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How Perceptions Change, Drive Behavior, and Impact Performance

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Individual Investors and the Financial Crisis:

How Perceptions Change, Drive Behavior, and Impact Performance

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Abstract: We show for the first time how individual investor perceptions change, drive trading and risk-taking behavior, and impact investment performance during the 2007–2009 financial crisis. Based on a unique combination of monthly survey data and matching brokerage records of a sample of brokerage clients from April 2008 to March 2009, we find that investor perceptions fluctuate significantly over the sample period, with risk attitudes and risk perceptions being less volatile than return expectations. In particular, revisions in return expectations and risk attitudes are positively, and revisions in risk perceptions negatively, related to overall market developments. Overall, successful investors had higher return expectations and higher risk aversion, which led them to trade less, take less risk, and have lower buy-sell ratios. Investors who outperformed during the height of the crisis (September–October 2008) also performed better before. Afterward, however, they became less risk averse, were no longer less likely to trade, and no longer outperformed, suggesting that their success made them overconfident about their investment skills.

JEL Classification: D14, D81, G01, G11, G24

Keywords: Financial Crisis, Investor Decision Making, Investor Perceptions, Individual Investor Performance

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Individual investors were hit hard by the financial crisis of 2007–2009. Several months of double-digit negative stock market returns almost halved investor portfolio values within the time period studied in this paper (April 2008 to March 2009). This dramatic shock to investor wealth combined with the high uncertainty and extreme volatility of the market likely induced individual investors to radically change their perception of the stock market and/or their own investment behavior (Hudomiet, Kézdi, and Willis 2011). For some investors, it may even have led them to shy away from equity investing all together (Bucher-Koenen and Ziegelmeyer 2011). Ultimately, the recent shock to financial market returns might permanently lower households' stock market participation (Malmendier and Nagel 2011), leading to possible future welfare losses (Cocco, Gomes, and Maenhout 2005). Surprisingly, however, although numerous studies contribute to understanding the crisis's causes and consequences for housing and securitization markets (Foote et al. 2008; Piskorski, Seru, and Vig 2010; Demyanyk and Van Hemert 2011), financial institutions (Shin 2009; Wagner 2010; Brunetti, di Filippo, and Harris 2011; Maddaloni and Peydró 2011; Gropp, Hakenes, and Schnabel 2011), corporate investment decisions (Campello et al. 2011), households (Hurd and Rohwedder 2010; Bricker et al. 2011), bank lending (Ivashina and Scharfstein 2010; Santos 2011), and financial contagion (Longstaff 2010; Tong and Wei 2011), little is known to date about how the 2007–2009 financial crisis affected *individual investors'* perceptions, behavior, and performance.

The current paper closes this gap in the literature and is organized around three objectives: (1) to investigate how individual investors' perceptions, as well as their trading and risk-taking behavior, evolved over the course of the crisis; (2) to understand how the levels and dynamics (month-to-month revisions) of investors' perceptions explain their behavior, and ultimately affect investment performance; and (3) to discover what distinguishes outperforming from underperforming investors during the height of the crisis. We analyze whether their perceptions,

behavior, and performance are persistent; identify the factors underlying their success; and investigate the extent to which these dramatic months and the resulting heterogeneity in performance feeds back on investors' perceptions and behavior.

To achieve our objectives, we combine monthly survey data with matching brokerage records to create a unique set of panel data that allows us to examine the perceptions, behavior, and performance of individual investors during the financial crisis. For each month between April 2008 and March 2009, we measure these investors' perceptions in a survey on their expectations for stock-market returns, as well as their risk attitudes and risk perceptions.[1] In addition, we collect information on these investors' trading behavior and performance through their brokerage records and match this information to the survey data. The sample period corresponds with the time during which worldwide stock markets were hit hardest and includes such major crisis events as the collapse of Lehman Brothers and the AIG bailout.

The results show that during the financial crisis, investor perceptions exhibit significant fluctuation, with risk attitudes and risk perceptions being less volatile than return expectations. During the height of market turbulence, there are sharp increases in the fraction of investors trading, their turnover, and buy-sell ratios. Most importantly, the levels and revisions of investor perceptions help explain their trading and risk-taking behavior and contribute to understanding differences in performance amongst investors. Indeed, we demonstrate that investor perceptions provide explanatory power for their behavior well beyond the effect of past returns. Regarding trading behavior, we find that investors with higher levels and upward revisions of return expectations are more likely to trade, have higher turnover, and trade larger amounts per transaction. Furthermore, investors with higher levels of and upward revisions in their risk

[1] Whenever we do not specifically refer to return expectations, risk attitudes, or risk perceptions, the term "perceptions" is used to refer to these survey variables in a general way and set them apart from the brokerage data.

attitudes (they are and become less risk averse) are more likely to trade and have higher buy-sell ratios. Finally, investors with higher levels of risk perception are more likely to trade, have higher turnover, and have a lower buy-sell ratio. Regarding risk-taking behavior, we find that investors with lower levels of and downward revisions in their risk attitudes (they are and become more risk averse) and that have lower levels of risk perceptions hold portfolios with lower risk. Overall, investors that outperform during the financial crisis are characterized by high return expectations and high risk aversion. Compared to less successful investors, they have lower turnover, take less risk, trade less in derivatives, and have lower buy-sell ratios. Investors who perform well during the height of the crisis (September–October 2008) also perform better before and have higher return expectations during this very volatile period, but become less risk averse afterward. Subsequently, they no longer outperform and are no longer less likely to trade, suggesting that their success makes them overconfident about their investment skills.

This paper contributes to the existing literature in several ways. First, it fills a critical gap in the emerging literature on the 2007–2009 financial crisis by showing for the first time how *individual investors'* perceptions change, drive behavior, and impact performance during this period of uncertainty and volatile markets. It is important to study the experiences of this group of market participants, as the aggregate behavior of individual investors is known to impact stock prices (Kumar and Lee 2006) as well as the macro-economy (Korniotis and Kumar 2011). Moreover, the economic significance of individual investors' stock market participation rises due to an increasing self-responsibility for building up wealth to finance retirement consumption. Second, existing work on individual investors' return expectations, risk attitudes, and risk perceptions often *proxies* for the effect of these factors on individual investors' behavior by assessing their effect on *hypothetical choices* using surveys or experiments (Weber and Milliman 1997; Weber, Weber, and Nosic 2010). This paper, in contrast, examines the *direct* relationship

between individual investors' perceptions and their *actual* trading and risk-taking behavior, using a unique set of matched survey and brokerage data. The use of a real decision context is important. Investors often treat hypothetical choices and risks differently than real choices and risks (Slovic 1969), and results of experiments may not generalize outside of the lab (Kühberger, Schulte-Mecklenbeck, and Perner 2002). Third, this paper goes beyond a static, cross-sectional observation of one of the aforementioned relationships, and is, instead, a dynamic, longitudinal study of their joint effects during the financial crisis.

The paper proceeds as follows. Section 1 presents the brokerage and capital-market data and outlines the survey design and corresponding data collection. Section 2 sets out descriptive results on the dynamics of investors' perceptions, trading and risk-taking behavior, and returns over time. Section 3 links the dynamics of investors' perceptions to their trading and risk-taking behavior, as well as their performance. Section 4 focuses on the most turbulent crisis months and identifies feedback effects of performance on perceptions and behavior. Section 5 presents robustness checks and evaluates alternative explanations. Section 6 summarizes and concludes.

1. Data

We base the analyses on the brokerage records of a sample of 1,510 clients of the largest discount broker in the Netherlands and on matching monthly questionnaire data that we collected for these individual investors from April 2008 through March 2009. Using discount-brokerage data ensures that the observed trading patterns, as well as the survey responses, reflect investors' own decision making and opinions and not those of an advisor. An additional advantage of using a discount broker is that this represents the dominant channel through which both U.S. and Dutch individuals invest in the stock market today (Barber and Odean 2000; Bauer, Cosemans, and Eichholtz 2009). As in Bauer et al. (2009), we exclude accounts owned by minors (age < 18

years) and accounts with an average end-of-month portfolio value (within the sample period) of less than €250. Furthermore, we limit the sample to individual investors. To exclude professional traders, we discard accounts in the top 1% of annual trading volume, number of transactions, or turnover distributions. Imposing these criteria leaves 1,376 individual accounts for investigation.

1.1 Brokerage Records and Capital-Market Data

Complete 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, as well as their 6-digit ZIP code. Based on this ZIP code, which is unique to each street in the Netherlands, and data retrieved from Statistics Netherlands (Central Bureau of Statistics), we assign income and residential house value to each investor. Table 2 shows descriptive statistics of all brokerage accounts available, as well as those for the subset of accounts belonging to clients who responded to the survey in each particular month of the sample period. Variables are defined in Table 1.

[Tables 1-2 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 et al., 2009) shows that the sample is similar with regard to key characteristics, although trading activity is higher, especially compared to U.S. samples. U.S. samples, however, were collected before the advent of low-cost (online) trading platforms for individual investors and the

associated higher frequency of trading (cf. Bailey, Kumar, and Ng 2010). Comparing the average account value of the surveyed investors to the average account value of €50,000–60,000 for Dutch individual investors in general (Bauer et al., 2009) suggests that the average investor in the sample invests more than three-fourths of her total self-managed portfolio with this broker. Over 40% of survey respondents hold an investment account only with this particular broker. Of the respondents who also have accounts with other brokers, more than 50% indicated that the other account(s) comprise(s) less than half their total investment portfolio. In addition to the reported results, we ran all analyses separately for investors who invest only at this broker and those who do not, but found no significant differences. Together with the reasons outlined above, the sample seems sufficiently representative to justify extrapolating to the broader population of self-managed individual investors any significant pattern of results that emerges. To relate individual investors' perceptions and trading behavior to overall stock-market developments, we use DataStream. As there is no capital gains tax under the Dutch tax system, the data and results are not affected by tax-loss selling motivated trading.

1.2 Survey Design and Data Collection

At the end of each month between April 2008 and March 2009, we conducted a survey among a panel of the broker's clients. To develop the panel, we sent an email invitation to 20,000 randomly selected clients in March 2008. Six months later, a re-invitation was sent to all initially invited clients to maintain a sufficient response rate. There were 856 clients who responded to the first questionnaire of April 2008. The resulting response rate of 4.28% is in line with those of comparable large-scale surveys (cf. Dorn and Sengmueller 2009). Including respondents who joined the panel after April 2008, 1,510 clients answered at least one questionnaire, with an

average of 539 clients answering each month, and a minimum of 296. Regarding willingness to respond regularly, 319 (43) clients responded at least 6 (12) consecutive times (see Table 2).

A possible concern with samples of investors such as the one used in this study is that monthly variation of non-response might not be random. For example, the especially successful or, alternatively, unsuccessful, investors could be more likely to respond. Such response behavior could distort the inferences we make from the data. Section 5.1 provides a number of robustness checks showing that the sample is not subject to non-random response behavior problems.

The survey elicited information on investors' expectations of stock market returns, their risk attitudes, and their risk perceptions for the upcoming month (see Table 3). To ensure a valid measurement of these variables, we utilize tested and well-established measures from the psychometric literature (Nunnally and Bernstein 1994). Return expectations reflect the extent to which a respondent is optimistic about her investment portfolio and corresponding returns and are measured in line with Weber et al. (2010). Risk attitude reflects a respondent's general predisposition toward financial risk (like or dislike of risky situations) and is measured following Pennings and Smidts (2000). Risk perception reflects a respondent's 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). The reliability of the measurement instrument is high, as Cronbach's alpha is between 0.71 and 0.89 for the different survey variables (Hair et al. 1998). One-factor solutions of exploratory factor analyses confirm the variables' convergent validity. Additional factor analyses show that cross-loadings between the different survey variables are either low or insignificant, confirming their discriminant validity (Nunnally and Bernstein 1994). In line with Dillon and McDonald

(2001), the survey variables are computed by equally weighting and averaging their respective item scores. This type of variables performs at least as well as those employing "optimally" weighted scores using factor analysis, but have the advantage of expressing a readily interpretable absolute modal meaning (Dillon and McDonald 2001, p. 62).

