson, Tellis, and Macinnis 2005). Accordingly, we formulate the following competing hypotheses about the impact of past returns on investors' subsequent optimism as expressed by their return expectations:

H_{1a}: Past returns are negatively related to investors' subsequent return expectations.

H_{1b}: Past returns are positively related to investors' subsequent return expectations.

Regarding the impact of individual investors' past risk on their return expectations, we build on and extend prior literature on the representativeness and affect heuristics (Kahneman and Tversky 1972; Finucane et al. 2000). Shefrin (2001), for example, argues that because of individuals' reliance on representativeness, they expect high returns from safe stocks and low returns from risky stocks. In particular, investors judge that "good" stocks are those issued by "good" companies and associate these with both safety and high future returns. This tendency to rely on representativeness when making investment decisions causes investors to use the affective associations they have of a company when forming expectations about the risk-return attributes of this company's stock (Finucane, Alhakami, Slovic, and Johnson 2000; Statman, Fisher, and Anginer 2008). The resulting cross-sectional negative correlation between investors' expected risk and returns is robust, as confirmed by Ganzach (2000). We extend this relationship to an intertemporal setting. That is, to draw inferences about the expected returns of various assets, investors are expected to use available information on those assets' past risk, just like they use past return information to form their expectations about future returns. We develop the following hypothesis about the impact of past risk on investors' subsequent optimism as expressed by their return expectations:

H_2: Past risk is negatively related to investors' subsequent return expectations.

2.2 Investor Fear

We define investor fear as consisting of two components: risk tolerance and risk perceptions. That is, fear is comprised of an investor's general predisposition toward taking risk (risk

tolerance) and his or her current interpretation of the riskiness of the stock market (risk perception). We first develop hypotheses regarding the impact of past returns on risk tolerance and risk perceptions and subsequently formulate hypotheses regarding the impact of past risk.

Considering the impact of past returns on investors' subsequent risk tolerance, we build on the house-money effect as established by Thaler and Johnson (1990). Accordingly, we expect individuals to display an increased risk tolerance after experiencing a gain (see also Barberis, Huang, and Santos 2001). We thus offer the following hypothesis regarding the impact of past returns on investors' subsequent fear as expressed by their risk tolerance:

H_3: Past returns are positively related to investors' subsequent risk tolerance.

Concerning the impact of past returns on investors' subsequent risk perceptions, there is evidence in support of a negative as well as a positive relationship. In an experimental setting, De Bondt (1993) finds that although individuals generally tend to expect price trends to continue, their risk perceptions depend on prior performance in an opposite manner. De Bondt notes that "the mere fact that a stock goes up in price increases its 'downward potential'" (1993: 369). Thus, risk perceptions can be expected to increase after investors experience positive returns. However, Shefrin's (2001) work on the role of representativeness in investors' cross-sectional assessments of the riskiness of stocks with good or bad returns suggests a negative relationship between past returns and subsequent risk perceptions. That is, when investors have experienced favorable returns, they apparently have bought "good" stocks, which, in their opinion, are also safe stocks. Accordingly, we formulate the following competing hypotheses about the impact of past returns on investors' subsequent fear as expressed by their risk perceptions:

H_{4a}: Past returns are positively related to investors' subsequent risk perceptions.

H_{4b}: Past returns are negatively related to investors' subsequent risk perceptions.

Regarding the impact of past risk on investors' subsequent risk tolerance, we build on Kahneman and Lovallo (1993), who find that individuals often expose themselves to risk because they misjudge the odds. Thus, being confronted with the outcomes of previous risky choices in the form of realized past risk should affect investors' risk tolerance. It is unclear, however, in which direction this effect will go. For some investors, awareness of the amount of risk they have taken reaffirms their true willingness to take risks, while for others, the level of realized risk comes as a surprise, increases fear, and leads them to reduce their risk tolerance. Hence, we formulate the following unidirectional hypothesis regarding the impact of realized past risk on investors' subsequent fear as expressed by their risk tolerance:

H_5: Past risk is related to investors' subsequent risk tolerance.

Considering the influence of past risk on investors' subsequent risk perceptions, we expect a positive relationship to the extent that individuals believe that market trends will continue, as do a majority of households when asked about aggregate market returns (cf. Dominitz and Manski 2011). Hence, we formulate the following hypothesis about the impact of past risk on investors' subsequent fear as expressed by their risk perceptions:

H_6: Past risk is positively related to investors' subsequent risk perceptions.

3. Data

We base our analyses on a data set first used in Hoffmann, Post, and Pennings (HPP) (2010). The data consist of the brokerage records of 1,510 clients of the largest discount broker in the Netherlands, along with matching monthly survey data collected for these investors from April 2008 through March 2009. Using discount brokerage data has two advantages. First, discount brokerage is the dominant channel through which both U.S. and Dutch individuals invest in the stock market (Barber and Odean 2000; Bauer, Cosemans, and Eichholtz 2009). Second, as discount brokers do not offer advice, the investment transactions and survey responses reflect investors' own decisions and opinions. As the sample period corresponds to a time of high market volatility, there is substantial variation in investors' optimism and fear as well as in their portfolio returns and risk, which is beneficial for estimating the effect of investors' past portfolio risk and returns on the formation of optimism and fear. Following HPP (2010), we exclude accounts of minors and of those with an average portfolio value of less than €250. To exclude professional traders, we discard accounts in the top 1% of annual trading volume, transaction frequency, or turnover distributions, leaving 1,376 accounts.

3.1 Brokerage Records

Brokerage records are available for investors who completed at least one survey during the sample period. A "record" consists of an identification number, a transaction date and time, a buy/sell indicator, the type of asset traded, the gross transaction value, and transaction commissions. The records also contain information on investors' daily account balances, demographics such as age and gender, and their six-digit postal code. Based on this postal code, which is unique to each street (or parts of a street) in the Netherlands, and data retrieved from Statistics Netherlands (Central Bureau of Statistics), we assign income and

residential house value to each investor.[1] Table 1 defines all variables. Table 2 shows descriptive statistics of all brokerage accounts available, and those for the subset of accounts belonging to clients who completed the survey in each particular month of the sample period.

[Tables 1 and 2 here]

A comparison with samples used in other studies of individual investor behavior in the United States (Barber and Odean 2000), Germany (Dorn and Huberman 2005), and the Netherlands (Bauer, Cosemans, and Eichholtz 2009) shows that this study's sample of investors is similar in terms of age and gender, portfolio size, and turnover. Moreover, the account values comprise the major share of investors' total self-managed wealth. Due to the Dutch tax code, tax-loss-selling motivated trading does not affect the results.

3.2 Survey Design and Data Collection

At the end of each month between April 2008 and March 2009, we conducted an online survey among a panel of the broker's clients. To develop the panel, an email invitation was sent to 20,000 randomly selected clients in March 2008. Six months later, a re-invitation was sent to these clients to maintain a sufficient response rate. The response rate of 4.28% (for April 2008) is in line with comparable large-scale surveys (cf. Dorn and Sengmueller 2009). A possible concern is that monthly variation of non-response (Table 2) might not be random. For example, investment success could be related to propensity to respond. Robustness checks in HPP (2010) show that the sample is not subject to non-random response problems and, in addition, indicate that the results are unaffected by the timing of responses.

[1] Home ownership rates are high in the Netherlands (67.5%, as of 2008 (Eurostat 2011), as well as skewed toward wealthier households (Rouwendal 2007). Thus, it is likely, that the house values assigned correspond closely to the value of the houses actually owned by the investors in the sample.

