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Arvid Hoffmann, Thomas Post and Joost Pennings

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How Severe Was the Impact of the Financial Crisis on Individual Investor Perceptions and Behavior?

Arvid O. I. Hoffmann[*]

Maastricht University and Netspar

Thomas Post

Maastricht University and Netspar

Joost M. E. Pennings

Maastricht University, Wageningen University, and University of Illinois at Urbana–Champaign

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Abstract: Based on a unique combination of monthly survey data and matching trading records, we examine how individual investor perceptions change and drive trading and risk-taking behavior during the 2007–2009 financial crisis. Investor perceptions fluctuate significantly, with risk tolerance and risk perceptions being less volatile than return expectations. At the onset of the crisis, return expectations and risk tolerance sharply decline, while risk perceptions strongly increase. Towards the end of the crisis, these survey variables recover. We find substantial swings in trading and risk-taking behavior that are driven by changes in perceptions. As perceptions recover, trading and risk-taking behavior also return to pre-crisis levels. Although the crisis temporarily depresses individual investor perceptions and substantially changes their behavior, the impact of the crisis is not particularly long-lasting.

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

Keywords: Financial Crisis, Individual Investors, Investor Perceptions, Trading Behavior, Risk-Taking Behavior

[*] Corresponding author: Arvid O. I. Hoffmann, Maastricht University, School of Business and Economics, Department of Finance, P.O. Box 616, 6200 MD, The Netherlands. Tel.: +31 43 38 84 602. E-mail: a.hoffmann@maastrichtuniversity.nl.

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Individual investors' wealth was 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 market's high uncertainty and extreme volatility, may have induced individual investors to radically change their perceptions of the stock market and their investment behavior. According to the popular press, for example, the crisis made investors aware of the true risk of investing in stocks, lowered their return expectations and risk tolerance, increased their risk perceptions, and led them to de-risk their portfolios (Steverman 2009; Shell 2010). Surprisingly, however, academic research on these issues remains scarce to date.

We fill this void in the literature and provide a comprehensive analysis of individual investor perceptions, their behavior, and the impact of perceptions on behavior during the financial crisis. To do so, we employ a unique panel-data set in which we combine monthly survey data with matching brokerage records. For each month between April 2008 and March 2009, we measure individual investors' perceptions in a survey on their expectations for stock-market returns, as well as their risk tolerance and risk perceptions.[1] In addition, we collect information on these investors' trading and risk-taking behavior through their brokerage records. The sample period includes, on the one hand, the months when worldwide stock markets were hit hardest, that is, September and October 2008. During these months, in the U.S., Lehman Brothers collapsed and AIG was bailed out, and in Europe, parts of ABN AMRO and Fortis were nationalized. On the other hand, stock markets were still relatively calm at the start of the sample period (April 2008), while at the end of the sample period, stock markets began to recover (March 2009). As such, the sample period provides a relatively complete coverage of the crisis.

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

The results of this paper show that investor perceptions fluctuate significantly during the crisis, with risk tolerance and risk perceptions being less volatile than return expectations. At the start of the crisis, return expectations and risk tolerance sharply decline, while risk perceptions strongly increase. Towards the end of the crisis, however, return expectations, risk tolerance, and risk perceptions recover. We find substantial swings in trading and risk-taking behavior that are driven by changes in investor perceptions. As perceptions recover, trading and risk-taking behavior soon return to pre-crisis levels. In contrast to the expectations of conventional wisdom (e.g., Steverman 2009; Shell 2010), the overall pattern of results suggest that the financial crisis did not have a particularly long-lasting impact on individual investors' perceptions and behavior.

This paper contributes to the literature on the financial crisis by showing for the first time how individual investor perceptions change as well as recover and drive behavior during this period. Existing studies focus on understanding the crisis's causes and consequences for housing and securitization markets (Piskorski, Seru, and Vig 2010; Demyanyk and Van Hemert 2011), financial institutions (Brunetti, di Filippo, and Harris 2011; Maddaloni and Peydró 2011; Gropp, Hakenes, and Schnabel 2011), corporate investment decisions (Campello et al. 2011), household welfare (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). It is important to also study the experiences of individual investors, as their aggregate behavior impacts stock prices (Kumar and Lee 2006), return volatility (Foucault, Sraer, and Thesmar 2011), and ultimately even the macro-economy (Korniotis and Kumar 2011). Moreover, the economic significance of individual investors' stock-market participation rises because of an increasing self-responsibility for building up retirement wealth.