[Table 3 here]

2. Descriptive Results

This section addresses the first research objective. That is, we examine how individual investors' trading behavior, risk taking, investment returns, and perceptions evolve over the course of the crisis.

2.1 Investor Trading Behavior, Risk-Taking Behavior, and Returns

Figures 1–5 show key indicators of investors' trading behavior, risk-taking behavior, and returns during the sample period, and relate these to the volume, volatility, and returns of the Dutch stock market index, AEX.

[Figures 1-5 here]

Both the share of investors trading and their turnover sharply increase during the height of the crisis in September–October 2008 (Figure 1). The variation in monthly volume traded by individual investors is similar to that of the overall market (Figure 2). During September–October 2008, buying volume increases and is larger than selling volume (Figure 2). In line with Kaniel, Saar, and Titman's (2008) findings for normal stock-market periods, this study's sample

of investors, on average, increase their buying volume after price decreases (and vice-versa). That is, during the market turbulence, individual investors enter the market when prices appear to be depressed. Wang (2010) finds similar behavior for individual investors in China.

Investor's returns (calculated as the product of the daily relative changes in the value of the investment portfolio, taking into account transaction costs and portfolio in- and outflows) closely resemble market returns (Figure 3). Similarly, investors' realized return volatilities track that of the market, while being higher, on average (Figure 4). The higher buy than sell volumes are thus not the result of investors reducing portfolio risk, but instead indicate a desire to maintain risky asset exposure even during the financial crisis. Especially in September–October 2008, investors' average return volatility spikes and continues to exceed the market's volatility (Figure 4). Thus, in contrast to Weber et al.'s (2010) findings obtained for a choice experiment with U.K. individual investors, our trading data indicate that Dutch individual investors continue investing in risky assets during the crisis.

2.2 Investor Perceptions

Figures 5 and 6 show the evolution of individual investors' return expectations, risk attitudes, and risk perceptions during the crisis and relate these to the returns of the Dutch stock market index, AEX.

[Figures 5-6 here]

Overall, return expectations (measured at the end of each month) closely follow past market returns (Figure 5). Consistent with earlier studies using survey data obtained from a panel of Dutch households in April 2004 and in April 2006 (Hurd, van Rooij, and Winter 2011), our

longitudinal research design shows that return expectations appear to be influenced by recent stock-market developments. This finding is also in line with results obtained from the Survey of Economic Expectations in 1999–2001 and the Michigan Survey of Consumers in 2002–2004 (Dominitz and Manski 2011), which indicate that U.S. households' expectations of equity returns are often based on the belief that recent stock-market performance will persist into the near future. Our results extend these earlier findings by showing that the relationship between return expectations and market returns not only holds for households in general (that may or may not participate in the stock market), but also for a sample of self-directed individual investors and during very volatile market phases, such as that experienced during the financial crisis of 2007–2009.

We find similar effects for risk attitude and risk perception, though these measures display less fluctuation over the sample period (cf. Sahm 2007; Bateman et al. 2010; Weber, Weber, and Nosic 2010). Regarding risk attitudes, this study's findings extend those of Bateman et al. (2010) and Weber et al. (2010) by having a longitudinal research design with more frequent measurement. As such, we can obtain a more detailed insight into how individual investors' risk attitudes change during the course of the financial crisis. Indeed, although this study's results are similar to those obtained by Weber et al. (2010) for the same months investigated in their U.K.-based survey (August 2008, November 2008, and February 2009), we find far more significant changes from month to month (Figure 6).[2] As risk attitudes and changes therein are an important driver of investors' behavior and help explain their performance during the crisis (see Sections 3 and 4), having a frequent measurement provides additional insight into their dynamics during

[2] Our results cannot be compared with those of Bateman et al. (2010), because risk tolerance in their study is inferred from two data points, March 2007 and October 2008, the first of which falls outside our sample period.

times of market turbulence, which are more difficult to identify when investigating longer time intervals.

3. How Investors' Perceptions Drive Trading Behavior, Risk Taking, and Performance

The previous analyses illustrate that investor perceptions, trading behavior, and risk taking vary from month to month on an investor-averaged basis, while they are linked to each other through variations in market returns. Here, we address the second research objective by examining how the underlying time variation in investors' perceptions drives trading behavior, risk taking, and performance. We use panel regressions in which investor perceptions are included as explanatory variables in their one-month lagged levels and changes (revisions) from that month to infer how perceptions at the start of a month subsequently influence behavior and performance.

3.1 Investor Perceptions and Trading Behavior

Table 4 presents results on investors' stock-market participation (having traded or not), turnover, average trade size, and buy-sell ratio. Whereas the first two indicators refer to investors' trading activity, the latter two refer to particular actions taken by investors when trading.

[Table 4 here]

Probit regression results show that individual investors' perceptions help explain their market participation during the financial crisis and extend the findings of previous research (first column in Table 4). In particular, investors are more likely to trade the higher both the levels and upward revisions of their return expectations and risk attitude (less risk aversion), and the higher the level of their risk perception. Investors are less likely to trade if they have more experience, as

proxied by account tenure (Dhar and Zhu 2006; Glaser and Weber 2007; Kumar 2009), whereas they are more likely to trade if they have higher income (van Rooij, Lusardi, and Alessie 2011), show overconfidence about their investment skills as indicated by trading derivatives, or are financially better off as proxied by their portfolio value (Bauer et al., 2009).

For the subset of investors who traded, higher levels of return expectations and risk perceptions, as well as upward revisions thereto, induce higher turnover (second column in Table 4). Risk attitudes are not significantly linked to turnover once the decision of whether to trade or not is made. Turnover is also higher for investors with larger portfolios (Bauer et al., 2009) and for those who prefer stock over cash dividends and thus possibly have a less risk-averse nature (Shefrin and Statman 1984). Turnover is lower for investors living in neighborhoods with a higher average house value and who thus are likely to be wealthier (Dorn and Huberman 2005).

As to average trade size, we find evidence that upward revisions in return expectations are associated with trading larger amounts per transaction (third column in Table 4). Thus, also during the widespread uncertainty and volatility associated with a major financial crisis, investors' conviction drives their bet size (De Long et al. 1991; Baks, Busse, and Green 2006).

Finally, investors with higher levels of and upward revisions in risk attitudes (they are and become less risk averse), lower levels of risk perceptions, less experience (shorter account tenure), more wealth (higher average house value), and lower levels of derivatives usage have higher buy-sell ratios (fourth column in Table 4). That is, less risk-averse investors incur greater exposure to the market, while investors who perceive higher risk lower their exposure.

In sum, this section's results provide important insights into our understanding of how individual investors' perceptions drive different aspects of their trading behavior during the financial crisis. In particular, higher levels and upward revisions of return expectations make investors more likely to trade, and when they trade, it increases their turnover and average trade

size. Similarly, higher levels and upward revisions of risk attitudes make investors more likely to trade, and when they trade, it leads them to increase their buy-sell ratios. In contrast, although higher levels and upward revisions of *risk perceptions* also make investors more likely to trade, when they trade, it *decreases* their buy-sell ratios while *increasing* their turnover.

3.2 Investor Perceptions and Risk Taking

To measure investors' risk taking, we use the standard deviation of their daily returns.[3] Table 5 shows how studying the dynamics of investors' perceptions leads to a better understanding of their risk-taking behavior during the crisis. Both the levels of and revisions in risk attitude, as well as the levels of risk perception, are associated with risk taking. That is, higher past levels of and upward revisions in risk attitude (less risk aversion) lead investors to choose portfolios with higher standard deviations. Furthermore, higher risk perceptions are associated with higher portfolio risk, which suggests that individual investors are aware of the risk of their investment portfolios. The perception regression coefficients are economically significant, as we examine monthly standard deviations. For example, a one-point increase in the past level of risk perception increases the annualized standard deviation by almost four percentage points.

Finally, we find that investors who are active (have one or more transactions in a given month), more experienced (longer account tenure), and confident of their investment skills (use of derivatives) take on more risk (cf. Barber and Odean 2001; Bauer, Cosemans, and Eichholtz 2009; Grinblatt and Keloharju 2009), whereas investors with larger portfolios may better understand and hence be less willing to take risk (cf. Shefrin 2002).

[3] Due to data limitations, we cannot consider other measures of risk taking such as the degree of portfolio diversification as indicated by the Herfindahl-Hirschman Index. Detailed portfolio data are available only for a subset of approximately 30% of the sample's investors. For this subset, we calculated the average number of securities held in each month as a crude measure of diversification. Results of analyses that include this measure as a control variable are in line with the findings presented in this section and the Sharpe ratios results in Section 3.3.

[Table 5 here]

3.3 Investor Perceptions and Performance

In this section, we first examine investors' portfolio returns and subsequently account for heterogeneity in the investment risk these investors take by analyzing their Sharpe ratios. Table 6 reveals that the dynamics of investors' perceptions are important to explain their portfolio returns. In particular, higher levels and upward revisions of return expectations are associated with higher returns, while higher levels of risk attitude (investors are less risk averse) are associated with lower returns. Since we control for various measures of trading and risk-taking behavior (and thus the effect of perceptions on these determinants of investment returns), additional effects, such as variation in portfolio compositions, must play a role. We cannot investigate such effects in detail because of data limitations with respect to the portfolio holdings. We can control for investors' past returns, however, to examine whether it is only good (and persistent) past performance that leads to high current performance and thus possibly increasing return expectations. After controlling for past returns, the positive effect of return expectations remains significant (second column in Table 6). When we remove the change in the return expectations coefficient from the regression model, the coefficient for past month's level of return expectation becomes insignificant, whereas removing the past month's level substantially alters neither the significance of the change in the return expectations coefficient nor its size. This suggests that the observed effect of return expectations on performance stems from reverse causality: High return performance leads to higher return expectations.[4] This interpretation is reinforced by a detailed analysis of past returns and their relationship to changes

[4] For all other regression models, we examine whether including lags or, alternatively, changes of perceptions has an effect. The results confirm that in all other models, perceptions in their lagged levels and/or changes have an influence on investor behavior.

in perceptions in Section 5.2. There we show that of the three types of perceptions, return expectations in particular are partly influenced by changes in past returns.

Apart from these new findings, we reinforce the validity of our dataset by finding that having a larger portfolio value positively affects returns, while derivatives usage, low risk aversion (preference for stock over cash dividend), trading more, and having higher turnover leads to lower returns (cf. Barber and Odean 2000; Bauer, Cosemans, and Eichholtz 2009).

[Table 6 here]

As a risk-adjusted performance measure that accounts for individual investors' imperfect diversification, we use the Sharpe ratio. Following Israelsen (2005), we calculate a modified Sharpe ratio for each investor *i* in month *t* as follows:

$$Modified\ Sharpe\ Ratio_{i,t} = \frac{r_{i,t}}{\mathrm{Std}(r_{i,t})^{\left(r_{i,t}/\mathrm{abs}(r_{i,t})\right)}}. \quad (1)$$

This modification is important in this particular sample period, because it results in meaningful rankings of investors, even in times of mostly negative market returns. That is, given a certain negative return *r*, an investor's performance ranking worsens with an increasing standard deviation (while for the classical Sharpe ratio, the opposite holds). The regression of the modified Sharpe ratio on investor perceptions shows that over the sample period, high risk-adjusted performance is significantly related to high past levels and upward revisions of return expectations and low levels of risk attitudes (high risk aversion) (Table 7). Note that the results are robust to controlling for past month's Sharpe ratio (second column in Table 7). Coefficient magnitudes are economically significant, as the Sharpe ratio is measured in monthly terms.

[Table 7 here]

The regression results of Table 7 control for investor trading behavior, that is, the likelihood to trade, turnover, average trade size, and the buy-sell ratio. The only remaining channels through which perceptions influence the Sharpe ratio are investor returns and risk-taking behavior. That is, the previously identified positive (reverse causality) relationship of return expectations with investor returns increases the Sharpe ratio, while the negative association of risk attitudes with returns and its positive association with investment risk taken lower the Sharpe ratio (see Tables 4 and 5).[5] In terms of behavior, successful investors have lower turnover, take less risk, trade less in derivatives, and have lower buy-sell ratios than less successful investors.