The survey elicited information on investors' expectations of stock-market returns, their risk tolerance, and their risk perceptions for each upcoming month (see Table 3).). We use simple subjective measures, as they typically have higher explanatory power for individuals' financial decision-making than do more complex types of measurement, which are often misunderstood by respondents (Wärneryd 1996; Kapteyn and Teppa 2011). Return expectations measure investors' optimism about the returns of their investment portfolio and are measured as in Weber, Weber, and Nosic (2010). Risk tolerance reflects investors' general predisposition toward financial risk (like or dislike of risky situations) and is measured following Pennings and Smidts (2000). Risk perception reflects investors' interpretation of the riskiness of the stock market and is measured according to Pennings and Wansink (2004).

To ensure a reliable measurement instrument, we used multiple items per variable, included these items in the questionnaire in a random order (Netemeyer, Bearden, and Sharma 2003), and used a mixture of regular and reverse-scored items (Nunnally and Bernstein 1994). Reliability is high; Cronbach's alpha is between 0.71 and 0.89 for the different survey variables (Hair et al. 1998). The survey variables are computed by equally weighting and averaging their respective item scores. Such variables perform at least as well as those using "optimally" weighted factor scores, but have the advantage of a readily interpretable absolute modal meaning (Dillon and McDonald 2001).

[Table 3 here]

4. Descriptive Results

Figures 1 and 2 show investors' portfolio returns and the volatility of theses returns during the sample period, as well as the corresponding returns and volatilities of the Dutch stock market index (AEX). Investors' returns (calculated as the product of the daily relative changes in the value of their investment portfolio, taking into account transaction costs and

portfolio in- and outflows) closely resemble market returns (Figure 1). Changes in investors' realized return volatility also track changes in the overall market's volatility, but the level of investors' return volatility is, on average, higher than that of the market (Figure 2).

[Figures 1 and 2 here]

Figures 3–5 show the evolution of investors' return expectations, risk tolerance, and risk perceptions during the sample period and also plot investors' average portfolio returns.

[Figures 3-5 here]

The figures reveal three key insights. First, on average, the three survey measures fluctuate over time and the majority of monthly changes are statistically significant. In particular, 11 of the 12 monthly changes in return expectations, 4 of the 12 changes in risk tolerance, and 7 of the 12 changes in risk perceptions are significant. Consistent with prior literature, return expectations change more frequently than risk perceptions and risk attitudes (cf. Sahm 2007; Weber, Weber, and Nosic 2010; Bateman et al. 2011). Second, investor optimism, as expressed by their return expectations, moves in line with their returns (Figure 3). Since the survey measures represent a prospective view of the investor at the end of each month, changes in return expectation tend to follow changes in past returns. That is, changes in investors' return expectations reflect a belief in the persistence of their *individual* past performance. This finding extends prior studies that examine how households' return expectations relate to *aggregate* market returns by showing how individual investors update their expectations based on their *individually* experienced portfolio returns (Dominitz and Manski 2011; Hurd, van Rooij, and Winter 2011). Third, fear, as expressed by investors' risk tolerance and risk perception, seems to be similarly influenced by changes in past returns. That is, improving returns make individual investors more risk tolerant and lead them to

perceive less risk (Figures 4 and 5). Surprisingly, the risk associated with these returns does not seem to influence investors' fear (compare Figure 2). These findings extend prior literature on the house-money effect (Thaler and Johnson 1990) as well as work on how representativeness and affect jointly influence investors' expectations regarding the risk-return relationship (Shefrin 2001).

5. Test of Hypotheses

In this section, we test hypotheses H1–H6. That is, we analyze in detail the determinants of changes in investors' optimism, as expressed by their return expectations, and fear, as expressed by their risk tolerance and risk perceptions. We run a series of panel regressions with changes in return expectations, risk tolerance, or risk perception as dependent variables. We alternatively include investors' past portfolio returns, changes in past portfolio returns, past portfolio risk (standard deviation of returns), and changes in past portfolio risk as explanatory variables. With respect to investor time-invariant effects, we include gender, age, account tenure, income, average portfolio value, and house value.[2] We also include time-variant controls (Derivatives, Traded, Turnover), to capture potential feedback effects of trading activity on the survey measures (e.g., investors who trade more could expect higher returns (cf. Dorn and Sengmueller 2009)). Finally, we include month fixed-effects to control for unobserved external factors that could impact both the survey measures and the risk and return variables (such as monthly variation in market returns).

Table 4 shows that realized past returns are positively related to investors' subsequent return expectations, providing support for H_{1b}, but not for H_{1a}. Past returns are also positively related to investors' risk tolerance, consistent with H_3. Finally, realized past returns are

[2] We include the average of the portfolio value instead of the time-variant monthly portfolio value because the monthly value is highly correlated with investors' returns.

negatively related to investors' risk perceptions, providing evidence in support of H_{4b}, but not H_{4a}. Changes in past returns are positively related to changes in return expectations, while there is no effect on risk tolerance or risk perceptions. In terms of explanatory power (R^2), past returns have the strongest impact on return expectations, followed by risk perceptions, and, finally, risk tolerance.

Table 5 shows the unexpected result that neither past risk nor changes in past risk impact changes in investors' return expectations, risk tolerance, and risk perception.[3] Thus, we find no empirical support for H_2, H_5, or H_6. Taken together, the results, as presented in Tables 4 and 5, indicate that past returns have a strong momentum-like impact on subsequent changes in investors' return expectations, risk tolerance, and risk perception, while the risk associated with these returns plays no role. These findings suggest that individual investors care mainly about the returns they achieve, and consider risk, after it is realized, to be irrelevant. To examine whether the findings of this section hold equally for all investors, we perform a series of robustness checks and tests of alternative explanations in the next section.

[Tables 4-5 here]

6. Robustness Checks and Tests of Alternative Explanations

6.1 Investor Experience and Sophistication

Prior literature shows that behavioral biases tend to be less prevalent among more experienced and sophisticated investors (Agnew and Szykman 2005; Agnew 2006). These characteristics could also affect the formation of investor optimism and fear. To examine the possible impact of investment experience and financial sophistication, we run the same

[3] Figure 2 indicates that the distribution of the standard deviation of returns is skewed. Robustness checks with regressions including transformations of the standard deviation that remove skewness (log or square root of the standard deviation) deliver qualitatively similar results: past risk is not a significant predictor in any of the regressions.

regression models as before, this time adding interaction terms for the levels and changes in realized past returns and realized past risk with derivatives trading (Bauer, Cosemans, and Eichholtz 2009), age quintiles (Korniotis and Kumar 2011b), account tenure (Agnew and Szykman 2005; Seru, Shumway, and Stoffman 2010), income (Agnew and Szykman 2005; Dhar and Zhu 2006), and wealth as proxied by the combined value of an investor's portfolio and house (Vissing-Jorgensen 2003; Agnew and Szykman 2005; van Rooij, Lusardi, and Alessie 2011).

As we find no significant effect of either wealth or trading derivatives, we do not report the results of these variables. For the remaining variables, Tables 6 and 7 report the coefficients for the main effect and the interaction term whenever the latter is significant.

[Tables 6-7 here]

The overall pattern of results indicates that investors who are more experienced (longer account tenure) and more sophisticated (higher income quintile) form their return expectations, risk tolerance, and risk perceptions more cautiously and are less prone to looking at past returns alone in this regard. For example, the risk tolerance of investors in the top 50% of the income distribution is hardly impacted at all by their past returns (and even negatively by changes in past returns). Recall that, overall, investors become more risk tolerant after experiencing positive returns. More sophisticated investors, however, are not subject to this house-money effect (Thaler and Johnson 1990). Similar moderating patterns appear for account tenure with respect to the effect of past returns on return expectations and risk tolerance. Interestingly, older investors have a stronger tendency to extrapolate changes in past returns into the future (Table 6). Most importantly, past risk matters for more experienced investors: older investors and those with longer account tenure increase their risk perception after experiencing more risk or greater changes in past risk (Table 7).