The remainder of this paper is organized as follows. Section 1 presents related literature and develops hypotheses. Section 2 introduces the data. Section 3 sets out the results. Section 4 presents robustness checks and evaluates alternative explanations. Section 5 concludes.

1. Literature and Hypotheses

Prior research shows that individual investors are subject to various behavioral biases, which seem to be rather persistent (Barber and Odean 2001; Bailey, Kumar, and Ng 2011). Among these, individual investors have difficulty learning from their experiences, and if they learn, this is a slow process (Gervais and Odean 2001; Seru, Shumway, and Stoffman 2010). Individual investors often fail to update their behavior to match their experiences and are relatively unaware of their return performance (Glaser and Weber 2007). Thus, it seems that in normal times, investors' experiences have little or no impact on their perceptions and behaviors. Extreme events such as the financial crisis of 2007–2009, however, may have a strong impact on individual investors because of their salience (Kahneman and Tversky 1972). De Bondt and Thaler (1985), for example, show that investors tend to overreact to unexpected and dramatic news events. In addition, Malmendier and Nagel (2011) show that dramatic experiences, such as the Great Depression of the 1930s in the U.S., may have a permanent impact on investor perceptions and risk-taking behavior. Finally, prior literature suggests that experiencing a number of consecutive losses reduces investors' subsequent willingness to take risks (Thaler and Johnson 1990; Barberis 2011). As the financial crisis combines a severe shock to investor wealth with a highly uncertain and volatile market environment, we expect a strong and long-lasting impact on investor perceptions and behavior. As such, we develop the following hypotheses regarding investor perceptions (H_1) and risk-taking behavior (H_2) during the crisis:

H_{1a}: The financial crisis depresses investor perceptions. That is, their return expectations and risk tolerance are expected to decrease, while their risk perceptions are expected to increase.

H_{1b}: These effects on investor perceptions are long-lasting because of the extreme nature of the crisis.

H_{2a}: The financial crisis makes investors aware of a higher than previously expected market risk. Therefore, individual investors are expected to reduce their portfolio risk during this period.

H_{2b}: These effects on investor behavior are long-lasting because of the extreme nature of the crisis.

During a crisis, investors are exposed to a frequent stream of often dramatic and unexpected news events. Prior research shows that receiving (too) much information can lead to information overload, which stimulates status-quo bias, thus potentially reducing individual investors' trading activity during a crisis (cf. Agnew and Szykman 2005). Alternatively, however, the large amount of new and potentially conflicting information that investors receive during a crisis may induce frequent changes in their perceptions, as well as a larger divergence of such perceptions (i.e., disagreement amongst various investors). Glaser and Weber (2005), for example, find an increase in the standard deviation of individual investors' return and volatility forecasts directly after the terror attacks of September 11 and the subsequent stock-market turmoil. Changes in and divergence of perceptions are both expected to lead to higher trading activity: The first effect provides more reasons to trade, and the second effect makes it more likely for investors to find a trading counterpart (cf. Banerjee 2011). Hence, we develop two mutually exclusive hypotheses about individual investors' trading activity during a financial crisis:

H_{3a}: The frequent arrival of new information during the financial crisis leads to information overload. As a result, individual investors are expected to reduce their trading activity.

H_{3b}: The frequent arrival of new information during the financial crisis changes investor perceptions and creates a larger divergence in their perceptions. As such, having more reasons as well as opportunities to trade are expected to increase individual investors' trading activity.

2. Data

We base our 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 observed trading patterns, as well as survey responses, reflect investors' own decision making and opinions and not those of an advisor. An additional advantage is that discount brokers represent 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.

2.1 Brokerage Records

Brokerage records are available for investors who completed at least one survey during the sample period. A "record" consists of an identification number, a transaction date and time, a

buy/sell indicator, the type of asset traded, the gross transaction value, and transaction commissions. The records also contain information on investors' daily account balances, demographics such as age and gender, as well as their 6-digit postal code. Based on this postal code, which is unique to each street (or even parts of a street) in the Netherlands, and data from Statistics Netherlands (Central Bureau of Statistics), we assign income and residential house value to each investor. Variables are defined in Table 1. Table 2 shows descriptive statistics.