Overall, the analyses in this section demonstrate that the dynamics of individual investors' perceptions (levels as well as month-to-month revisions thereto) are a significant and important driver of their trading as well as risk-taking behavior, and impact their performance during the crisis. Furthermore, investor perceptions have explanatory power above and beyond characteristics that can be inferred from brokerage records alone, such as age, gender, or portfolio value.

4. Overconfidence and Performance During Times of Extreme Market Turbulence

This section addresses the third and final research objective by studying the determinants of investor performance during times of severe market turbulence and related feedback effects on perceptions and behavior. We sort investors according to their modified Sharpe ratio in the two

[5] An insignificant coefficient for risk perception in the Sharpe ratio regression shows that the Sharpe ratio is not picking up information on only return volatility but also on investor returns. If the Sharpe ratio picks up information only from return volatilities, which could be the case when differences in volatilities are more persistent between investors than differences in returns, we would expect a significant negative coefficient for risk perception (compare Table 5), which is not the case (Table 7), adding to the robustness of our findings.

months with the most dramatic stock-market developments of the financial crisis: September and October 2008. We examine whether and, if so, how the most successful investors differ from other investors in terms of account and investor characteristics, perceptions, and trading and risk-taking behavior. This analysis clarifies whether success during the height of the crisis is the result of "luck," personal (fixed) characteristics and behavior already present before (and after) this dramatic period ("strategy"), or a timely and appropriate adaptation of behavior and strategies during these two months ("tactics") that may persist outside these months ("skill"). Finally, we examine to what extent these dramatic months and the resulting heterogeneity in investment performance have a feedback effect on investors' perceptions and behavior.

4.1 Descriptive Results

Figure 7 presents investors' modified Sharpe ratios according to the September–October 2008 ranking (investors are sorted into performance quintiles) for the pre September–October period (April to August 2008), the September–October 2008 period, and the period after September–October (November 2008 to March 2009).[6]

[Figure 7 here]

The modified Sharpe ratio quintiles in September–October 2008 are monotonically increasing (by construction). Although the same pattern holds before this period, afterward the quintile bars are hump-shaped. Some of the most successful investors during September–October are somewhere in the middle ranks afterward. This suggests there is no strong performance persistence resulting from superior skills, at least not among the best-performing investor

[6] Sorting investors into deciles or quartiles leads to similar results.

quintiles. There appears to be persistent investor underperformance, however: Investors in the lowest quintile in September–October also have the lowest performance before and after this period (cf. Carhart 1997).

[Figure 8 here]

Figure 8 shows how successful investors differ from less successful investors in terms of turnover, likelihood to trade, and buy-sell ratio. Investment success in September–October 2008 is associated with having both a low turnover and low likelihood to trade (Panels A and B of Figure 8). Figure 8 shows that in each of the three periods, successful investors have relatively low buy-sell ratios, which provides some evidence for successful market-timing during a market phase with almost only negative returns (Panel C).

[Figure 9 here]

Figure 9 shows investor perceptions according to the September–October performance ranking.[7] Within the September–October period, investment success is increasing in return expectations (Panel A of Figure 9), decreasing in risk attitude (more risk aversion) (Panel B), and roughly decreasing in risk perception as well (Panel C). Before and after this period, this univariate analysis finds no clear pattern with respect to perceptions, with the exception that the most successful investors in September–October 2008 continue to have the highest return expectations and lowest risk perception in the following months. Table 8 summarizes the investor

[7] We center the data prior to averaging the survey items over the different subperiods. As the panel is not balanced, mere averaging would put more emphasis on high-response months with particularly high or low perception scores.

characteristics discussed so far. In addition, this table shows that successful investors, on average, have higher portfolio values and higher trade sizes over the entire sample period.

[Table 8 here]

4.2 Regression Analyses

We now analyze September–October performance in a multivariate setting. We run three regressions models. In each model, the dependent variable is September–October 2008 mean performance (modified Sharpe ratio). The values of the independent variables, however, refer to one of the three respective subperiods (April–August 2008, September–October 2008, and November 2008–March 2009). Note that this changes the interpretation of the results. For example, when we regress September–October 2008 performance on a set of explanatory variables over the period November 2008 to March 2009, we can identify by which characteristics investors who were successful in September–October 2008 differed from less successful investors in the period November 2008 to March 2009.

As the dependent variable no longer has time variation, we remove the time dimension from the independent variables. For each regression, we average the values of the monthly realizations of independent variables, except those that are fixed over time (e.g., gender). Indicator variables (e.g., Traded, indicating whether an investor traded in a certain month) now refer to percentages (e.g., the percentage of months an investor traded).

[Table 9 here]

Table 9 presents regression results, including perceptions, time-invariant (fixed) investor characteristics, trading behavior, and performance indicators for each of the three subperiods.

Overall, this multivariate setting confirms the previous univariate results. With respect to performance persistence, achieving success in September–October is positively related to having achieved success in the preceding subperiod (first column in Table 9), but has no effect on achieving success in the subsequent subperiod (third column in Table 9). For investors who are successful in September–October 2008, the likelihood of trading is significantly lower both before and during this period, while afterward, successful investors are no longer less likely to trade than less successful investors. The same holds for the likelihood of trading derivatives: Investors that are successful in September–October 2008 are significantly less likely to trade derivatives both before and during this period, but afterward they no longer differ from less successful investors in this regard. In all three subperiods, average trade size is positively related to good September–October performance, confirming a persistent difference in behavior between successful investors and their less successful peers. For none of the subperiods do we find a significant relationship between turnover and the buy-sell ratio and September–October performance. With respect to fixed investor characteristics, we do not find a significant gender effect. Having a higher portfolio value is significantly and positively related to September–October 2008 performance in all three subperiods.

Investor perceptions shed additional light on the drivers of successful investors' performance during the height of the financial crisis. Before the September–October 2008 subperiod, the perceptions of investors who were successful in September–October do not differ significantly from those of less successful investors. During this period, however, investor return expectations are positively related to success, which provides further evidence of a possible feedback effect of investors' performance on their return expectations (see Sections 3.3 and 5.2 for details). After the September–October period, when we do not find performance persistence, the return expectations of investors who are successful in September–October no longer differ

significantly from those of less successful investors. Interestingly, achieving success in September–October 2008 is related to having a significantly higher risk attitude after this period while there is no persistence in outperformance, which suggests that achieving success in times of severe crisis may lead investors to become more convinced of their investment skills and thus more willing to take and accept (uncompensated) risk (see e.g., Barber and Odean 2002). The earlier finding that investors who are successful in September–October 2008 are less likely to trade in general, and in derivatives in particular, both before and during this period, but afterward no longer differ from unsuccessful investors in this regard, reinforces the notion that the success of these investors made them overconfident. That is, we find a feedback effect of investment success on risk attitude (less risk aversion), which is linked to particular changes in trading behavior that negatively affect performance (trading in general and in derivatives in particular). This finding reinforces and extends Gervais and Odean's (2001) "learning to be overconfident" hypothesis, as well as predictions of prospect theory (Barberis, Huang, and Santos 2001; Barberis and Xiong 2009; Liu et al. 2010), by showing how not only their past success, but also (changes in) investors' perceptions affect their trading behavior and (future) performance.

The results of this section show that achieving success during the height of the financial crisis is related to a combination of fixed investor characteristics and behavior (strategy) and, possibly, luck, but not necessarily to successful tactical investment behavior or skills. Yet, as the sample period is relatively short for a detailed performance attribution, this finding should be interpreted with some caution. Most importantly, we find that achieving success during severe market turbulence may lead investors to become overconfident about their investment skills.

5. Robustness Checks and Tests of Alternative Explanations

5.1 Sample Selection Bias

A general concern with studies using surveys is that response behavior could be non-random. To examine this issue, we first compare the investors that responded to the survey to the broker's overall investor population, followed by an analysis of the monthly variation of non-response.

As described in Section 1, complete brokerage records are available only for investors who responded at least once to the survey. A limited amount of background information is available for all of the broker's clients, however, for December 2005, including their age, gender, portfolio value, and number of trades. After imposing the same sample-selection restrictions for the broker's complete client base as for the 2008–2009 survey respondents (see Section 1), we have background information from 2005 for 35,122 investors in total, of which 742 are also respondents to the 2008–2009 survey. A comparison of the 742 survey respondents with all of the broker's clients based on the 2005 data shows that 2008–2009 survey respondents are, on average, more likely to be male (95% vs. 91%, $p = 0.000$) and older (3.25 years, $p = 0.000$), have higher portfolio values (€10.956, $p = 0.000$), and are more likely to trade (55% vs. 39%, $p = 0.000$). No significant differences are found regarding their number of trades (given that they traded).

In the following, the characteristics of all investors who responded to the 2008–2009 survey are compared with those of the non-responding investors for each month using the 2008–2009 brokerage account data. Table 10 presents mean differences between respondents and non-respondents and indicates statistical significance. To examine whether non-response is related to key aspects of investor behavior or performance, risk-taking (portfolio standard deviation) and performance variables (return, modified Sharpe ratio) are analyzed as well.

[Table 10 here]

Comparing respondent with non-respondent means shows that in some months there are significant differences, especially with respect to age, account tenure, and trading activity. In these months, respondents, compared to non-respondents, are older, have longer account tenure, and are more likely to trade, whereas their overall transaction volume is smaller. That is, based on the 2008–2009 data, similar tendencies with respect to response behavior emerge as with the 2005 data. This indicates that investors that responded to the survey only a few times mimic investors that did not respond at all. There are no significant differences between respondents and non-respondents with respect to risk taking or performance, and thus response behavior is unlikely to be driven by these investor characteristics. When examining the months with significant differences between respondents and non-respondents regarding overall market performance, no clear patterns emerge that indicate that response behavior is driven by overall market developments and would thus be non-random (Figure 1).

To account for the identified differences between respondents and non-respondents, as well as the monthly variation in significant differences, an inverse probability weighted estimator is applied (Robins and Rotnitzky 1995; Wooldridge 2002). For each of the 12 months, a logit model is estimated where the dependent variable indicates either response (1) or non-response (0). As explanatory variables, the set of variables contained in Table 10 is included. Next, the predicted probabilities of survey response are calculated. Finally, all regression models of this paper are estimated again using the inverse of the predicted probabilities as sample weights. The results of the regressions that include this estimator are similar to those obtained from the original specifications in terms of coefficient magnitudes, significance, and signs (detailed results are available from the authors upon request). Exceptions are the turnover regression

where we now identify that, compared to male investors, female investors have lower turnover (β = -0.149, p = 0.085), and the risk-taking regression, where we find that female investors also hold less risky portfolios (β = -0.036, p = 0.048). Both results confirm Barber and Odean (2001).

All in all, these results show that non-random response behavior is unlikely to affect the results of this study either qualitatively or quantitatively.

5.2 Investor Perceptions versus Past Returns as Drivers of Behavior

Figures 5 and 6 suggest that the month-to-month changes (revisions) in investors' perceptions are linked to changes in the Dutch stock market index, AEX. In particular, revisions in return expectation and risk attitude seem to be positively, and revisions in risk perception negatively, associated with changes in market returns. Hence, one could hypothesize that investor perceptions have a significant effect in the regression analyses only because they reflect past returns, and that as such, it is actually the past market (or individual investor) returns that drive current investor behavior (cf. Statman, Thorley, and Vorkink 2006; Barber, Odean, and Zhu 2007; Nicolosi, Peng, and Zhu 2009).

To examine this alternative explanation, Panels A and B of Table 11 first present the correlations of the levels of and revisions in perceptions with the levels of and changes in the market and individual investor returns, respectively. Since perceptions are measured at the end of each month, while returns are realized over the course of each month, Table 11 contains the contemporaneous correlations to detect an impact of past returns on current perceptions.

[Table 11 here]

Although the levels and changes in perceptions are correlated with both the levels and changes in the market and individual investor returns, all correlations are relatively low and far from unity. This provides first evidence that investors' perceptions provide additional information over and beyond the information included in their past returns. In addition, Table 12 breaks down the changes in investor perceptions on a monthly basis and distinguishes between investors with positive and negative past returns, as well as changes in past returns.