6.2 Investor Overconfidence

Barber and Odean (2001) show that women are less likely to engage in overconfident investment behavior. Indeed, results in Table 7 show that female investors become less risk tolerant after experiencing a greater change in past risk. That is, female investors react more rationally to experiencing higher risk than do male investors, who update their risk tolerance in the same direction as experienced past risk. As a typical measure of overconfidence (Barber and Odean 2000; Statman, Thorley, and Vorkink 2006; Bailey, Kumar, and Ng 2008), trading activity should be positively related to investor optimism and negatively to investor fear. Indeed, Tables 4 and 5 show that past turnover is positively related to return expectations, while trading activity (likelihood to trade) is positively related to risk tolerance, and negatively to risk perceptions.

6.3 Signal Salience

To the extent that our finding that changes in return expectations, risk tolerance, and risk perceptions are driven by investors' past returns, but not by their past risk, is related to the salience of these signals, one could expect the impact of past returns to be stronger when an investor achieved a return that exceeds a highly salient benchmark. According to recent research (Barber and Odean 2008; Veld and Veld-Merkoulova 2008), the market index, whose returns are most frequently reported in the news, will be an especially salient benchmark in this respect. To test this expectation, we interact a dummy variable indicating whether an investor has beaten the Dutch stock market index (AEX) with his or her returns and changes in returns in the return regressions introduced in Section 5. The regressions of risk tolerance and risk perceptions on past returns and changes in past returns do not yield significant results for the interaction term. However, with respect to return expectations, a clear picture emerges: beating the return of the index increases the slope of the change of

return expectations with respect to both past returns and changes in past returns. In particular, the main effect of past returns is reduced from 0.469 to 0.396, while the interaction term of beating the index and past returns is 0.347 (compare Tables 4 and 8). Thus, achieving returns that exceed a highly salient benchmark increases investors' return expectations more than does just achieving high returns.

[Table 8 here]

The results on signal salience also help answer another puzzling question: Why does *past* risk not effectuate changes in most investors' risk tolerance and risk perceptions, while these two measures (and changes therein) are generally strong predictors of the risk that investors *subsequently* take (see, e.g., HPP 2010)? That is, in the formation of investor fear, risk seems to be ignored, but when selecting portfolios, investors apparently do incorporate information on risk. Potentially, the underlying reason for this discrepancy lies in the communication interface design of a typical brokerage system. When buying (or selling) a security, snapshot information on past return and past risk is automatically displayed to clients or is just a mouse click away. Thus, at this stage of the investment process, past risk is highly salient. However, for the individual components of and/or the complete existing portfolio of an investor, such information is generally much more cumbersome to retrieve. Generally, only information on past return performance in either absolute or relative terms is readily available at this stage. Moreover, information on the past risk of each portfolio component needs to be looked up by the investor himself or herself, and to figure the risk of the complete portfolio, relatively complex calculations need to be performed. Clearly, for many investors, this requires too much effort and they thus rely primarily on past return information, which is easily available.

6.4 Asymmetric Effects of Positive and Negative Returns

According to the "ostrich effect" (Karlsson, Loewenstein, and Seppi 2009), investors are more likely to watch their portfolio holdings in a rising market than in a falling one. Related to this phenomenon, Shafir (1993) and Johnson, Tellis, and Macinnis (2005) show that positive information (upward trends) typically has a greater impact than negative information (downward trends). Accordingly, one could expect investors who achieve positive returns to update their return expectations, risk tolerance, and risk perceptions to a greater extent than investors without such positive returns. To check for this possibility, we interact a dummy variable indicating whether an investor achieved a positive return with past returns or changes in past returns. The regressions of risk tolerance and risk perceptions on past returns and changes in past returns do not yield significant results for the interaction term. However, with respect to return expectations, we find a significant effect: Having achieved a positive return increases the slope of the change of return expectations with respect to the effect of past returns. In particular, the main effect of past returns is reduced from 0.469 to 0.365, while the interaction term of having had a positive return and past returns becomes 0.414 (compare Tables 4 and 8). Thus, achieving a positive return leads to a larger increase in return expectations than the decrease in return expectations that results from a negative return of the same size.

6.5 Alternative Time Horizons

To this point, we have tested the impact of last month's return and risk on next month's change in optimism and fear, finding that past returns are an important determinant thereof but that past risk is not. However, we have no theory leading us to expect that one month is the exact time horizon investors use in forming optimism and fear. Thus, in the following, we test the effect of using different time horizons for past returns and risk. In particular, we run

the same regression models as in Section 5, but instead of using information on the returns and risk of the past month, we alternatively use information on the past 60, 20, and 10 days. Results obtained in these alternative specifications confirm the findings from the previous section: past returns are an important predictor of investors' optimism and fear (Table 9), whereas past risk is not (untabulated to conserve space).

[Table 9 here]

With respect to past returns, this analysis provides additional insights. The size of the coefficient of the past 60-day return in the return expectation regression is only about one-third the size of the coefficients in the regressions referring to shorter return horizons, and is less significant. Thus, for the formation of return expectations, more immediate experiences matter more (see Table 9, Panel A). Similar tendencies arise with respect to the formation of risk perceptions. For the formation of investor risk attitude, however, a different pattern is revealed: more distant experiences (past 60 days) matter more, which is in line with the results of Section 4 that risk attitudes are more stable and less influenced by the recent past.

6.6 Alternative Performance and Risk Measures

In the previous analyses, we used investors' past returns as a measure of performance and the standard deviation of these returns as a measure of risk. Next, we perform a sensitivity analysis to test whether our prior results continue to hold when other measures of past performance and risk are employed. As alternative measures for past performance, we use the risk-adjusted one-factor Alpha and the Sharpe ratio; for past risk, we use the one-factor Beta.[4]

[4] We cannot estimate multi-factor alphas and betas because of limitations on the portfolio-holdings data. Daily market-value data on the portfolio level is available for all investors. Detailed portfolio component data, however, is only available for 30% of the investors. But even in that case, only the name of the security, the indication of the asset class, and the historical purchase prices are available for each portfolio component.

The results obtained with these alternative measures confirm our previous findings (Table 10): past performance is a powerful driver of investor optimism and fear, while past risk is not.

[Table 10 here]

Specifically, we find that past Alpha, like past returns, is a strong driver of investor optimism and fear. Both variables are highly correlated (Pearson correlation coefficient between return and Alpha = 0.72), and thus impact investors in a similar way. The past Sharpe ratio takes into account both the past returns and their risk (standard deviation). Accordingly, we find that it is a weaker driver of investor optimism and fear. That is, since this measure combines the strong predictor past return with the insignificant predictor past standard deviation (noise), its total explanatory power shrinks. We find that the Sharpe ratio is only relevant for shaping changes in return expectation, but that it is not a significant predictor for risk tolerance or risk perception (the past return in the risk tolerance and perceptions regressions was significant at only the 10% level (compare Table 4)). Past systematic risk (Beta), like the past standard deviation of returns, is not a significant predictor of investor optimism or fear.