[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 slightly higher. 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 our 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% indicate that the other account(s) comprise(s) less than half their total investment portfolio. Together with the reasons outlined above, this paper's sample of investors seems sufficiently representative to justify extrapolating our results to the broader population of self-directed individual investors. 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.

2.2 Survey Data

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. The initial response rate of 4.28% (April 2008) is comparable to that of other large-scale surveys (cf. Dorn and Sengmueller 2009).

A possible concern with samples of investors such as the one used in this study is that monthly variation of non-response (see Table 2) might not be random. For example, investment success could be related to the likelihood to respond. Robustness checks in Section 4.1 show that our sample is not subject to such non-random response behavior problems.

The survey elicited information on investors' expectations of stock-market returns, their risk tolerance, and their risk perceptions for each upcoming month (see Table 3). To ensure a valid measurement of these variables, we use tested and well-established scales 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 following Weber et al. (2010). Risk tolerance reflects a respondent's 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 use multiple items per variable, include these items in the questionnaire in a random order (Netemeyer, Bearden, and Sharma 2003), and employ a mixture of regular and reverse-scored items (Nunnally and Bernstein 1994). Reliability 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). The survey variables are computed by equally weighting and averaging their respective item scores. Such variables perform 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]

3. Tests of Hypotheses

3.1 Investor Perceptions during the Crisis

In this section we test hypothesis H_1. That is, we examine whether the financial crisis has a depressing effect on investor perceptions (H_{1a}), and if so, whether this effect is long-lasting (H_{1b}). Figures 1 and 2 show the evolution of individual investors' return expectations, risk tolerance, and risk perceptions during the crisis, as well as the Dutch stock market's index returns (AEX).

[Figures 1-2 here]

Investors' return expectations (Figure 1) quickly drop at the onset of the crisis, to reach their lowest levels during the height of the crisis (September–October 2008). Afterward, return expectations recover. Towards the end of the financial crisis (March 2009), they almost reach their level at the beginning of the sample period (April 2008). The rapid recovery of return expectations suggests that individual investors did not experience a long-lasting shock to their return expectations as a result of the crisis, but instead regularly adapt their expectations to changes in return experiences. In addition, Figure 1 highlights that return expectations (measured at the end of each month) closely follow past returns. The adaptive evolution of return

expectations during the crisis is similar to the adaptation process found in calmer market periods (Hurd, van Rooij, and Winter 2011). Moreover, this finding is in line with De Bondt and Thaler's (1985) result that investors overweight the recent past when forming return expectations.

We find similar effects for risk tolerance and risk perception (Figure 2), though these measures display less fluctuation over the sample period than return expectations. Both risk tolerance and risk perception recover towards the end of the crisis. Again, it does not seem that the dramatic experiences of the financial crisis either permanently lowered individual investors' risk tolerance or enduringly increased their risk perceptions. Compared to other studies that measure investor perceptions during the financial crisis, this study's longitudinal research design and more frequent measurement offer additional insights. Both Bateman et al. (2010) and Weber et al. (2010), for example, measure investor perceptions during the financial crisis, but their infrequent and long-apart measurements do not detect meaningful changes in risk tolerance and risk perceptions. Although this study's findings confirm the results of Bateman et al. and Weber et al. that risk tolerance and risk perception are relatively stable over longer time intervals, we find that during the crisis period, they significantly fluctuate and temporarily become depressed.

Overall, we find support for hypothesis H_{1a}, but do not find clear evidence for hypothesis H_{1b}. Investor perceptions are impacted by the crisis, but they become only temporally depressed, and quickly recover with improving market returns. The one-year sample period that is available prevents testing very long-lasting effects of the crisis on investor perceptions. Since investor perceptions before the most dramatic months of the crisis (September–October 2008) are similar to their perceptions afterward, however, any long-term effect, should it exist, is expected to be rather small in magnitude in comparison to the monthly fluctuations in investor perceptions.