[Table 12 here]

Table 12 shows that, in most months, average return expectations and risk attitudes move in the same direction, while risk perceptions move in the opposite direction as both market returns (Panel A) and individual investor returns (Panel B). There is, however, considerable heterogeneity between the directions of investors' changes in perceptions. The maximum percentage of investors that changes perceptions in line with the average change of the overall sample of investors is 77% (= negative change in return expectations in June 2008); in most months, this percentage is lower than 60% (Panel A). Moreover, when looking closer at individual investor returns, which may be the source of heterogeneity of the direction of changes in investor perceptions, it becomes clear that it is not only individuals' past return experience that drives changes in their perceptions. Panel B of Table 12 shows that the fraction of investors that change their perceptions in line with the change in the overall market return is larger among the investors with an individual return experience that matches the sign (direction) of the market return (change). Thus, investor perceptions are partially influenced by past individual returns (see also the return regression in Section 3.3). The effect of past individual returns is small, however, because the difference between the fractions of investors with positive and negative

individual return experience that change perceptions in line with the market is usually less than 10 percentage points.

Finally, we analyze the impact of past return experience versus investor perceptions on investors' trading and risk-taking behavior (compare Tables 4 and 5 in Section 3). It should first be noted that any possible impact of the past market return (AEX) on investor behavior is already accounted for by the time fixed effects that are included in all regression models previously presented. Therefore, only the possible impact of *individual* investor return experience is examined further. For this, all regression models are estimated again, now also including investors' past returns, change in past returns, or both, as control variables. The results show that investors' past returns have no significant effect in any of the regression models. Changes in investors' past returns do impact behavior, but including them does not eliminate the explanatory power of investor perceptions (detailed results are available from the authors upon request). In line with Statman et al.'s (2006) findings, changes in investors' past returns have a significant effect in the turnover regression ($\beta = 0.013$, $p = 0.004$), which also includes past returns as a control variable, and in the buy-sell ratio regression models that include only the investors' change in past returns, as well as both the past returns and change in past returns ($\beta = 0.011$, $p = 0.000$ in both models). The significance, signs, as well as approximate magnitudes of the investor perception coefficients do not change in any of the regression models. The only exception is that in the risk-taking regression models that include the change in past returns, or both the past returns and the change in past returns, the coefficient for the change in risk perception now becomes significant and positive ($\beta = 0.009$, $p = 0.072$ in both models).

All in all, the analyses of this section show that investor perceptions do not only pick up information from past returns. Rather, they provide explanatory power for investor behavior well beyond the effect of past returns and changes in past returns.

6. Summary and Conclusions

This paper combines monthly survey data with matching brokerage records to create a unique set of panel data that shows how individual investor perceptions change, drive behavior, and impact performance during the financial crisis of 2007–2009. We find that investor perceptions exhibit significant fluctuation over the course of the crisis, with risk attitudes and risk perceptions being less volatile than return expectations, but more subject to change compared those in non-crisis periods (Pennings and Smidts 2000). During the height of the crisis (September–October 2008), there is a sharp increase in the share of investors trading, their turnover, and their buy-sell ratios.

Notably, both the levels and dynamics (monthly revisions) of investor perceptions drive their trading and risk-taking behavior and contribute to explaining investment performance. Revisions in investor perceptions are influenced by past returns, but perceptions have explanatory power for investor behavior well beyond previously documented effects of past returns on behavior. Regarding trading behavior, we find that investors with higher levels and upward revisions of return expectations are more likely to trade, to have higher turnover, and to trade larger amounts per transaction. Furthermore, investors with higher levels of and upward revisions in their risk attitudes (they are and become less risk averse) are more likely to trade and have higher buy-sell ratios. Finally, investors with higher levels of risk perception and upward revisions therein are more likely to trade, have a higher turnover, and have a lower buy-sell ratio. Regarding risk-taking behavior, we find that investors with lower levels of and downward

revisions in their risk attitudes (they are and become more risk averse), and that have lower levels of risk perceptions, hold portfolios with lower risk.

Overall, successful investors during the crisis are characterized by high return expectations and high risk aversion. In terms of behavior, successful investors have lower turnover, take less risk, trade fewer derivatives, and have lower buy-sell ratios. Investors who perform well during the height of the market turbulence (September–October 2008) also perform better in the months before and have higher return expectations during this very volatile period, but become less risk averse in the following months. In the subsequent period, these investors are no longer able to outperform their peers and are no longer less likely to trade, suggesting that their earlier success may make them overconfident (Gervais and Odean 2001). That is, performing relatively well during extreme times characterized by overall negative market returns, high uncertainty, high volatility, and very salient events, such as bank failures, may lead investors to overestimate their investment skills (Moore and Healy 2008) and give them ill-founded illusions as to their knowledge and control (Barber and Odean 2002). The results thus support and extend Gervais and Odean's (2001) findings on the "learning to be overconfident" hypothesis in times of a major financial crisis. We not only show how past performance can affect future behavior, but also demonstrate the role of (the dynamics of) investors' perceptions.

This study's findings have implications for policymakers involved in crisis management. Changes in investors' perceptions over time drive changes in such key behaviors as trading frequency, turnover, and risk taking. Other research not only finds that individual investors' trading behavior influences stock prices (Kumar and Lee 2006), but also shows that their systematic behavioral biases ultimately affect the macro-economy (Korniotis and Kumar 2011). Therefore, frequent collection of information about investor perceptions could be a crucial aspect of an early warning system designed to identify and possibly prevent an overheating financial

market. Collecting such information could be part of an integrative communication strategy targeted at financial-market participants with the aim of moderating their perceptions so as to prevent destabilizing investment behavior that could ultimately put the entire financial system at risk. In this regard, it may be especially fruitful to educate investors about how their perceptions drive their trading and risk-taking behavior and impact the risk and returns of their investment portfolios (cf. Roszkowski and Davey 2010).

In sum, this paper demonstrates the importance of perceptual data in explaining key patterns in individual market participants' financial behavior. As investors' perceptions provide insight into the underlying drivers of their trading and risk-taking behavior, without this data, it may be hard to adequately explain individual investor performance during the 2007–2009 financial crisis. Moreover, this paper's results demonstrate that drawing a detailed picture of the dynamic interactions among individual investors' perceptions, trading and risk-taking behavior, and performance requires a longitudinal research design with frequent data collection. To make this picture a comprehensive one, it is recommended that researchers combine "hard" trading data with matching "soft" survey data (cf. Lewellen, Lease, and Schlarbaum 1977).

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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 and social security contributions). Assigned to each investor based on their 6-digit ZIP code. This ZIP code is unique for each street in the Netherlands. Data source is the average net income per 6-digit ZIP 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 their 6-digit ZIP code. This ZIP code is unique for each street in the Netherlands. Data source is the average residential house value per 6-digit ZIP code from Statistics Netherlands (Central Bureau of Statistics).
Derivatives	Indicator variable taking the value 1 if an investor traded an option or futures contract at least once during the sample period or 0 otherwise.
Traded	Indicator variable taking the value 1 if an investor traded in a particular month or 0 otherwise.
Trades	Number of all executed transactions in a particular month.
Volume	Sum of the absolute values of all purchases and sales in a particular month.
Turnover	Volume divided by the average of the portfolio values at the beginning and end of a particular month.
Dividend Choice Stock	Indicator variable taking the value 1 if the investors' preferred way to receive dividend is stock dividend or 0 in case of a preference for cash dividend.
Dividend Choice Cash & Stock	Indicator variable taking the value 1 if the investors' preferred way to receive dividend is stock dividend for one of her subaccounts and cash for another subaccount or 0 in case of a preference for cash dividend for all her subaccounts.
Average Trade Size	The investor's monthly volume divided by her trades.
Buy-Sell Ratio	Difference between volume buy and volume sell, normalized (divided) by volume. For investors with no trades in a particular month, this ratio is set to zero (such investors mimic an investor with equal buy and sell volume).
Return	Monthly investor return given by the product of the daily relative changes in the value of her portfolio after transaction costs and portfolio in- and outflows.
Modified Sharpe Ratio	The investor's modified Sharpe ratio in a particular month, calculated according to Equation (1).
Return Expectation	Reflects how optimistic a respondent is about her investment portfolio and its returns in the upcoming month. Details on the survey questions are given in Table 3.
Risk Attitude	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		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	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55	50.55
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
Income €	mean	20,231	20,231	20,231	20,231	20,231	20,231	20,231	20,231	20,231	20,231	20,231	20,231
Income €	median	19,300	19,300	19,300	19,300	19,300	19,300	19,300	19,300	19,300	19,300	19,300	19,300
Portfolio Value €	mean	52,892	52,751	44,919	42,906	46,028	37,754	31,224	30,192	30,771	29,649	26,589	27,949
Portfolio Value €	median	12,108	12,305	10,175	9,912	11,172	8,481	6,907	6,465	6,743	6,543	6,231	6,739
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 €	median	261,500	261,500	261,500	261,500	261,500	261,500	261,500	261,500	261,500	261,500	261,500	261,500
Fraction Derivatives		0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Fraction Traded		0.47	0.47	0.49	0.47	0.40	0.51	0.63	0.43	0.37	0.41	0.40	0.42
Trades (Traders)	mean	8.57	7.54	7.71	9.24	7.16	8.71	10.62	8.81	7.80	9.63	8.85	10.13
Trades (Traders)	median	4.00	3.00	3.00	3.00	3.00	4.00	4.00	3.50	3.00	4.00	3.00	4.00
Volume € (Traders)	mean	48,049	30,285	33,048	36,291	30,861	41,342	51,039	31,140	22,902	28,456	25,956	29,548
Volume € (Traders)	median	7,323	7,306	6,477	6,022	4,278	5,965	6,183	5,279	3,736	4,388	4,373	4,930
Turnover (Traders)	mean	1.10	0.91	0.84	1.19	0.92	1.23	1.99	1.46	1.22	1.60	1.33	1.57
Turnover (Traders)	median	0.29	0.25	0.25	0.29	0.18	0.26	0.42	0.31	0.22	0.27	0.26	0.32

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	654	402	330	312	272	291
Gender		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	51.49	52.30	52.66	52.62	53.80	53.23
Account Tenure	mean	3.93	3.98	4.09	3.98	4.11	4.08	4.24	4.33	4.33	4.43	4.51	4.36
Income €	mean	20,166	20,066	20,079	19,973	20,078	19,985	20,139	19,867	19,844	20,015	20,025	20,016
Income €	median	19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,100	19,000	19,200	19,100
Portfolio Value €	mean	54,446	54,264	45,411	45,509	49,557	39,707	29,968	33,953	30,078	31,059	27,814	27,584
Portfolio Value €	median	12,731	13,569	10,970	10,558	13,547	10,179	7,898	7,862	9,141	8,358	8,357	8,611
House Value €	mean	277,086	273,145	271,955	273,254	274,079	274,452	278,463	272,460	271,801	273,281	277,193	273,037
House Value €	median	259,000	258,000	253,000	254,000	258,000	255,000	261,500	259,000	259,000	260,000	261,000	257,000
Fraction Derivatives		0.41	0.42	0.43	0.42	0.44	0.44	0.38	0.38	0.41	0.45	0.41	0.41
Fraction Traded		0.52	0.54	0.55	0.52	0.46	0.54	0.64	0.46	0.43	0.48	0.49	0.45
Trades (Traders)	mean	9.23	7.08	7.94	8.40	6.68	8.54	10.89	8.61	7.21	10.14	10.02	9.69
Trades (Traders)	median	4.00	3.00	3.00	4.00	3.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00
Volume € (Traders)	mean	56,262	24,814	31,821	27,447	22,637	28,375	55,621	30,293	22,924	35,560	31,069	27,483
Volume € (Traders)	median	7,375	6,233	6,538	6,358	4,012	5,965	6,948	5,280	3,660	5,285	3,670	6,605
Turnover (Traders)	mean	1.30	0.86	0.97	1.14	0.71	0.99	2.18	1.71	0.94	1.11	1.40	1.99
Turnover (Traders)	median	0.30	0.23	0.24	0.25	0.17	0.21	0.40	0.24	0.17	0.24	0.23	0.32

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 that participated at least once during the entire sample period in the survey, and that were not removed by the restrictions as defined in section I. The monthly summary statistics presented in Panel B refer to the subset of the investors that 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)	
This month my investments are doing less well than desired.	1 (totally agree)–7 (totally disagree)
My investment experiences of this month give me a positive feeling about my financial future.*	1 (totally agree)–7 (totally disagree)
This month my investments will have a worse performance than those of most other investors.	1 (totally agree)–7 (totally disagree)
This month it is unlikely that my investment behavior will lead to positive returns.	1 (totally agree)–7 (totally disagree)
This month the future of my investment portfolio looks good.*	1 (totally agree)–7 (totally disagree)
Risk Attitude (1 = high risk aversion, 7 = low risk aversion)	
When investing, I prefer financial certainty over uncertainty this month.	1 (totally agree)–7 (totally disagree)
Regarding investing, I prefer certainty over uncertainty this month.	1 (totally agree)–7 (totally disagree)
This month I avoid risks when investing.	1 (totally agree)–7 (totally disagree)
This month, I do not like to take financial risks.	1 (totally agree)–7 (totally disagree)
This month, I do not like to "play it safe."*	1 (totally agree)–7 (totally disagree)
Risk Perception (1 = low perceived risk, 7 = high perceived risk)	
I consider investing to be very risky this month.*	1 (totally agree)–7 (totally disagree)
I consider investing to be safe this month.	1 (totally agree)–7 (totally disagree)
I consider investing to be dangerous this month. *	1 (totally agree)–7 (totally disagree)
I consider investing to have little risk this month.	1 (totally agree)–7 (totally disagree)

This table presents the questions as 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 attitude, 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 0.71–0.89 for all survey variables, indicating the measurement instrument is reliable (Hair et al. 1998).