6.7 Discriminant Validity of Survey Measures

The similar reaction of the three survey measures to past returns does not result from a lack of discriminant validity. The survey measures employ validated scales from prior literature and have been shown to be reliable measurement instruments (Nunnally and Bernstein 1994). Additionally, using the same data set, HPP (2010) show that the three survey measures relate to different aspects of investor behavior, which supports their discriminant validity. For example, return expectations, risk tolerance, and risk perceptions are all related to trading activity, but only risk tolerance and risk perceptions are related to risk-taking behavior (i.e.,

buy-sell ratios and portfolio risk). Finally, the correlations between the survey measures on the individual-investor level are far from unity (Table 11).

[Table 11 here]

7. Summary and Conclusions

Prior research shows that individual investor behavior can influence asset prices, market volatility, and even the macro economy (Kumar and Lee 2006; Foucault, Sraer, and Thesmar 2011; Korniotis and Kumar 2011a). Important drivers of individual investor behavior are investors' optimism, as expressed by their return expectations, and investors' fear, as expressed by their risk tolerance and risk perceptions (HPP 2010). Debated, however, is how individual investors exactly *form* and *update* their optimism and fear as a function of their individually-experienced past returns and past risk.

The results of this paper helps to resolve this controversy in the existing literature by showing that investor returns are a powerful driver of their optimism as well as of their fear: past returns positively impact investors' return expectations and risk tolerance, and negatively impact their risk perceptions. The risk associated with these returns, however, is not related to changes in investors' return expectations, risk tolerance, or risk perceptions. The tendency to look primarily at past returns is especially pronounced among less experienced and sophisticated, and more overconfident, investors. These investors seem to find it difficult to evaluate and interpret portfolio risk, and use portfolio returns as a more easily available and salient performance metric.

The findings of this paper have implications for theory as well as for practice. Regarding theory, our results help explain a common puzzle in the mutual fund flow literature where it is typically found that past fund returns are a powerful driver of fund flows, but past risk is not (see e.g., Sirri and Tufano 1998). Moreover, this literature finds that

positive past returns are stronger drivers of fund flows than are negative returns. The results of this paper shed light on these previous findings. As only past returns (and not risk) shape investors' return expectations, risk tolerance, and risk perception, and these measures drive their trading and risk-taking behavior, only past returns drive mutual fund flows.

Moreover, the momentum-like impact of past returns on subsequent changes in investor optimism and fear (trend following) provides empirical evidence with respect to the psychological factors contributing to the creation of asset-price bubbles. Hommes and Wagener (2009), for example, show that bubbles typically occur in adaptive belief systems where agents have heterogeneous expectations and (most) agents use trend-following strategies. We find support in our data for the existence of such conditions.

In addition, finding that individual investors are biased toward the returns they realize but ignore their risks helps explain the *underlying mechanisms* of investor overconfidence. That is, prior work suggests that achieving positive returns breeds overconfidence (Statman, Thorley, and Vorkink 2006; Nicolosi, Peng, and Zhu 2009). Our finding suggests that investors are relatively unaware of the risks of these returns or, at least, do not incorporate them in updating their return expectations. This tendency may make investors even more overconfident, as they might not fully realize that returns should primarily compensate for the risk taken (see e.g., Markowitz 1952; Sharpe 1964).

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Table 1

Variable Definitions

Variable	Definition
Gender	Indicator variable taking the value 0 for male investors and 1 for female investors.
Age	Age of the investor in years as of April 2008.
Account Tenure	Account tenure of the investor in years as of April 2008.
Income	Annual disposable income in 2007 (equals gross income minus taxes, social security contributions, and health insurance premiums paid). Assigned to each investor based on their 6-digit postal code. This postal code is unique for each street in the Netherlands. Data source is the average net income per 6-digit postal code from Statistics Netherlands (Central Bureau of Statistics).
Portfolio Value	Value of the investment assets in an investor's account at the end of the month.
House Value	Value of the house in 2008. Assigned to each investor based on his or her 6-digit postal code. This postal code is unique for each street in the Netherlands. Data source is the average residential house value per 6-digit postal code from Statistics Netherlands (Central Bureau of Statistics).
Wealth	Portfolio Value + House Value
Derivatives	Indicator variable taking the value 1 if an investor traded an option or futures contract at least once during a particular month; 0 otherwise.
Traded	Indicator variable taking the value 1 if an investor traded in a particular month; 0 otherwise.
Turnover	Average of the absolute values of all purchases and sales in a particular month divided by the average of the portfolio values at the beginning and end of a particular month.
Return	Monthly investor return given by the product of the daily relative changes in the value of his or her portfolio after transaction costs and portfolio in- and outflows.
Std(Return)	Investor-specific standard deviation of daily portfolio returns in a particular month in monthly terms.
Alpha	One-factor alpha (Jensen's alpha) in a particular month (in monthly terms).
Beta	One-factor beta in a particular month.
Sharpe Ratio	Monthly return divided by the standard deviation of return (in monthly terms).
Return Expectation	Reflects how optimistic a respondent is about his or her investment portfolio and its returns in the upcoming month. Details on the survey questions are given in Table 3.
Risk Tolerance	Reflects a respondent's general predisposition toward financial risk. Details on the survey questions are given in Table 3.
Risk Perception	Reflects a respondent's interpretation of how risky the stock market will be in the upcoming month. Details on the survey questions are given in Table 3.

Due to data availability, the data retrieved from Statistics Netherlands refer to different years, that is, to 2007 for income and to 2008 for house value.

Table 2
Descriptive Statistics

Panel A: All Brokerage Accounts													
Month		Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
Investors	N	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376
Gender	mean	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Age	mean	50.56	50.56	50.56	50.56	50.56	50.56	50.56	50.56	50.56	50.56	50.56	50.56
Age	std	13.57	13.57	13.57	13.57	13.57	13.57	13.57	13.57	13.57	13.57	13.57	13.57
Account Tenure	mean	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07
Account Tenure	std	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77
Income €	mean	20,242	20,242	20,242	20,242	20,242	20,242	20,242	20,242	20,242	20,242	20,242	20,242
Income €	std	4,314	4,314	4,314	4,314	4,314	4,314	4,314	4,314	4,314	4,314	4,314	4,314
Portfolio Value €	mean	52,854	52,695	44,872	42,840	45,963	37,688	31,127	30,100	30,679	29,564	26,514	27,875
Portfolio Value €	std	156,058	156,096	134,883	127,338	135,203	117,935	101,325	104,663	105,279	99,322	91,598	92,307
House Value €	mean	278,982	278,982	278,982	278,982	278,982	278,982	278,982	278,982	278,982	278,982	278,982	278,982
House Value €	std	112,278	112,278	112,278	112,278	112,278	112,278	112,278	112,278	112,278	112,278	112,278	112,278
Fraction Derivatives		0.22	0.20	0.21	0.21	0.19	0.22	0.25	0.18	0.16	0.17	0.17	0.18
Fraction Traded		0.46	0.47	0.48	0.47	0.41	0.51	0.63	0.42	0.37	0.41	0.40	0.42
Turnover (Traders)	mean	0.55	0.46	0.42	0.60	0.46	0.62	0.99	0.73	0.61	0.80	0.67	0.78
Turnover (Traders)	std	1.53	1.22	1.12	1.85	1.41	1.87	3.63	1.82	1.82	2.77	2.49	2.46