3.2 Investor Risk Taking during the Crisis

In this section we test hypotheses H_2. That is, we examine whether the financial crisis leads investors to reduce their portfolio risk (H_{2a}), and if so, whether this reduction is long-lasting (H_{2b}). To measure portfolio risk, we use the volatility (standard deviation) of investors' daily portfolio returns. Figure 3 shows the monthly volatility of investor returns and the volatility of the market index (AEX). Changes in investors' return volatility track those of the market, while being higher, on average. Especially in September–October 2008, investors' return volatility spikes. Thus, during the height of the crisis, investors are not de-risking their portfolios. The sharp increase in market risk in this particular period may have come as a surprise to individual investors. After September–October 2008, however, when market volatility decreases, individual investors' return volatility remains at a higher level than that of the market, with the magnitude of the difference staying at the same level as in September–October. Additional (untabulated) tests that consider the cash position in investors' accounts confirm these results. Total account volatility (i.e., the sum of the investment portfolio and cash) is generally lower than portfolio volatility (e.g., – 6 percentage points in April 2008). It also spikes at the height of the crisis. Again, we find that toward the end of the crisis, account volatility is higher than at its beginning (e.g., + 9 percentage points in March 2009 compared with April 2008). Thus, investors are not reducing risk by shifting from investments to cash. The results show that during, and also after the financial crisis, individual investors do not de-risk their portfolios.

[Figure 3 here]

Instead, individual investors use the depressed asset prices as a chance to enter the market. Figure 4 shows individual investors' monthly buy-sell ratio. Especially during September–October 2008, the buy-sell ratio increases. Generally, the buy-sell ratio is greater than zero

(indicating net buying, on average). This behavior of investors during the crisis mimics the findings of Kaniel, Saar, and Titman (2008) for normal stock-market periods and those of Griffin et al. (2011) for the technology stock reversal in March 2000. That is, individual investors, on average, increase their buying volume after price decreases (and vice-versa).

[Figure 4 here]

To gain more insight into the factors that drive individual investors' risk-taking behavior, we regress their portfolio standard deviation and buy-sell ratio on their perceptions. We run 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, and changes in perceptions during a month, influence behavior. This approach differentiates the general effect of levels of investor perceptions (e.g., always having high risk tolerance and high trading activity) from specific effects of revisions in perceptions and resulting behavior. That is, we examine whether the monthly fluctuations in investor perceptions are an important ingredient for understanding investor behavior, or whether only the levels of perceptions matter. We control for other investor characteristics that prior literature suggests as drivers of investor behavior, such as gender, age, account tenure, income, portfolio value, house value, derivative usage, and dividend choice. Results are presented in Table 4.

[Table 4 here]

Table 4 shows that 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 tolerance, as well as the levels of risk perception, are associated with risk taking. That is, higher past levels of and upward revisions in risk tolerance lead investors to choose portfolios

with higher standard deviations. Furthermore, risk perceptions are positively associated with portfolio risk. This result suggests that individual investors are aware of the risk of their investment portfolios. The 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.

Regarding the control variables, we confirm prior literature. Investors who are more experienced (longer account tenure) and confident of their skills (trade derivatives) take more risk (cf. Barber and Odean 2001; Bauer, Cosemans, and Eichholtz 2009; Grinblatt and Keloharju 2009), while investors with larger portfolios take less risk (cf. Shefrin 2002).

With respect to buy-sell ratios, we find that investors with higher levels of and upward revisions in risk tolerance, 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 (second column in Table 4). That is, more risk-tolerant investors increase their exposure to the market, while investors who perceive higher risk lower their exposure.

Overall, the results of this section lead us to reject hypotheses H_{2a} and H_{2b}. The financial crisis did not induce individual investors to de-risk their portfolios. This behavior is rooted in the time-variation of investor perceptions: Since risk tolerance and risk perception quickly return to pre-crisis levels, and these measures are important drivers of portfolio risk and buy-sell ratios, investors did not reduce their portfolio risk. Although temporarily dramatic, the crisis thus does not seem to have a long-lasting effect on individual investors' risk-taking behavior.

3.3 Investor Trading Activity during the Crisis

In this section we test hypothesis H_3. That is, we examine whether experiencing a crisis leads individual investors to decrease (H_{3a}) or increase (H_{3b}) their trading activity. Figure 5 plots the

fraction of investors that trades each month and their turnover, and shows that the likelihood of trading and turnover increase sharply during the height of the crisis (September–October 2008).