Table 4
Trading Behavior

Dependent Variable	Traded		Turnover		Avg. Trade Size/1,000		Buy-Sell Ratio	
	Marg. Eff.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Return Expectation prev. month	0.094	0.019 ***	0.069	0.042 *	0.680	0.534	-0.008	0.022
Δ Return Expectation	0.054	0.016 ***	0.062	0.034 *	0.473	0.271 *	-0.030	0.021
Risk Attitude prev. month	0.076	0.015 ***	0.030	0.030	-0.369	0.393	0.060	0.017 ***
Δ Risk Attitude	0.069	0.013 ***	-0.017	0.027	-0.200	0.176	0.067	0.016 ***
Risk Perception prev. month	0.028	0.013 **	0.065	0.024 ***	0.182	0.217	-0.029	0.015 *
Δ Risk Perception	0.016	0.010	0.053	0.017 ***	0.103	0.178	-0.013	0.013
Gender	0.046	0.070	-0.133	0.089	-0.864	0.877	0.019	0.057
Age	0.001	0.002	0.005	0.003 *	-0.002	0.029	0.000	0.001
Account Tenure	-0.014	0.007 **	0.021	0.012 *	0.022	0.153	-0.009	0.006
ln(Income)	0.313	0.181 *	0.495	0.330	2.582	2.506	-0.215	0.171
ln(Portfolio Value) prev. month	0.068	0.010 ***	-0.130	0.024 ***	1.746	0.399 ***	-0.055	0.010 ***
ln(House Value)	-0.197	0.090 **	-0.420	0.190 **	-0.296	1.329	0.181	0.078 **
Derivatives	0.475	0.037 ***	0.004	0.079	-0.908	0.896	-0.175	0.043 ***
Dividend Choice Stock	0.010	0.052	0.304	0.103 ***	0.727	0.802	0.007	0.045
Dividend Choice Cash & Stock	-0.046	0.045	0.146	0.068 **	0.364	0.827	0.003	0.040
Constant			1.264	1.833	-38.223	15.709 **	0.525	1.145
Time fixed effects	YES		YES		YES		YES	
N Observations	3,885		1,914		1,914		1,914	
N Investors	1,041		698		698		698	
R^2			0.108		0.134		0.091	

This table presents the results from regressions of several indicators of investor trading behavior on investor perceptions and a set of control variables. Dependent variables referring to trading behavior are market participation (Traded), turnover, average trade size, and buy-sell ratio. The first column shows the results of a random effects panel probit estimation for the dependent variable Traded, which indicates whether an investor traded in a particular month (1) or not (0). Reported are marginal effects at means (0) of independent continuous (discrete dummy) variables. The number of individual investors included the regression (1,041) is smaller than the sample available for analysis (1,376) since not all investors responded to the survey for two consecutive months. The other columns show results of linear panel models for the truncated sample of investors who have at least one trade in a particular month. Standard errors are clustered on the investor level for all linear panel models. Variables are defined in Table 1. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5
Risk-Taking Behavior

Dependent Variable	Std(Return)	
	Coef.	Std. err.
Return Expectation prev. month	-0.005	0.009
Δ Return Expectation	-0.004	0.006
Risk Attitude prev. month	0.023	0.007 ***
Δ Risk Attitude	0.009	0.005 *
Risk Perception prev. month	0.011	0.005 **
Δ Risk Perception	0.005	0.004
Gender	-0.025	0.020
Age	0.001	0.001
Account Tenure	0.006	0.003 **
ln(Income)	0.070	0.053
ln(Portfolio Value) prev. month	-0.051	0.007 ***
ln(House Value)	-0.016	0.031
Derivatives	0.088	0.017 ***
Dividend Choice Stock	0.006	0.021
Dividend Choice Cash & Stock	0.025	0.017
Traded	0.064	0.013 ***
Turnover	0.027	0.008 ***
Avg. Trade Size/1,000	0.002	0.002
Buy-Sell Ratio	-0.005	0.008
Constant	0.231	0.366
Time fixed effects	YES	
N Observations	3,885	
N Investors	1,041	
R^2	0.324	

This table presents the results from regressions of risk-taking behavior on investor perceptions and a set of control variables. Dependent variable is the standard deviation of investors' daily portfolio returns. The column shows results of a linear panel model. The number of individual investors included the regression (1,041) 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. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6
Investor Performance – Returns

Dependent Variable	Return (1)		Return (2)	
	Coef.	Std. err.	Coef.	Std. err.
Return Expectation prev. month	0.011	0.004 **	0.011	0.005 **
Δ Return Expectation	0.023	0.004 ***	0.023	0.004 ***
Risk Attitude prev. month	-0.008	0.004 **	-0.008	0.004 **
Δ Risk Attitude	-0.001	0.003	-0.001	0.003
Risk Perception prev. month	-0.003	0.003	-0.003	0.003
Δ Risk Perception	-0.001	0.002	-0.001	0.002
Gender	0.008	0.009	0.008	0.009
Age	0.000	0.000	0.000	0.000
Account Tenure	0.000	0.001	0.000	0.001
ln(Income)	-0.025	0.027	-0.025	0.027
ln(Portfolio Value) prev. month	0.015	0.003 ***	0.015	0.003 ***
ln(House Value)	0.017	0.015	0.017	0.015
Derivatives	-0.041	0.009 ***	-0.041	0.009 ***
Dividend Choice Stock	-0.005	0.010	-0.005	0.010
Dividend Choice Cash & Stock	-0.013	0.008 *	-0.013	0.008 *
Traded	-0.030	0.007 ***	-0.029	0.007 ***
Turnover	-0.016	0.003 ***	-0.016	0.003 ***
Avg. Trade Size/1,000	0.000	0.000	0.000	0.000
Buy-Sell Ratio	-0.017	0.005 ***	-0.017	0.005 ***
Return prev. month			0.002	0.035
Constant	-0.249	0.195	-0.219	0.196
Time fixed effects	YES		YES	
N Observations	3,885		3,885	
N Investors	1,041		1,041	
R^2	0.347		0.347	

This table presents the results from regressions of investor returns on investor perceptions and a set of control variables. Dependent variable is investors' monthly portfolio return. The columns show results of linear panel models. The number of individual investors included the regression (1,041) 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. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7

Investor Performance – Modified Sharpe Ratios

Dependent Variable	Mod. Sharpe Ratio (1)		Mod. Sharpe Ratio (2)	
	Coef.	Std. err.	Coef.	Std. err.
Return Expectation prev. month	0.029	0.009 ***	0.022	0.008 ***
Δ Return Expectation	0.045	0.008 ***	0.046	0.008 ***
Risk Attitude prev. month	-0.023	0.008 ***	-0.020	0.007 ***
Δ Risk Attitude	-0.011	0.007	-0.011	0.007
Risk Perception prev. month	-0.005	0.006	-0.006	0.006
Δ Risk Perception	0.001	0.005	0.001	0.005
Gender	-0.001	0.020	-0.003	0.019
Age	-0.001	0.001	0.000	0.000
Account Tenure	-0.002	0.003	-0.002	0.003
ln(Income)	0.031	0.056	0.028	0.051
ln(Portfolio Value) prev. month	0.033	0.005 ***	0.029	0.005 ***
ln(House Value)	-0.008	0.030	-0.004	0.027
Derivatives	-0.072	0.018 ***	-0.064	0.017 ***
Dividend Choice Stock	0.000	0.021	0.001	0.019
Dividend Choice Cash & Stock	-0.025	0.017	-0.025	0.015 *
Traded	-0.033	0.016 **	-0.029	0.015 *
Turnover	-0.027	0.007 ***	-0.025	0.006 ***
Avg. Trade Size/1,000	0.000	0.001	0.000	0.001
Buy-Sell Ratio	-0.024	0.011 **	-0.024	0.011 **
Mod. Sharpe Ratio prev. month			0.124	0.045 ***
Constant	-0.512	0.415	-0.471	0.379
Time fixed effects	YES		YES	
N Observations	3,885		3,885	
N Investors	1,041		1,041	
R^2	0.346		0.360	

This table presents the results from regressions of investor modified Sharpe ratios on investor perceptions and a set of control variables. Dependent variable is the monthly modified Sharpe ratio of investors' portfolio. The columns show results of linear panel models. The number of individual investors included the regression (1,041) 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. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8
Descriptive Statistics for Crisis Subperiods