Table 2
Descriptive Statistics – continued

Panel B: Survey Respondents													
Month		Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
Investors	N	787	701	605	557	520	491	650	402	330	312	272	291
Gender	mean	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.09	0.09
Age	mean	50.55	51.22	51.50	51.83	52.79	52.60	51.50	52.31	52.65	52.64	53.83	53.25
Age	std	13.51	13.55	13.43	13.57	12.90	13.05	13.29	13.25	12.88	12.86	12.62	12.67
Account Tenure	mean	3.93	3.98	4.09	3.98	4.11	4.08	4.26	4.35	4.34	4.45	4.53	4.38
Account Tenure	std	2.76	2.79	2.77	2.78	2.77	2.76	2.78	2.73	2.75	2.74	2.68	2.71
Income €	mean	20,181	20,088	20,109	19,978	20,085	20,002	20,147	19,892	19,859	20,046	20,034	20,028
Income €	std	4,285	3,956	4,240	3,729	3,835	4,153	4,197	3,808	3,543	3,897	3,844	3,860
Portfolio Value €	mean	54,446	54,264	45,411	45,509	49,557	39,707	29,490	33,660	30,169	30,693	27,444	27,229
Portfolio Value €	std	143,872	144,617	128,455	128,159	124,176	105,507	100,216	118,529	66,600	66,198	53,089	55,039
House Value €	mean	276,690	272,969	272,038	273,559	274,221	274,736	277,543	272,429	272,020	273,443	277,193	273,037
House Value €	std	110,125	102,015	109,290	101,943	101,006	110,771	112,864	104,787	98,530	99,506	108,672	100,576
Fraction Derivatives		0.24	0.23	0.25	0.25	0.23	0.24	0.26	0.19	0.20	0.24	0.22	0.20
Fraction Traded		0.52	0.54	0.55	0.52	0.46	0.54	0.64	0.46	0.42	0.48	0.49	0.45
Turnover (Traders)	mean	0.65	0.43	0.49	0.57	0.36	0.50	1.10	0.86	0.47	0.56	0.70	1.00
Turnover (Traders)	std	1.82	1.13	1.41	1.61	0.91	1.08	4.68	2.23	1.51	1.07	2.08	3.91
Return Expectation	mean	4.28	4.18	3.57	3.78	4.09	3.45	3.37	3.59	3.72	3.97	3.53	4.16
Return Expectation	std	0.94	0.92	0.96	0.97	1.00	1.06	1.04	1.10	0.99	1.09	1.17	1.06
Risk Tolerance	mean	3.91	3.93	3.58	3.77	3.85	3.56	3.67	3.70	3.79	3.74	3.73	3.86
Risk Tolerance	std	1.19	1.11	1.25	1.19	1.18	1.30	1.33	1.26	1.18	1.20	1.28	1.14
Risk Perception	mean	4.49	4.44	5.00	4.15	3.97	4.45	4.27	4.26	4.24	4.18	4.44	4.24
Risk Perception	std	1.63	1.58	1.93	1.13	1.15	1.17	1.31	1.28	1.24	1.22	1.32	1.20

This table presents monthly summary statistics for the brokerage account data. Panel A refers to all investors for whom brokerage records are available. This sample includes the investors who participated at least once during the entire sample period in the survey, and who were not exclude by the sample selection restrictions defined in Section 1. The monthly summary statistics presented in Panel B refer to the subset of investors who responded to the survey in each respective month. Variables are defined in Table 1.

Table 3
Survey Questions

Survey Variable	Answer Categories
Return Expectation (1 = low/pessimistic, 7 = high/optimistic)	
Next month, I expect my investments to do less well than desired.	1 (totally agree)–7 (totally disagree)
For the next month, I have a positive feeling about my financial future.*	1 (totally agree)–7 (totally disagree)
Next month, my investments will have a worse performance than those of most other investors.	1 (totally agree)–7 (totally disagree)
Next month, it is unlikely that my investment behavior will lead to positive returns.	1 (totally agree)–7 (totally disagree)
For the next month, the future of my investment portfolio looks good.*	1 (totally agree)–7 (totally disagree)
Risk Tolerance (1 = low risk tolerance, 7 = high risk tolerance)	
Next month, I prefer certainty over uncertainty when investing.	1 (totally agree)–7 (totally disagree)
Next month, I avoid risks when investing.	1 (totally agree)–7 (totally disagree)
Next month, I do not like to take financial risks.	1 (totally agree)–7 (totally disagree)
Next month, I do not like to "play it safe" when investing.*	1 (totally agree)–7 (totally disagree)
Risk Perception (1 = low perceived risk, 7 = high perceived risk)	
I consider investing to be very risky next month.*	1 (totally agree)–7 (totally disagree)
I consider investing to be safe next month.	1 (totally agree)–7 (totally disagree)
I consider investing to be dangerous next month.*	1 (totally agree)–7 (totally disagree)
I consider investing to have little risk next month.	1 (totally agree)–7 (totally disagree)

This table presents the questions used in this study's 12 consecutive monthly surveys. A 7-point Likert scale is used to record investors' response to each question. Each survey variable (return expectation, risk tolerance, risk perception) is calculated as the equally weighted average of the respective survey questions. * denotes a reverse-scored question. All survey variables are measured using psychometrically validated measurement scales (Nunnally and Bernstein 1994). Cronbach's alpha is between 0.71 and 0.89 for all survey variables, indicating the measurement instrument is reliable (Hair et al. 1998).

Table 4

The Impact of Past Return on Changes in Survey Measures

Dependent Variable	Δ Return Expectation		Δ Return Expectation		Δ Risk Tolerance		Δ Risk Tolerance		Δ Risk Perception		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Return	0.469	0.086 ***			0.186	0.110 *			-0.223	0.133 *		
Δ Return			0.404	0.078 ***			-0.013	0.092			-0.185	0.121
Gender	0.053	0.039	0.057	0.039	-0.015	0.041	-0.016	0.040	-0.027	0.055	-0.033	0.056
Age	0.001	0.001	0.000	0.001	-0.001	0.001	-0.001	0.001	-0.001	0.001	-0.001	0.001
Account Tenure	-0.002	0.003	-0.002	0.003	0.003	0.004	0.002	0.004	-0.002	0.005	-0.003	0.005
ln(Income)	0.014	0.088	0.006	0.087	-0.116	0.105	-0.134	0.106	0.095	0.161	0.101	0.161
ln(Avg. Portfolio Value)	-0.003	0.006	0.004	0.006	-0.006	0.007	-0.002	0.007	0.002	0.009	-0.002	0.009
ln(House Value)	0.016	0.045	0.022	0.045	-0.004	0.051	0.006	0.051	-0.040	0.074	-0.054	0.074
Derivatives	0.017	0.041	-0.008	0.040	-0.050	0.050	-0.068	0.050	-0.074	0.072	-0.060	0.073
Traded	0.038	0.031	0.030	0.031	0.119	0.038 ***	0.119	0.038 ***	0.034	0.053	0.037	0.053
Turnover	0.029	0.012 **	0.019	0.010 **	0.029	0.020	0.020	0.019	-0.041	0.017 **	-0.033	0.015 **
Constant	0.144	0.586	-0.887	0.587	1.214	0.676 *	1.239	0.683 *	-0.633	1.049	-0.092	1.058
Time fixed effects	YES		YES		YES		YES		YES		YES	
N Observations	3,955		3,955		3,955		3,955		3,955		3,955	
N Investors	1,045		1,045		1,045		1,045		1,045		1,045	
R^2	0.165		0.166		0.032		0.030		0.063		0.062	

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor returns or changes in past investor returns and a set of control variables. The columns show results of linear panel models. The number of individual investors included in the regression (1,045) is smaller than the sample available for analysis (1,376) since not all investors responded to the survey for two consecutive months. Standard errors are clustered on the investor level. Variables are defined in Table 1. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5