[Figure 5 here]

The sharp increase in trading activity, as shown in Figure 5, makes it unlikely that information overload, and the associated lower trading activity, plays a major role for individual investors during the financial crisis. Increasing trading activity alone, however, is insufficient to rule out potential information overload effects. Therefore, we also regress investor trading activity on their perceptions and variables shown to be linked to susceptibility for information overload. Agnew and Szykman (2005) show that financially literate and experienced investors, that is, those with longer account tenure, higher income, and larger portfolio values, suffer less from information overload. These investors have less difficulty interpreting the frequent and sometimes conflicting information that arrives during a crisis. Therefore, we expect them to have a lower tendency to be overwhelmed by crisis events that could have led them to refrain from trading. As such, if information overload plays an important role, trading activity (i.e., likelihood to trade and turnover) should be positively related to financial literacy and experience. We find that income is indeed positively related to the likelihood of trading, while other measures of investor sophistication display conflicting signs. Table 5 thus confirms the graphical evidence of Figure 5: Information overload does not seem to play an important role during the crisis.

[Table 5 here]

As we do not find evidence in support of hypothesis H_{3a}, we next test hypothesis H_{3b}. That is, we examine whether more reasons (changes in perceptions) and opportunities to trade (divergence of perceptions) explain the increase in trading activity, as observed in Figure 5. Both in the

likelihood of trading and the turnover regressions, most perception coefficients are significant (Table 5). Exceptions are the coefficients for changes in risk perception (likelihood to trade regression), and level and changes in risk tolerance (turnover regression). Overall, levels and changes in perceptions drive trading activity. Figures 1 and 2 show that perceptions fluctuate significantly during the crisis. Together with the regression results, this implies that having more reasons to trade leads investors to increase their trading activity. To measure divergence of perceptions (i.e., disagreement between different investors), we use the monthly cross-sectional standard deviation of the perception measures (Doukas, Kim, and Pantzalis 2006; Zhang 2006; Güntay and Hackbarth 2010; Banerjee 2011). Figure 6 plots the divergence of investor perceptions during the crisis and shows that divergence tends to co-move with trading activity. These results lead us to reject H_{3a} and accept H_{3b}. That is, the increased trading activity during the height of the crisis is related to changes in perceptions as well as higher divergence of perceptions. In other words, investors have more reasons as well as more opportunities to trade.

[Figure 6 here]

4. Robustness Checks and Tests of Alternative Explanations

4.1 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 2, 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 for December 2005. This information includes 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 2), 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 larger portfolios (€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 6 presents mean differences between respondents and non-respondents. To examine whether non-response is related to investor behavior or performance, investors' trading and risk-taking variables, returns, Sharpe ratios, and alphas are also analyzed.

[Table 6 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. Except for August 2008 (alpha) and December 2008 (Sharpe ratio) there are no significant differences between respondents and non-respondents regarding risk taking or performance. 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 would be driven by overall market developments (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 6 is included. Next, the predicted probabilities of survey response are calculated. Finally, all regression models of Section 3 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 available upon request). Exceptions are the turnover regression where we identify that, compared to male investors, female investors have lower turnover (β = -0.149, p = 0.085), and the portfolio risk regression, where we find that female investors hold less risky portfolios (β = -0.036, p = 0.048). Both results confirm Barber and Odean (2001).

4.2 Investor Perceptions versus Past Returns as Drivers of Behavior

Figures 1 and 2 suggest that the month-to-month changes (revisions) in investors' perceptions follow changes in the Dutch stock market index (AEX). In particular, revisions in return expectation and risk tolerance seem to be positively, and revisions in risk perception negatively, associated with changes in market returns. Hence, one could hypothesize that perceptions have a significant effect in the regression analyses only because they reflect past returns (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 7 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 7 contains the contemporaneous correlations to detect an impact of past returns on current perceptions.

[Table 7 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 gives first evidence that investors' perceptions provide additional information over and beyond the information included in their past returns. In addition, Table 8 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 8 here]

Table 8 shows that, in most months, average return expectations and risk tolerance move in the same direction, while risk perceptions move in the opposite direction of 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 8 shows that the fraction of investors that change their perceptions in line with the change in the overall market return is larger among 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. 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 investor past return experience versus investor perceptions on their trading and risk-taking behavior. Since the possible impact of the past market return (AEX) on investor behavior is already accounted for by the time fixed effects that are included in the regression models of Section 3, only the possible impact of individual investor return experience is examined further. For this, we again estimate the regression models including investors' past returns, change in past returns, or both, as control variables. The results show that the levels of 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 available 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, and 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 (standard deviation of portfolio return) 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 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 not only pick up information from past returns, but they also provide explanatory power for investor behavior well beyond the previously documented effect of past returns and changes in past returns.