		Crisis Subperiod														
		Apr 08 - Aug 08					Sept 08 - Oct 08					Nov 08 - Mar 09				
		Peformance Quintiles Conditional on September/October Modified Sharpe Ratio Ranking														
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Return Expectation Centered	mean	0.09	0.01	-0.13	-0.07	0.05	-0.02	-0.18	-0.14	0.02	0.11	0.06	-0.24	-0.11	-0.10	0.25
Risk Attitude Centered	mean	-0.03	0.08	-0.06	-0.12	0.07	0.04	0.10	-0.03	-0.06	-0.10	0.13	-0.11	-0.12	-0.04	0.11
Risk Perception Centered	mean	-0.07	0.00	0.11	-0.05	-0.06	0.13	0.16	0.06	-0.19	-0.10	-0.01	0.32	-0.02	-0.01	-0.21
Gender		0.04	0.10	0.05	0.11	0.09	0.04	0.10	0.05	0.11	0.09	0.04	0.10	0.05	0.11	0.09
Age	mean	51.25	49.93	49.53	52.47	49.84	51.25	49.93	49.53	52.47	49.84	51.25	49.93	49.53	52.47	49.84
Account Tenure	mean	4.41	3.89	3.83	3.70	4.42	4.41	3.89	3.83	3.70	4.42	4.41	3.89	3.83	3.70	4.42
Income €	mean	19,740	20,080	20,046	20,826	20,937	19,740	20,080	20,046	20,826	20,937	19,740	20,080	20,046	20,826	20,937
Income €	median	19,100	19,400	19,400	19,050	19,600	19,100	19,400	19,400	19,050	19,600	19,100	19,400	19,400	19,050	19,600
Portfolio Value €	mean	29,195	37,967	44,332	47,509	86,480	14,271	24,613	31,250	34,403	72,584	12,033	20,362	26,239	27,982	64,943
Portfolio Value €	median	5,783	10,888	13,716	12,898	16,437	2,699	7,041	10,570	10,137	12,272	2,485	5,964	8,926	9,120	9,945
House Value €	mean	263,632	271,931	277,208	294,466	296,937	263,632	271,931	277,208	294,466	296,937	263,632	271,931	277,208	294,466	296,937
House Value €	median	249,000	256,000	265,000	261,000	266,000	249,000	256,000	265,000	261,000	266,000	249,000	256,000	265,000	261,000	266,000
Fraction Derivatives		0.37	0.18	0.11	0.06	0.13	0.52	0.24	0.15	0.08	0.18	0.38	0.17	0.10	0.08	0.14
Fraction Traded		0.66	0.48	0.44	0.29	0.41	0.79	0.62	0.55	0.39	0.49	0.57	0.43	0.38	0.28	0.38
Trades (Traders)	mean	11.84	8.20	5.06	5.12	6.21	14.32	9.37	6.56	5.59	8.55	13.52	10.17	5.67	6.14	7.70
Trades (Traders)	median	6.00	3.00	3.00	2.00	3.00	7.00	4.00	3.00	3.00	3.00	6.00	4.00	3.00	2.00	3.00
Volume € (Traders)	mean	36,483	33,746	31,625	34,243	43,085	64,454	28,410	35,830	39,487	56,603	34,559	32,454	17,769	21,447	36,905
Volume € (Traders)	median	9,462	5,200	4,692	4,294	6,918	10,305	5,575	3,990	4,181	8,559	6,306	4,410	3,356	2,910	5,625
Turnover (Traders)	mean	1.60	1.07	0.54	0.55	0.40	3.13	1.34	0.97	0.77	0.79	2.73	1.46	0.79	0.77	0.65
Turnover (Traders)	median	0.55	0.26	0.18	0.15	0.14	0.97	0.42	0.18	0.17	0.18	0.63	0.41	0.18	0.15	0.19
Avg. Trade Size €	mean	3,318	3,536	4,653	4,321	7,252	3,660	3,023	3,329	3,479	7,796	2,635	2,518	2,677	2,717	4,457
Avg. Trade Size €	median	1,267	1,740	1,719	1,698	2,037	1,122	1,402	1,253	1,338	1,855	817	1,139	1,195	1,330	1,400
Buy-Sell Ratio (Traders)	mean	0.03	0.15	0.23	0.17	0.19	0.24	0.38	0.46	0.37	0.28	0.12	0.16	0.20	0.20	0.16
Buy-Sell Ratio (Traders)	median	0.02	0.08	0.21	0.14	0.21	0.15	0.36	0.85	0.65	0.27	0.05	0.08	0.10	0.21	0.10
Portfolio Return	mean	-0.05	-0.02	-0.02	-0.01	-0.01	-0.34	-0.29	-0.22	-0.15	-0.03	-0.05	-0.01	0.00	0.00	0.00
Portfolio Return	median	-0.01	0.00	0.01	0.01	0.01	-0.36	-0.30	-0.22	-0.15	-0.07	-0.04	-0.01	-0.01	-0.01	-0.01
Std(Portfolio Return)	mean	0.27	0.12	0.11	0.08	0.09	0.57	0.37	0.25	0.20	0.26	0.43	0.24	0.18	0.14	0.15
Std(Portfolio Return)	median	0.18	0.11	0.09	0.07	0.07	0.48	0.34	0.24	0.18	0.17	0.33	0.22	0.17	0.12	0.12
Modified Sharpe Ratio	mean	0.24	0.30	0.34	0.37	0.39	-0.20	-0.11	-0.05	-0.03	0.10	0.17	0.28	0.32	0.32	0.30
Modified Sharpe Ratio	median	0.00	0.00	0.08	0.11	0.10	-0.18	-0.10	-0.05	-0.03	-0.01	-0.01	0.00	0.00	0.00	0.00

This table presents summary statistics for the brokerage account and survey data for three subperiods. Within each respective subperiod, the monthly variable values are averaged. Descriptive statistics are based on investors sorted into quintiles according to their modified Sharpe ratio achieved in September–October 2008. In this table, the fraction derivatives refers to the percentage of investors in each particular month that traded an option or futures contract at least once. Variables are defined in Table 1.

Table 9

Investor Performance September–October 2008 – Modified Sharpe Ratios

Sample Subperiod	Apr 08 - Aug 08		Sept 08 - Oct 08		Nov 08 - Mar 09	
Dependent Variable	Mean Mod. Sharpe Ratio Sept/Oct		Mean Mod. Sharpe Ratio Sept/Oct		Mean Mod. Sharpe Ratio Sept/Oct	
	(1)		(2)		(3)	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Mean Return Expectation Centered	-0.001	0.011	0.022	0.006 ***	-0.003	0.013
Mean Risk Attitude Centered	0.008	0.008	-0.002	0.004	0.024	0.009 **
Mean Risk Perception Centered	0.006	0.007	-0.001	0.005	-0.016	0.010
Gender	-0.031	0.028	-0.010	0.018	-0.022	0.034
Age	0.000	0.001	0.000	0.000	0.000	0.001
Account Tenure	0.000	0.004	-0.004	0.003	-0.009	0.005 *
ln(Income)	-0.032	0.065	0.029	0.045	0.121	0.082
Mean ln(Portfolio Value)	0.005	0.005	0.011	0.004 ***	0.018	0.007 **
ln(House Value)	0.044	0.033	-0.004	0.024	-0.040	0.044
Mean Derivatives	-0.105	0.035 ***	-0.036	0.017 **	-0.050	0.039
Dividend Choice Stock	-0.026	0.021	-0.001	0.014	-0.021	0.026
Dividend Choice Cash & Stock	0.012	0.018	-0.019	0.012	-0.009	0.022
Mean Traded	-0.056	0.030 *	-0.034	0.016 **	-0.002	0.038
Mean Turnover	-0.004	0.006	-0.002	0.001	-0.006	0.005
Mean Avg. Trade Size/1,000	0.005	0.001 ***	0.003	0.001 ***	0.009	0.005 **
Mean Buy-Sell Ratio	0.002	0.034	-0.012	0.014	-0.037	0.051
Mean Modified Sharpe Ratio	0.180	0.042 ***			-0.076	0.062
Constant	-0.262	0.417	-0.260	0.271	-0.767	0.482
N	856		809		490	
Adj. R^2	0.149		0.174		0.069	

This table presents the results from regressions of investor modified Sharpe ratios on investor perceptions and a set of control variables for three subperiods. Dependent variable is the average modified Sharpe ratio of investors' portfolios in September–October 2008. The columns show results of OLS models. Within each respective subperiod, the monthly variable values are averaged. For these regressions, derivatives refer to investors that in each particular month traded an option or futures contract at least once. Variables are defined in Table 1. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10

Sample Differences Between Survey Respondents and Non-Respondents

	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
Gender	-0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.01
Age	0.07	1.28 *	1.73 **	2.18 ***	3.63 ***	3.26 ***	1.95 **	2.52 ***	2.76 ***	2.63 ***	4.05 ***	3.40 ***
Account Tenure	-0.29 **	-0.19	0.02	-0.16	0.05	0.02	0.36 **	0.39 **	0.35 *	0.45 ***	0.55 ***	0.37 **
Income €	-97	-335	-244	-462 *	-255	-386	-212	-508 **	-505 **	-265	-257	-270
Portfolio Value €	3,566	3,195	644	4,911	6,094	2,686	4,000	5,274	-872	2,955	1,529	-464
House Value €	-4,452	-11,950 **	-12,572 **	-9,646	-7,899	-7,066	-1,038	-9,223	-9,455	-7,387	-2,229	-7,539
Fraction Derivatives	0.05 *	0.06 **	0.07 **	0.05 **	0.08 ***	0.07 **	-0.04	-0.01	0.02	0.07 **	0.03	0.02
Fraction Traded	0.13 ***	0.13 ***	0.12 ***	0.09 ***	0.09 ***	0.04	0.03	0.05	0.07 **	0.09 ***	0.10 ***	0.04
Trades (Traders)	1.78 **	-1.12	0.39	-1.59	-0.82	-0.30	1.02	-0.36	-0.82	0.70	1.52	-0.57
Volume € (Traders)	22,218	-13,045 **	-2,788	-16,300 *	-14,690 *	-20,923 **	14,810	-1,462	30	9,697	6,716	-2,674
Turnover (Traders)	0.54 ***	-0.13	0.26	-0.11	-0.38	-0.39	0.37	0.35	-0.37	-0.67	0.08	0.54
Std(Portfolio Return)	0.01	-0.01	0.00	0.00	0.01	0.00	-0.01	0.02	0.00	0.00	0.02	0.03
Portfolio Return	0.00	0.00	-0.02	0.00	0.01	-0.01	0.03	0.00	0.00	0.01	-0.01	0.00
Modified Sharpe Ratio	-0.02	-0.02	-0.01	0.00	0.03	-0.02	0.02	0.00	0.00	0.05	-0.03	-0.01

This table presents the monthly differences in means between respondents and non-respondents. Variables are defined in Table 1. *, **, *** denote statistical significant differences in means between respondents and non-respondents at the 10%, 5%, and 1% levels, respectively.

Table 11
Correlations between Investor Perceptions and Returns

Panel A: Correlation Matrix for Levels in Perceptions and Returns				
	Return Expectation	Risk Attitude	Risk Perception	AEX Monthly Return
Risk Attitude	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 Perceptions and Returns				
	Δ Return Expectation	Δ Risk Attitude	Δ Risk Perception	Δ AEX Monthly Return
Δ Risk Attitude	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 perceptions and the corresponding (i.e., for the same month) realized total return on the Dutch stock market index (AEX), and the individual investor returns. Panel A refers to levels in perceptions and returns, while Panel B refers to changes in perceptions and returns. Variables are defined in Table 1. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 12

Changes in Investor Perceptions by Month and Monthly Returns

Panel A: Change in Perceptions versus the Market Return (AEX)												
Month		May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
AEX Monthly Return	%	+ 2.82	– 12.22	– 6.01	+ 4.17	– 19.65	– 19.15	– 5.19	– 2.47	+ 1.14	– 11.21	– 0.76
Δ AEX Monthly Return	% Points	– 5.88	– 15.04	+ 6.21	+ 10.18	– 23.83	+ 0.51	+ 13.95	+ 2.72	+ 3.61	– 12.35	+ 10.45
Mean Δ Return Expectation		– 0.11	– 0.61	+ 0.22	+ 0.33	– 0.64	– 0.08	+ 0.21	+ 0.14	+ 0.23	– 0.41	+ 0.62
Mean Δ Risk Attitude		+ 0.01	– 0.34	+ 0.19	+ 0.08	– 0.28	+ 0.08	+ 0.04	+ 0.07	– 0.04	– 0.03	+ 0.16
Mean Δ Risk Perception		– 0.04	+ 0.56	– 0.84	– 0.18	+ 0.44	– 0.17	– 0.01	– 0.02	– 0.05	+ 0.27	– 0.22
Δ Return Expectation >= 0	% Investors	47	23	56	67	23	38	61	50	60	31	72
Δ Risk Attitude >= 0	% Investors	51	40	56	57	35	46	55	52	48	54	52
Δ Risk Perception >= 0	% Investors	56	63	34	46	67	58	47	51	52	57	38
Panel B: Change in Perceptions versus Individual Investor Returns												
Month		May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
Mean Monthly Return	%	+ 0.70	– 14.73	– 7.06	+ 5.71	– 19.82	– 18.62	– 8.71	– 1.91	+ 0.41	– 13.16	+ 1.19
Mean Δ Monthly Return	% Points	– 3.20	– 15.43	+ 7.67	+ 12.77	– 25.53	+ 1.20	+ 9.92	+ 6.80	+ 2.32	– 13.57	+ 14.36
Mean Δ Return Expectation		– 0.11	– 0.61	+ 0.22	+ 0.33	– 0.64	– 0.08	+ 0.21	+ 0.14	+ 0.23	– 0.41	+ 0.62
Mean Δ Risk Attitude		+ 0.01	– 0.34	+ 0.19	+ 0.08	– 0.28	+ 0.08	+ 0.04	+ 0.07	– 0.04	– 0.03	+ 0.16
Mean Δ Risk Perception		– 0.04	+ 0.56	– 0.84	– 0.18	+ 0.44	– 0.17	– 0.01	– 0.02	– 0.05	+ 0.27	– 0.22
Δ Return Expectation >= 0 and Return >= 0	% Investors	50	22	69	68	50	24	64	53	62	50	77
Δ Return Expectation >= 0 and Return < 0	% Investors	42	23	53	56	22	41	60	48	57	29	64
Δ Risk Attitude >= 0 and Return >= 0	% Investors	51	39	60	58	30	48	57	53	51	55	54
Δ Risk Attitude >= 0 and Return < 0	% Investors	51	40	55	50	35	46	54	51	43	54	49
Δ Risk Perception >= 0 and Return >= 0	% Investors	53	83	30	46	80	56	37	49	57	64	36
Δ Risk Perception >= 0 and Return < 0	% Investors	60	63	35	42	66	59	49	52	45	57	41
Δ Return Expectation >= 0 and Δ Return >= 0	% Investors	51	26	58	68	50	39	59	56	62	53	77
Δ Return Expectation >= 0 and Δ Return < 0	% Investors	46	23	47	46	22	38	66	38	56	29	36
Δ Risk Attitude >= 0 and Δ Return >= 0	% Investors	52	26	56	58	22	43	52	53	49	53	53
Δ Risk Attitude >= 0 and Δ Return < 0	% Investors	50	40	56	49	36	48	64	50	45	54	44
Δ Risk Perception >= 0 and Δ Return >= 0	% Investors	53	74	36	46	61	49	44	47	56	68	37
Δ Risk Perception >= 0 and Δ Return < 0	% Investors	57	63	25	43	67	65	57	59	46	56	44

This table presents the monthly changes in investor perceptions and returns. Panel A compares changes in investor perception with changes in the total return on the Dutch stock market index (AEX). Panel B compares changes in investor perceptions with changes in individual investor returns and distinguishes further between investors with positive and negative return as well as changes in return experience. Variables are defined in Table 1.