The Impact of Past Risk on Changes in Survey Measures

Dependent Variable	Δ Return Expectation		Δ Return Expectation		Δ Risk Tolerance		Δ Risk Tolerance		Δ Risk Perception		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Std(Return)	-0.013	0.043			-0.001	0.054			0.033	0.072		
Δ Std(Return)			-0.009	0.076			0.058	0.103			-0.018	0.129
Gender	0.055	0.038	0.060	0.039	-0.014	0.041	-0.017	0.040	-0.027	0.055	-0.034	0.056
Age	0.000	0.001	0.000	0.001	-0.001	0.001	-0.001	0.001	-0.001	0.001	-0.001	0.001
Account Tenure	-0.002	0.003	-0.002	0.003	0.003	0.004	0.002	0.004	-0.003	0.005	-0.003	0.005
ln(Income)	0.014	0.088	0.014	0.088	-0.116	0.105	-0.136	0.106	0.094	0.161	0.098	0.161
ln(Avg. Portfolio Value)	0.004	0.006	0.004	0.006	-0.003	0.007	-0.002	0.007	0.000	0.009	-0.002	0.009
ln(House Value)	0.021	0.045	0.024	0.045	-0.002	0.051	0.006	0.051	-0.043	0.074	-0.055	0.074
Derivatives	-0.017	0.041	-0.019	0.040	-0.064	0.051	-0.068	0.050	-0.062	0.075	-0.055	0.073
Traded	0.031	0.031	0.030	0.031	0.116	0.038 ***	0.119	0.038 ***	0.036	0.053	0.037	0.053
Turnover	0.017	0.012	0.018	0.012	0.024	0.020	0.019	0.019	-0.037	0.016 **	-0.032	0.016 *
Constant	-0.816	0.591	-1.043	0.592 *	0.989	0.685	1.252	0.684 *	-0.217	1.043	-0.024	1.050
Time fixed effects	YES		YES		YES		YES		YES		YES	
N Observations	3,955		3,955		3,955		3,955		3,955		3,955	
N Investors	1,045		1,045		1,045		1,045		1,045		1,045	
R^2	0.158		0.158		0.031		0.031		0.063		0.062	

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor returns risk (standard deviation of return) or changes in past investor return risk and a set of control variables. The columns show results of linear panel models. The number of individual investors included in the regression (1,045) is smaller than the sample available for analysis (1,376) since not all investors responded to the survey for two consecutive months. Standard errors are clustered on the investor level. Variables are defined in Table 1. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6

The Impact of Past Return on Changes in Survey Measures—Interactions with Investor Characteristics

Panel A: Interaction with Return

Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Return						
Gender * Return						
Return						
Age > 25% * Return						
Return						
Age > 50% * Return						
Return						
Age > 75% * Return						
Return						
Account Tenure > 25% * Return						
Return						
Account Tenure > 50% * Return						
Return			0.348	0.110 ***		
Account Tenure > 75% * Return			-0.563	0.199 ***		
Return						
Income > 25% * Return						
Return			0.323	0.123 ***		
Income > 50% * Return			-0.295	0.170 *		
Return						
Income > 75% * Return						

Panel B: Interaction with Δ Return

Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Δ Return						
Gender * Δ Return						
Δ Return						
Age > 25% * Δ Return						
Δ Return			-0.230	0.125 *		
Age > 50% * Δ Return			0.409	0.158 **		
Δ Return	0.301	0.083 ***				
Age > 75% * Δ Return	0.415	0.142 ***				
Δ Return			0.263	0.180		
Account Tenure > 25% * Δ Return			-0.336	0.193 *		
Δ Return	0.541	0.103 ***				
Account Tenure > 50% * Δ Return	-0.246	0.128 *				
Δ Return			0.086	0.098		
Account Tenure > 75% * Δ Return			-0.344	0.183 *		
Δ Return						
Income > 25% * Δ Return						
Δ Return			0.181	0.111		
Income > 50% * Δ Return			-0.414	0.157 ***		
Δ Return						
Income > 75% * Δ Return						

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor returns (Panel A) or changes in past investor returns (Panel B) and a set of control variables. The columns show results of the same panel models previously used in Table 5, with additionally including alternative interaction terms. In each regression model only one interaction term is included at the same time. That is, each two-variable block reported refers to an alternative model specification. Reported are the main effect or the respective return variable and the interaction effect. Interaction variables with percentages refer to the quartiles in the distribution of the respective variable in the investor sample. Other variables are defined in Table 1. Standard errors are clustered on the investor level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7

The Impact of Past Risk on Changes in Survey Measures—Interactions with Investor Characteristics

Panel A: Interaction with Std(Return)

Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Std(Return)						
Gender * Std(Return)						
Std(Return)						
Age > 25% * Std(Return)						
Std(Return)						
Age > 50% * Std(Return)						
Std(Return)						
Age > 75% * Std(Return)						
Std(Return)						
Account Tenure > 25% * Std(Return)						
Std(Return)						
Account Tenure > 50% * Std(Return)						
Std(Return)					-0.030	0.082
Account Tenure > 75% * Std(Return)					0.159	0.096 *
Std(Return)						
Income > 25% * Std(Return)						
Std(Return)						
Income > 50% * Std(Return)						
Std(Return)						
Income > 75% * Std(Return)						

Panel B: Interaction with Δ Std(Return)

Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Δ Std(Return)			0.093	0.107		
Gender * Δ Std(Return)			-0.463	0.244 *		
Δ Std(Return)					-0.457	0.245 *
Age > 25% * Δ Std(Return)					0.504	0.266 *
Δ Std(Return)						
Age > 50% * Δ Std(Return)						
Δ Std(Return)						
Age > 75% * Δ Std(Return)						
Δ Std(Return)						
Account Tenure > 25% * Δ Std(Return)						
Δ Std(Return)						
Account Tenure > 50% * Δ Std(Return)						
Δ Std(Return)						
Account Tenure > 75% * Δ Std(Return)						
Δ Std(Return)						
Income > 25% * Δ Std(Return)						
Δ Std(Return)						
Income > 50% * Δ Std(Return)						
Δ Std(Return)						
Income > 75% * Δ Std(Return)						

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor return risk (standard deviation of return) (Panel A) or changes in past investor return risk (Panel B) and a set of control variables. The columns show results of the same panel models previously used in Table 6, with additionally including alternative interaction terms. In each regression model only one interaction term is included at the same time. That is, each two-variable block reported refers to an alternative model specification. Reported are the main effect or the respective return risk variable and the interaction effect. Interaction variables with percentages refer to the quartiles in the distribution of the respective variable in the investor sample. Other variables are defined in Table 1. Standard errors are clustered on the investor level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8

The Impact of Past Return on Changes in Survey Measures—Interactions with Return Benchmarks

Panel A: Interaction with Return

Dependent Variable	Δ Return Expectation			Δ Risk Tolerance			Δ Risk Perception		
	Coef.	Std. err.		Coef.	Std. err.		Coef.	Std. err.	
Return	0.396	0.096	***						
Beaten * Return	0.347	0.182	*						
Return	0.365	0.106	***						
Positive * Return	0.414	0.225	*						

Panel B: Interaction with Δ Return

Dependent Variable	Δ Return Expectation			Δ Risk Tolerance			Δ Risk Perception		
	Coef.	Std. err.		Coef.	Std. err.		Coef.	Std. err.	
Δ Return	0.410	0.097	***						
Beaten * Δ Return	-0.015	0.121							
Δ Return	0.410	0.099	***						
Positive * Δ Return	-0.011	0.132							