4.3 Relevance of Investor Risk-Taking and Trading Behavior During the Crisis

Results of Section 3 show that investor perceptions and fluctuations therein are important drivers of investor behavior. The aspects of trading and risk-trading behavior that we study have been shown to be related to investor performance during normal market periods. Thus, economically, they matter. In this section we assess whether, also during the financial crisis, the behavioral variables that we study are related to investor performance, and thus have relevance in this particular period. To do so, we regress three measures of investor performance on investor behavior and a set of controls. As performance measures, we study investors' portfolio return, their Sharpe-Ratio, and their one-factor (Jensen's) alpha.[2] The aspects of investor behavior that we include are based on Section 3: We examine the impact of the standard deviation of investors' portfolio return, as well as that of their buy-sell ratio, likelihood to trade, and turnover. Note that, since investment risk is already accounted for in the dependent variable in the Sharpe-Ratio and alpha regression, only in the portfolio-return regression do we include the standard deviation of returns as an independent variable. The results of Table 9 show that the behavioral variables that we consider in this paper are important drivers of investor performance during the financial crisis. As overall market returns were mostly negative during the sample period, both

[2] We cannot estimate multi-factor alphas in this paper because of limitations on the portfolio-holdings data.

portfolio risk (standard deviation) and the buy-sell ratio are negatively associated with performance. In addition, trading activity (turnover), is negatively related to performance, consistent with results obtained in normal market periods (Barber and Odean 2000). Overall, these regression results provide evidence that the investor behaviors that we study during the financial crisis are economically relevant.

[Table 9 here]

5. Conclusion

In this paper, we combine monthly survey data with matching brokerage records to create a unique set of panel data that shows how individual investor perceptions change and drive trading and risk-taking behavior during the financial crisis of 2007–2009. The results show that investor perceptions exhibit significant fluctuation over the course of the crisis, with risk tolerance and risk perceptions being less volatile than return expectations. At the start of the crisis, investors' return expectations and risk tolerance sharply decline, while their risk perceptions strongly increase. Towards the end of the crisis, however, return expectations, risk tolerance, and risk perceptions quickly recover. We find substantial swings in trading and risk-taking behavior during the crisis that are driven by changes in investor perceptions. Contrary to conventional wisdom, however, individual investors did not stop trading altogether or de-risk their portfolios. In fact, as perceptions recovered, trading and risk-taking behavior soon returned to pre-crisis levels. Thus, although the uncertainty and volatility of the financial crisis had a significant effect on investors' perceptions and behavior, these effects do not seem to be particularly long-lasting.

This study provides two insights for asset pricing. First, in contrast to Brunnermeier and Nagel (2008), we show that investor's risk tolerance is time-varying (see Figure 2) and significantly related to risk-taking behavior (see the risk-taking regression). Investor's portfolio

risk, however, seems to move in parallel with market risk (see Figure 3), as if changes in risk tolerance had no material impact. Hence, it may be investor inertia, that is, the large fraction of investors not trading during the sample period (see Figure 5), as well as rebalancing behavior after price changes (see Figure 4 and the buy-sell ratio regression), that ultimately drives portfolio risk. The impact of time-varying risk tolerance on risk-taking behavior discovered here may be masked and overcompensated by the impact of investor inertia found by Brunnermeier and Nagel (2008). Second, although the sample period does not cover the time before the crisis, this paper's findings on the evolution of investor perceptions shed light on the psychological factors contributing to the asset-price bubble preceding the crisis. Barberis (2011), for example, argues that the representativeness heuristic (i.e., people tend to base their predictions on small and recent samples) is largely responsible for the overly optimistic formation of pre-crisis expectations. This paper's results show that individual investor perceptions indeed exhibit adaptive behavior with respect to very recent stock-market performance (see Figures 1-2). We thus provide empirical support for Barberis's (2011) theoretical viewpoint regarding the psychological factors that contributed to the financial crisis of 2007–2009.

This study's results have implications for crisis management. Changes in investors' perceptions over time drive such key behaviors as trading frequency, turnover, buy-sell ratio, and risk taking. In particular, investor perceptions have explanatory power for their behavior well beyond previously documented effects of past returns. Individual investors' aggregate trading behavior influences stock prices (Kumar and Lee 2006), return volatility (Foucault, Sraer, and Thesmar 2011), and ultimately even the macro-economy (Korniotis and Kumar 2011). Therefore, frequently collected information about individual investors' perceptions could be a crucial input for an integrative communication strategy aimed to moderate individual investor perceptions so as to prevent destabilizing investment behavior.