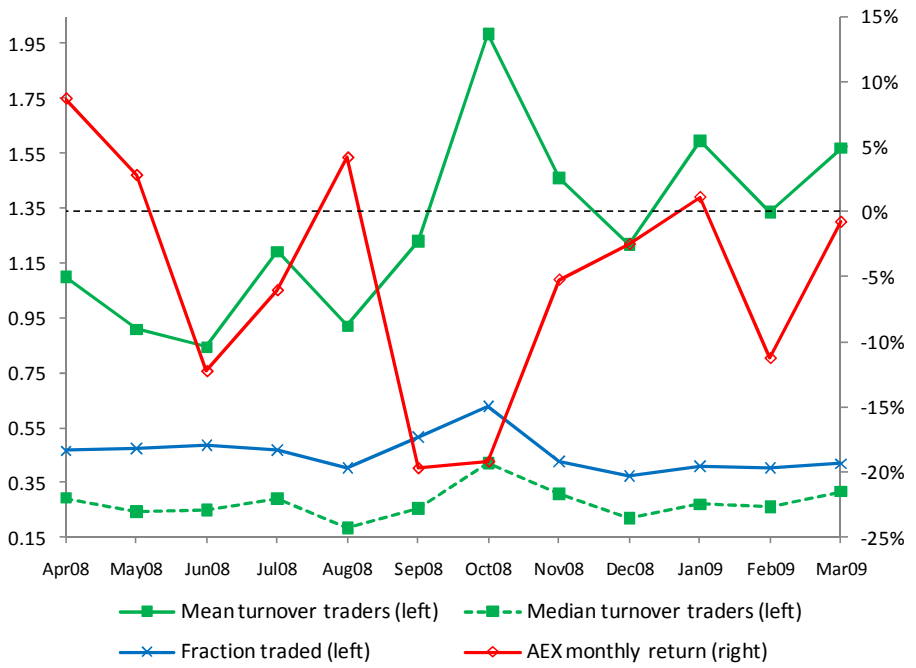

Figure 1. Trading Behavior – Fraction of Investors that Traded and Turnover. AEX return is the total return of the Dutch stock market index. Variables are defined in Table 1.

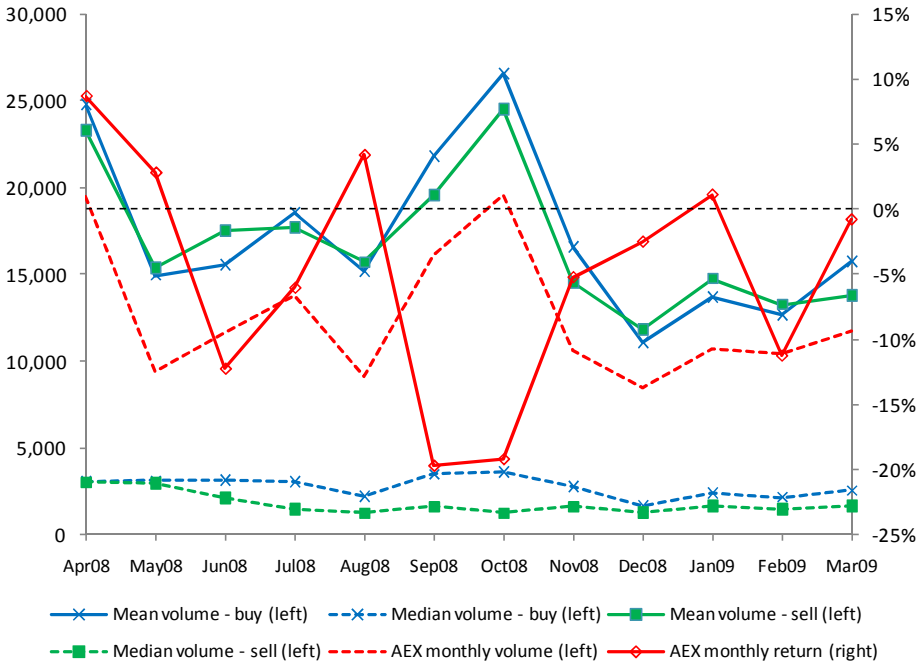

Figure 2. Trading Behavior – Volume per Investor (Traders). AEX return is the total return of the Dutch stock market index. Variables are defined in Table 1. AEX volume is the total monthly volume of the AEX in € divided by 250,000.

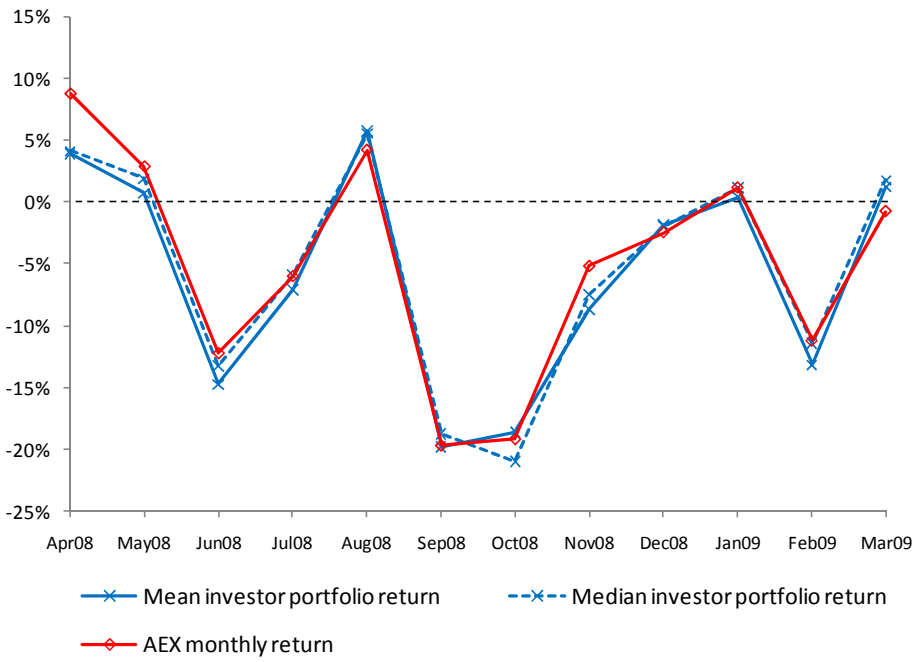

Figure 3. Investor Performance – Investors' Monthly Returns. All returns are depicted in monthly terms. AEX return is the total return of the Dutch stock market index. Variables are defined in Table 1.

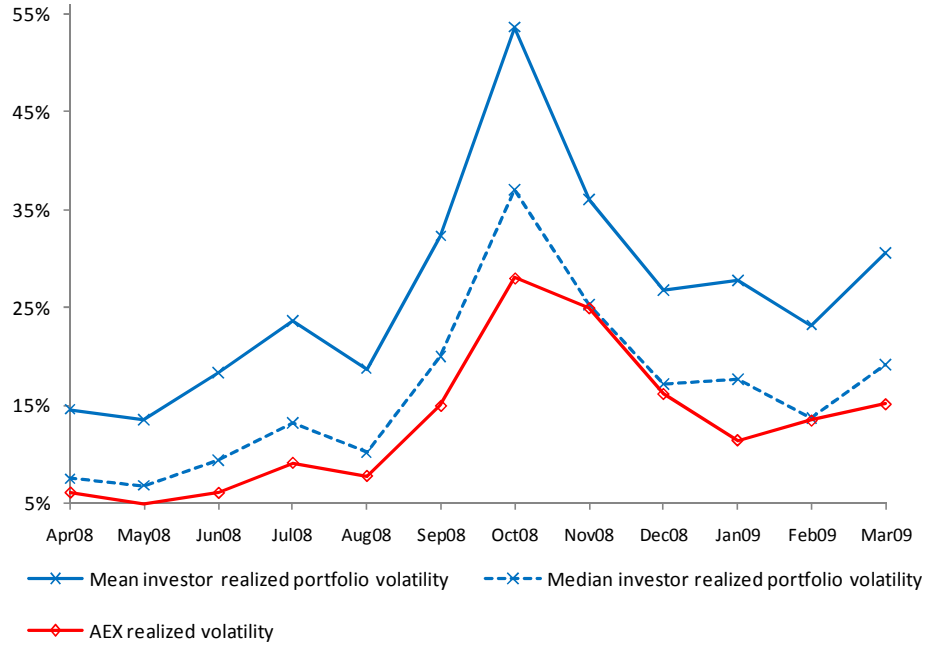

Figure 4. Risk-Taking Behavior – Investors' Monthly Return Volatility. Investor realized volatility is calculated based on the daily returns on their portfolio. AEX realized volatility is calculated for each month based on the daily total returns of the AEX index. All volatilities are depicted in monthly terms. Variables are defined in Table 1.

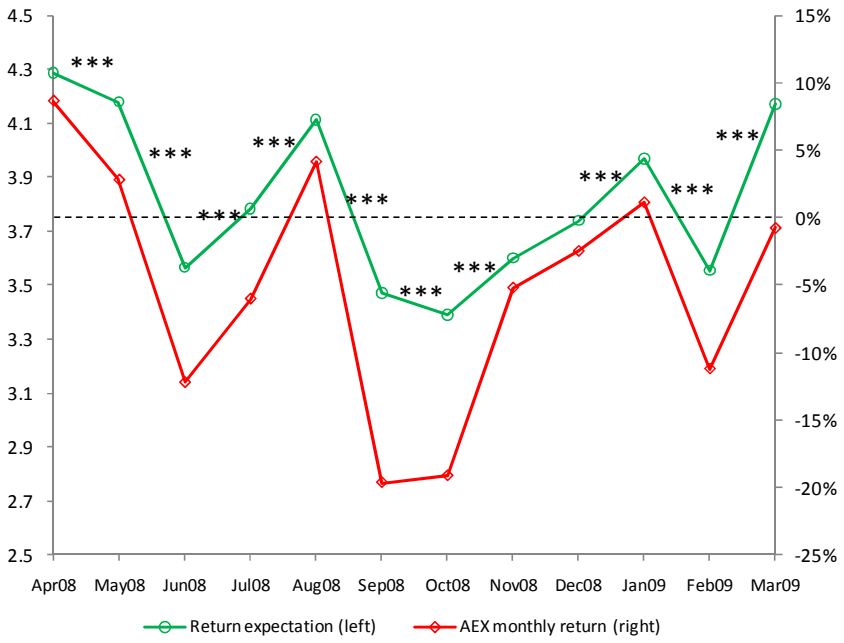

Figure 5. Return Expectations. Return expectations are measured on a 7-point Likert scale (see Table 3); shown is the sample mean. A small value indicates low return expectations, whereas a large value indicates high return expectations. AEX return is the total return of the Dutch stock market index. *, **, *** denote statistical significant differences between the means for subsequent month pairs for return expectations at the 10%, 5%, and 1% levels, respectively.