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor returns (Panel A) or changes in past investor returns (Panel B) and a set of control variables. The columns show results of the same panel models previously used in Table 5, with additionally including alternative interaction terms. In each regression model only one interaction term is included at the same time. That is, each two-variable block reported refers to an alternative model specification. Reported are the main effect or the respective return variable and the interaction effect. Interaction variables are Beaten (= 1 if past return is larger than the past index (AEX) return; 0 otherwise) or Positive (= 1 if past return is positive; 0 otherwise). Other variables are defined in Table 1. Standard errors are clustered on the investor level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9
The Impact of Past Return on Changes in Survey Measures—Alternative Past Return Windows

Panel A: Impact of Past Return						
Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Return past 60 days	0.152	0.080 *	0.257	0.107 **	-0.214	0.131
Return past month (baseline)	0.469	0.086 ***	0.186	0.110 *	-0.223	0.133 *
Return past 20 days	0.460	0.080 ***	0.056	0.098	-0.296	0.122 **
Return past 10 days	0.452	0.069 ***	0.063	0.082	-0.241	0.105 **
Panel B: Impact of Change in Past Return						
Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Δ Return past 60 days	0.560	0.109 ***	0.267	0.150 *	-0.246	0.172
Δ Return past month (baseline)	0.404	0.078 ***	-0.013	0.092	-0.185	0.121
Δ Return past 20 days	0.391	0.073 ***	-0.039	0.088	-0.144	0.107
Δ Return past 10 days	0.359	0.060 ***	0.069	0.069	-0.131	0.086

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor returns (Panel A) or changes in past investor returns (Panel B) and a set of control variables. The columns show results of the same panel models previously used in Table 5, with alternative windows for past returns. Each line reported refers to an alternative model specification. All returns are scaled to refer to monthly terms. Variables are defined in Table 1. Standard errors are clustered on the investor level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10

The Impact of Past Return and Risk on Changes in Survey Measures—Alternative Performance and Risk Measures

Panel A: Impact of Past Performance and Risk						
Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Alpha	0.410	0.086 ***	0.234	0.101 **	-0.323	0.112 ***
Sharpe Ratio	0.205	0.028 ***	0.029	0.037	-0.062	0.047
Beta	-0.002	0.016	-0.010	0.020	-0.030	0.029
Panel B: Impact of Change in Past Performance and Risk						
Dependent Variable	Δ Return Expectation		Δ Risk Tolerance		Δ Risk Perception	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Δ Alpha	0.358	0.075 ***	0.170	0.088 *	-0.172	0.096 *
Δ Sharpe Ratio	0.161	0.022 ***	0.006	0.026	-0.056	0.038
Δ Beta	-0.007	0.017	-0.022	0.022	-0.017	0.031

This table presents the results from regressions of changes in investor return expectation, risk tolerance, or risk perception on past investor Alpha, Sharpe ratio, or Beta (Panel A) or changes in these variables (Panel B) and a set of control variables. The columns show results of the same panel models previously used in Table 5, with alternative measures for past performance and risk. Each line reported refers to an alternative model specification. All performance and risk variables are scaled to refer to monthly terms. Variables are defined in Table 1. Standard errors are clustered on the investor level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11
Correlations Between Survey Measures and Returns

Panel A: Correlation Matrix for Levels in Survey Measures and Returns				
	Return Expectation	Risk Tolerance	Risk Perception	AEX Monthly Return
Risk Tolerance	0.29***			
Risk Perception	-0.34***	-0.12***		
AEX Monthly Return	0.30***	0.09***	-0.04***	
Investor Monthly Return	0.19***	0.00	-0.07***	0.49***
Panel B: Correlation Matrix for Changes in Survey Measures and Returns				
	Δ Return Expectation	Δ Risk Tolerance	Δ Risk Perception	Δ AEX Monthly Return
Δ Risk Tolerance	0.20***			
Δ Risk Perception	-0.26***	-0.10***		
Δ AEX Monthly Return	0.37***	0.13***	-0.17***	
Δ Investor Monthly Return	0.21***	0.03*	-0.08***	0.20***

This table presents the Pearson correlation coefficients between (end-of-month) investor survey measures and the corresponding (i.e., for the same month) realized total return on the Dutch stock market index (AEX), and individual investor returns. Panel A refers to levels in survey measures and returns; Panel B refers to changes in survey measures and returns. Variables are defined in Table 1. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

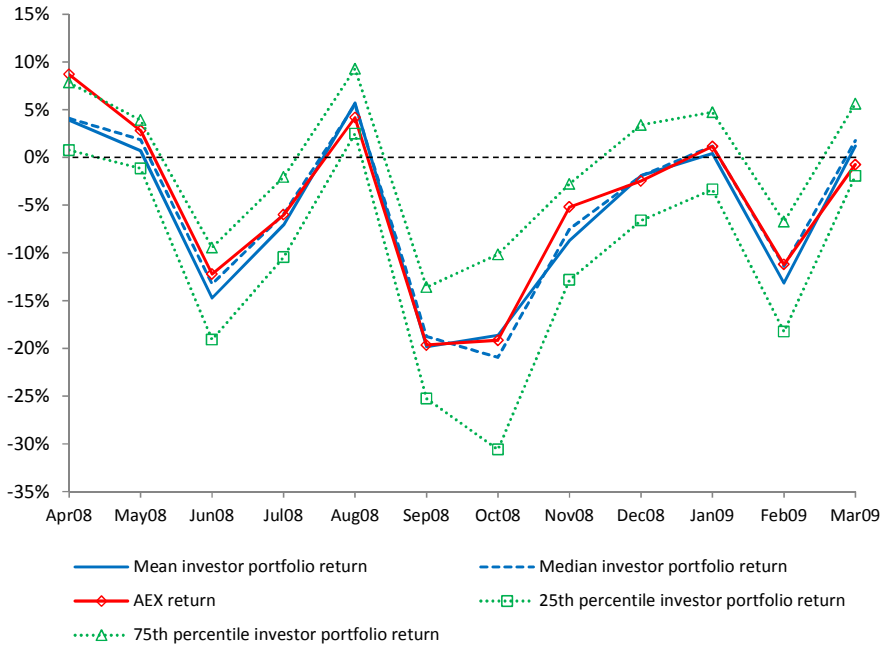

Figure 1. Investor Returns. Returns are depicted in monthly terms. AEX return is the total return of the Dutch stock market index. Variables are defined in Table 1.

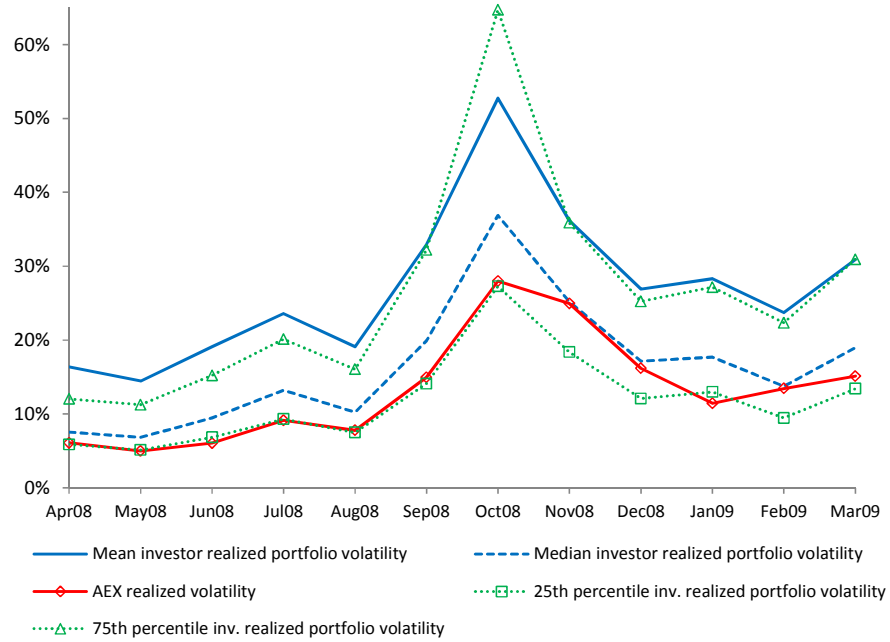

Figure 2. Investor Return Volatility. Investor realized volatility is calculated based on the daily returns on the portfolio. AEX realized volatility is calculated for each month based on the daily total returns of the AEX index. All volatilities are depicted in monthly terms. Variables are defined in Table 1.