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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 postal code. This postal code is unique for each street in the Netherlands. Data source is the average net income per 6-digit postal code from Statistics Netherlands (Central Bureau of Statistics).
Portfolio Value	Value of investment assets in an investor's account at the end of the month.
House Value	Value of house in 2008. Assigned to each investor based on their 6-digit postal code. This postal code is unique for each street in the Netherlands. Data source is the average residential house value per 6-digit postal 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 investor's 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 investor's 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.
Sharpe Ratio	Return divided by the standard deviation of return.
Alpha	Monthly one-factor alpha (Jensen's alpha).
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 Tolerance	Reflects a respondent's general predisposition toward financial risk. Details on the survey questions are given in Table 3.
Risk Perception	Reflects a respondent's interpretation of how risky the stock market will be in the upcoming month. Details on the survey questions are given in Table 3.

Because of data availability, 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
Return Expectation	mean	4.29	4.18	3.57	3.78	4.11	3.47	3.39	3.60	3.74	3.97	3.55	4.17
Risk Tolerance	mean	3.92	3.93	3.59	3.77	3.86	3.58	3.66	3.70	3.78	3.73	3.70	3.86
Risk Perception	mean	4.49	4.45	5.01	4.17	3.99	4.43	4.27	4.26	4.24	4.19	4.45	4.23

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 investors who participated at least once during the entire sample period in the survey and who were not excluded by the sample-selection restrictions as defined in section 2. The monthly summary statistics presented in Panel B refer to the subset of investors who responded to the survey in each respective month. Variables are defined in Table 1.

Table 3
Survey Questions

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

This table presents the questions 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 tolerance, risk perception) is calculated as the equally weighted average of the respective survey questions. * denotes a reverse-scored question. All survey variables are measured using psychometrically validated measurement scales (Nunnally and Bernstein 1994). Cronbach's alpha is between 0.71 and 0.89 for all survey variables, indicating the measurement instrument is reliable (Hair et al. 1998).

Table 4
Risk-Taking Behavior

Dependent Variable	Std(Return)		Buy-Sell Ratio	
	Coef.	Std. err.	Coef.	Std. err.
Return Expectation prev. month	0.006	0.009	-0.008	0.022
Δ Return Expectation	0.002	0.007	-0.030	0.021
Risk Tolerance prev. month	0.030	0.009 ***	0.060	0.017 ***
Δ Risk Tolerance	0.014	0.005 ***	0.067	0.016 ***
Risk Perception prev. month	0.017	0.006 ***	-0.029	0.015 *
Δ Risk Perception	0.007	0.004	-0.013	0.013
Gender	-0.022	0.022	0.019	0.057
Age	0.001	0.001	0.000	0.001
Account Tenure	0.006	0.003 *	-0.009	0.006
ln(Income)	0.097	0.057 *	-0.215	0.171
ln(Portfolio Value) prev. month	-0.049	0.007 ***	-0.055	0.010 ***
ln(House Value)	-0.028	0.034	0.181	0.078 **
Derivatives	0.115	0.019 ***	-0.175	0.043 ***
Dividend Choice Stock	0.021	0.023	0.007	0.045
Dividend Choice Cash & Stock	0.026	0.018	0.003	0.040
Constant	0.077	0.389	0.525	1.145
Time fixed effects	YES		YES	
N Observations	3,885		1,914	
N Investors	1,041		968	
R^2	0.262		0.091	

This table presents the results from regressions of risk-taking behavior on investor perceptions and a set of control variables. Dependent variables are the standard deviation of investors' daily portfolio returns and the buy-sell ratio. The columns show results of linear panel models for the full sample (standard deviation of return) and for the truncated sample of investors who have at least one trade in a particular month (buy-sell ratio). The number of individual investors included the first regression (1,041) is smaller than the sample available for analysis (1,376), because 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 5
Trading Activity