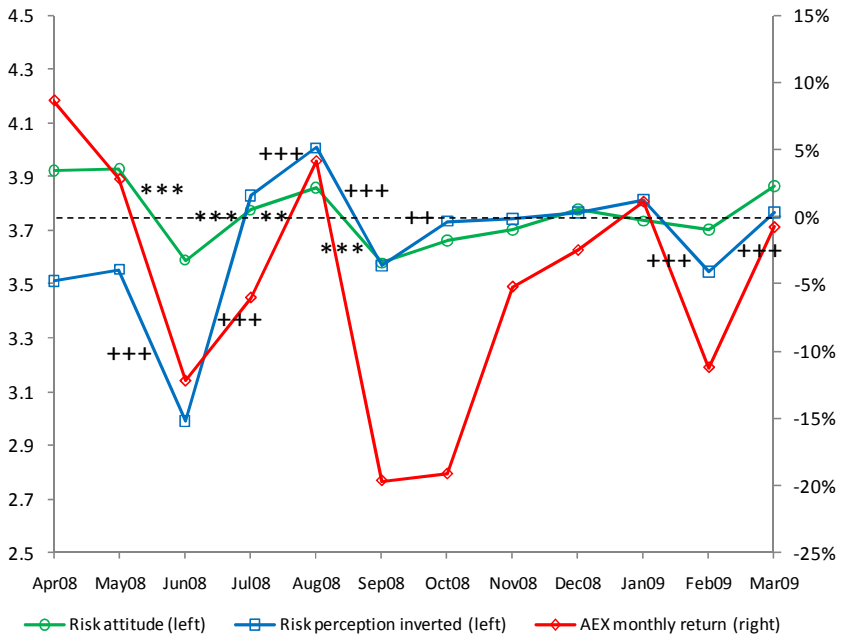

Figure 6. Risk Attitude and Risk Perception. Risk attitude and risk perception about investment prospects are measured on a 7-point Likert scale (see Table 3); shown is the sample mean. For illustrative purposes, risk perception is shown on an inverted scale. A small value indicates a risk averse risk attitude or high risk perceived, whereas a large value indicates a less risk averse risk attitude or low risk perceived. AEX return is the total return of the Dutch stock market index. * (+), ** (++), *** (+++) denote statistical significant differences between the means for subsequent month pairs for risk attitude (risk perception) at the 10%, 5%, and 1% levels, respectively.

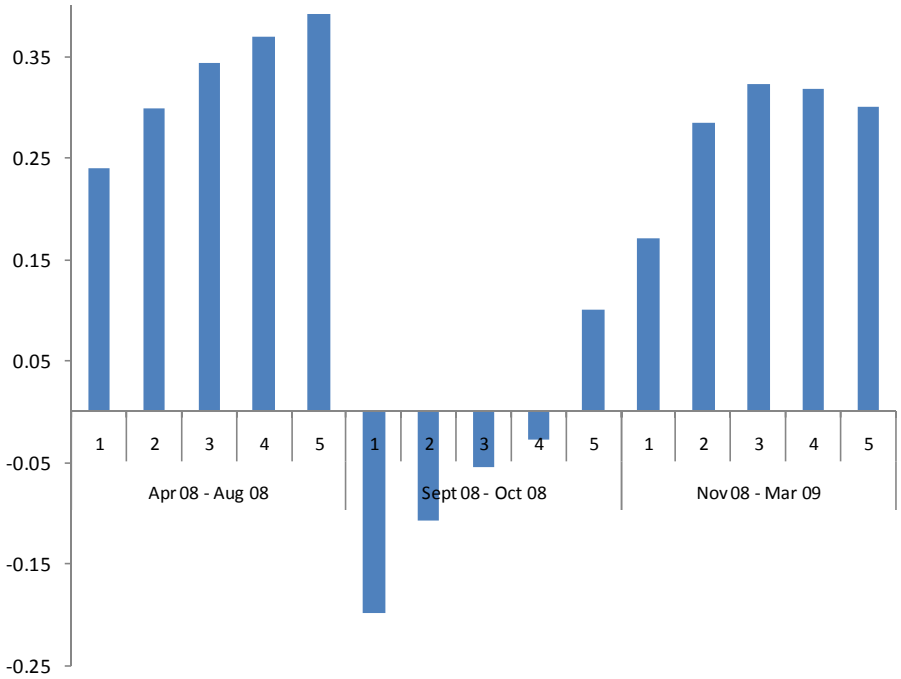

Figure 7. Crisis Performance – Investors' Modified Sharpe Ratios. Numbers from 1 to 5 on the x-axis indicate performance ranking quintiles of investors based on their mean modified Sharpe ratios in September–October 2008. Shown are the sample means for each modified Sharpe ratio quintile in a given observation period. Variables are defined in Table 1.

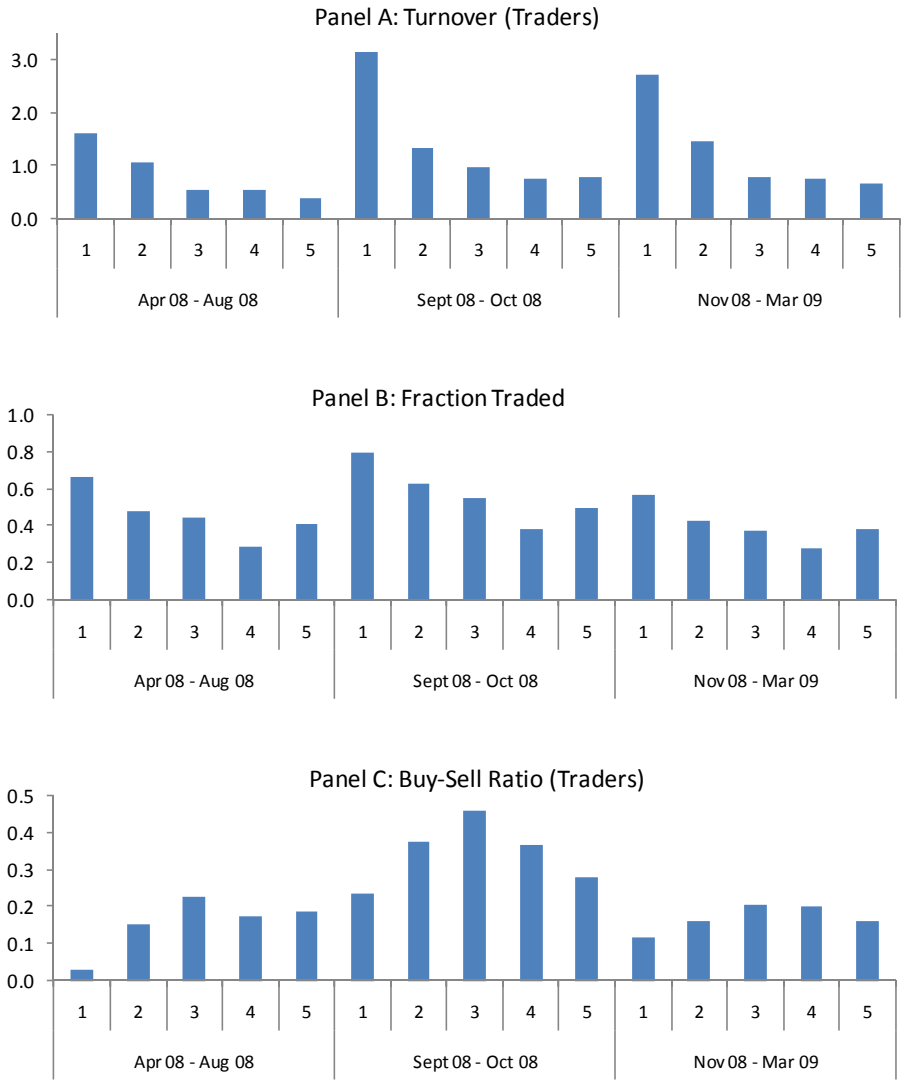

Figure 8. Crisis Performance – Investors' Trading Behavior. Numbers from 1 to 5 on the x-axes in Panels A–C indicate performance ranking quintiles of investors based on their mean modified Sharpe ratios in September–October 2008. Shown are the sample means for each trading indicator per performance quintile in a given observation period. Variables are defined in Table 1.

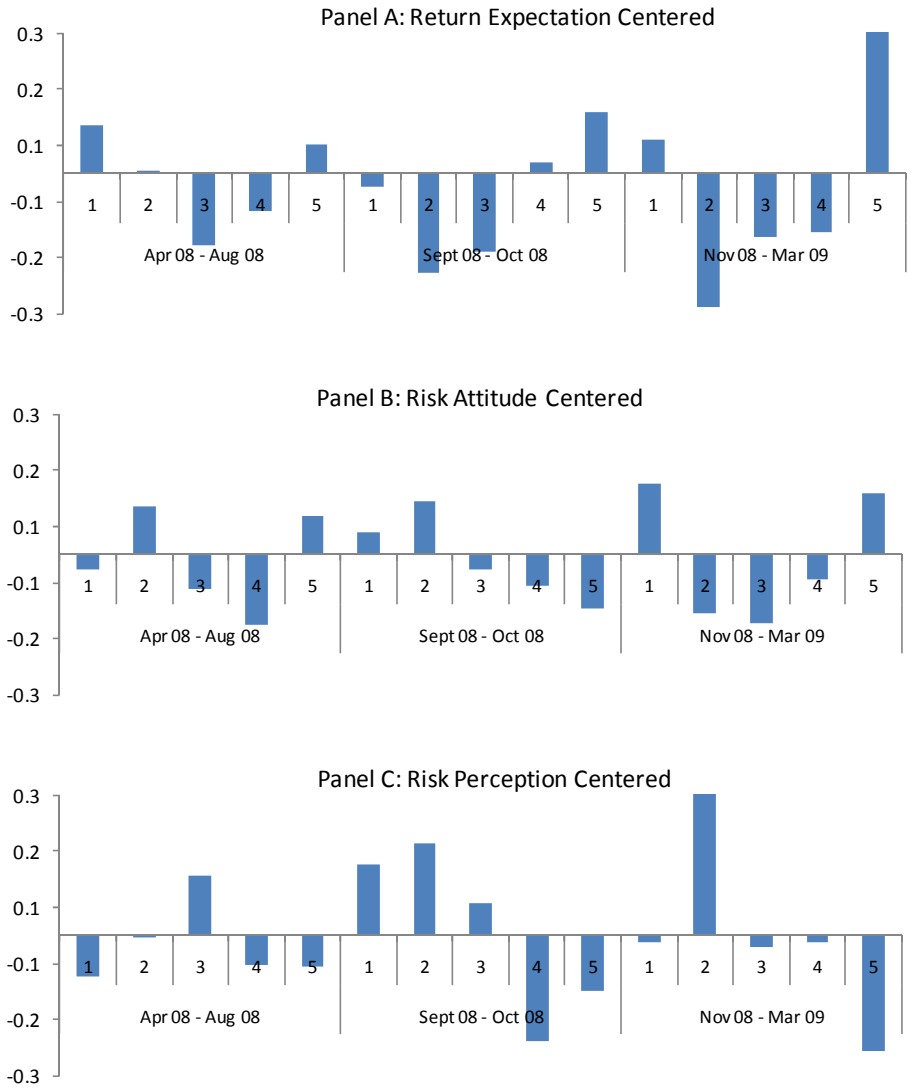

Figure 9. Crisis Performance – Investors' Perceptions. Numbers from 1 to 5 on the x-axes in Panels A–C indicate performance ranking quintiles of investors based on their mean modified Sharpe ratios in September–October 2008. Return expectation, risk attitude, and risk perception are measured on a 7-point Likert scale (see Table 3) and centered by their month-specific means. A small value indicates low return expectations (more risk averse risk attitudes, low risk perceived), whereas a large value indicates high return expectations (less risk averse risk attitudes, high risk perceived).