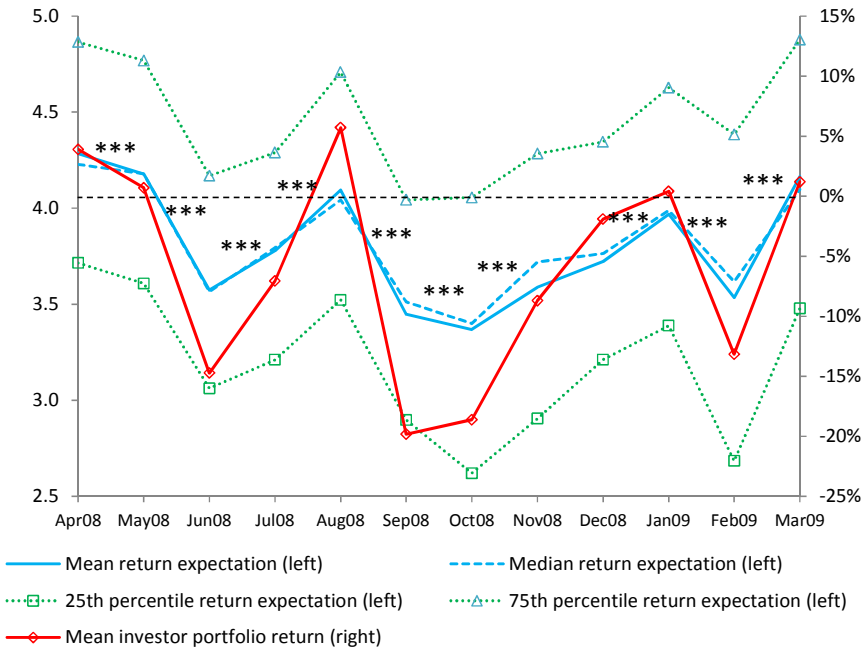

Figure 3. Investor Return Expectations. Return expectations are measured on a 7-point Likert scale (see Table 3). A small value indicates low return expectations, whereas a large value indicates high return expectations. *, **, and *** denote statistically significant differences between the means for subsequent month pairs for return expectations at the 10%, 5%, and 1% levels, respectively.

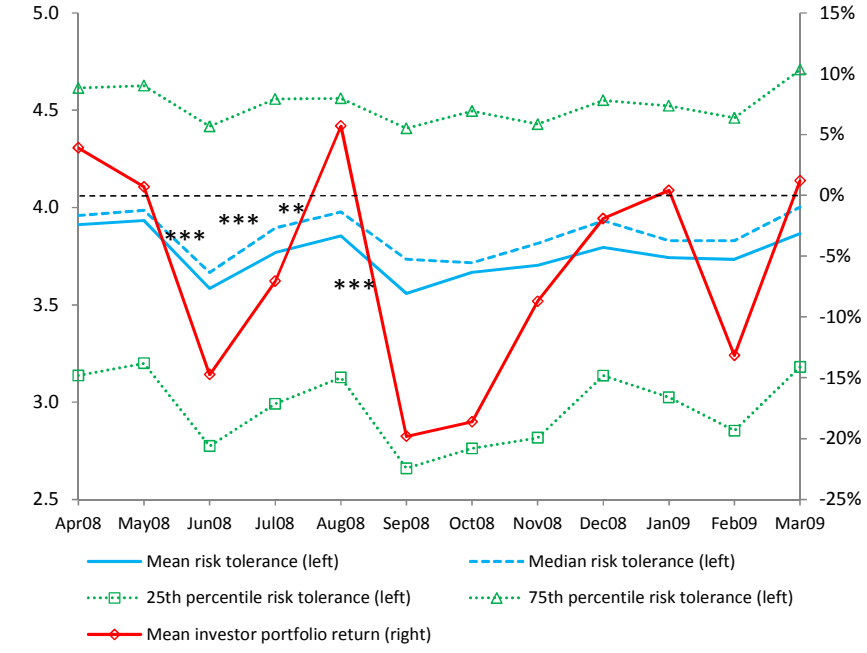

Figure 4. Investor Risk Tolerance. Risk tolerance is measured on a 7-point Likert scale (see Table 3). A small value indicates low risk tolerance, whereas a large value indicates high risk tolerance. *, **, and *** denote statistically significant differences between the means for subsequent month pairs for risk tolerance at the 10%, 5%, and 1% levels, respectively.

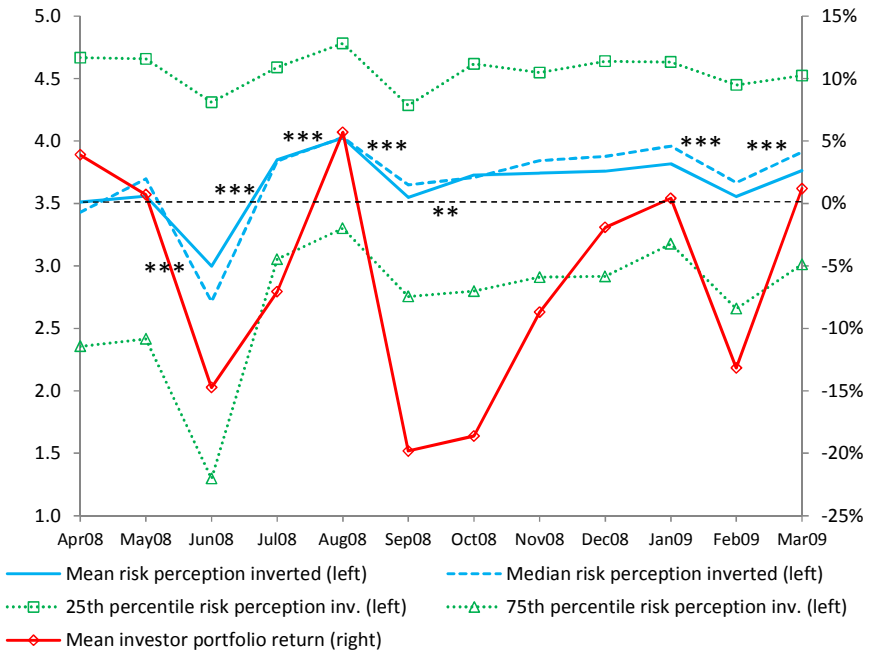

Figure 5. Investor Risk Perception. Risk perception about investment prospects is measured on a 7-point Likert scale (see Table 3). For illustrative purposes, risk perception is shown on an inverted scale. A small value indicates high perceived risk, whereas a large value indicates low perceived risk. *, **, and *** denote statistically significant differences between the means for subsequent month pairs for risk perception at the 10%, 5%, and 1% levels, respectively.