Dependent Variable	Traded		Turnover	
	Marg. Eff.	Std. err.	Coef.	Std. err.
Return Expectation prev. month	0.094	0.019 ***	0.069	0.042 *
Δ Return Expectation	0.054	0.016 ***	0.062	0.034 *
Risk Tolerance prev. month	0.076	0.015 ***	0.030	0.030
Δ Risk Tolerance	0.069	0.013 ***	-0.017	0.027
Risk Perception prev. month	0.028	0.013 **	0.065	0.024 ***
Δ Risk Perception	0.016	0.010	0.053	0.017 ***
Gender	0.046	0.070	-0.133	0.089
Age	0.001	0.002	0.005	0.003 *
Account Tenure	-0.014	0.007 **	0.021	0.012 *
ln(Income)	0.313	0.181 *	0.495	0.330
ln(Portfolio Value) prev. month	0.068	0.010 ***	-0.130	0.024 ***
ln(House Value)	-0.197	0.090 **	-0.420	0.190 **
Derivatives	0.475	0.037 ***	0.004	0.079
Dividend Choice Stock	0.010	0.052	0.304	0.103 ***
Dividend Choice Cash & Stock	-0.046	0.045	0.146	0.068 **
Constant			1.264	1.833
Time fixed effects	YES		YES	
N Observations	3,885		1,914	
N Investors	1,041		698	
R^2			0.108	

This table presents the results from regressions of two indicators of investor trading activity on investor perceptions and a set of control variables. Dependent variables are market participation (Traded) and turnover. 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), because not all investors responded to the survey for two consecutive months. The second column shows results of a linear panel model 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 the linear panel model. Variables are defined in Table 1. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6

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
Std(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
Buy-Sell Ratio (Traders)	0.09 *	0.11 **	-0.01	-0.06	0.07	0.02	0.01	0.01	-0.05	-0.19 ***	-0.02	0.05
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
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
Sharpe Ratio	0.01	0.00	0.01	-0.01	-0.01	0.00	-0.01	0.03	0.03 *	0.01	0.01	0.00
Alpha	0.01	0.00	0.00	0.00	0.02 **	-0.01	0.01	0.00	-0.01	0.00	0.02	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 7

Correlations between Investor Perceptions and Returns

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

This table presents the Pearson correlation coefficients between (end-of-month) investor perceptions and the corresponding (i.e., for the same month) realized total return on the Dutch stock market index (AEX), and individual investor returns. Panel A refers to levels in 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 8

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 Tolerance		+ 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 Tolerance >= 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 Tolerance		+ 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 Tolerance >= 0 and Return >= 0	% Investors	51	39	60	58	30	48	57	53	51	55	54
Δ Risk Tolerance >= 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 Tolerance >= 0 and Δ Return >= 0	% Investors	52	26	56	58	22	43	52	53	49	53	53
Δ Risk Tolerance >= 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 perceptions 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 returns as well as changes in return experience. Variables are defined in Table 1.

Table 9
Investor Performance

Dependent Variable	Return		Sharpe Ratio		Alpha	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Gender	0.001	0.007	-0.025	0.029	-0.005	0.010
Age	0.000	0.000	0.000	0.001	0.000	0.000
Account Tenure	0.002	0.001 **	0.005	0.003	0.002	0.001
ln(Income)	0.002	0.022	0.056	0.083	-0.042	0.032
ln(Portfolio Value) prev. month	0.000	0.002	-0.009	0.005	0.005	0.002 **
ln(House Value)	0.011	0.012	0.013	0.041	0.019	0.017
Derivatives	-0.011	0.006 *	0.006	0.022	-0.009	0.007
Dividend Choice Stock	-0.004	0.007	0.003	0.022	-0.007	0.008
Dividend Choice Cash & Stock	-0.006	0.005	0.006	0.019	-0.004	0.007
Std(Return)	-0.309	0.022 ***				
Buy-Sell Ratio	-0.019	0.005 ***	-0.079	0.018 ***	-0.017	0.006 ***
Traded	-0.005	0.005	0.023	0.019	-0.005	0.007
Turnover	-0.008	0.002 ***	-0.007	0.003 ***	-0.011	0.003 ***
Constant	-0.191	0.150	-1.202	0.523 **	0.174	0.190
Time fixed effects	YES		YES		YES	
N Observations	3,885		3,885		3,885	
N Investors	1,041		1,041		1,041	
R^2	0.492		0.585		0.056	

This table presents the results from regressions of investment performance on investor behavior and a set of control variables. Dependent variables are the investor's return, Sharpe Ratio, and alpha. 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), because 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.

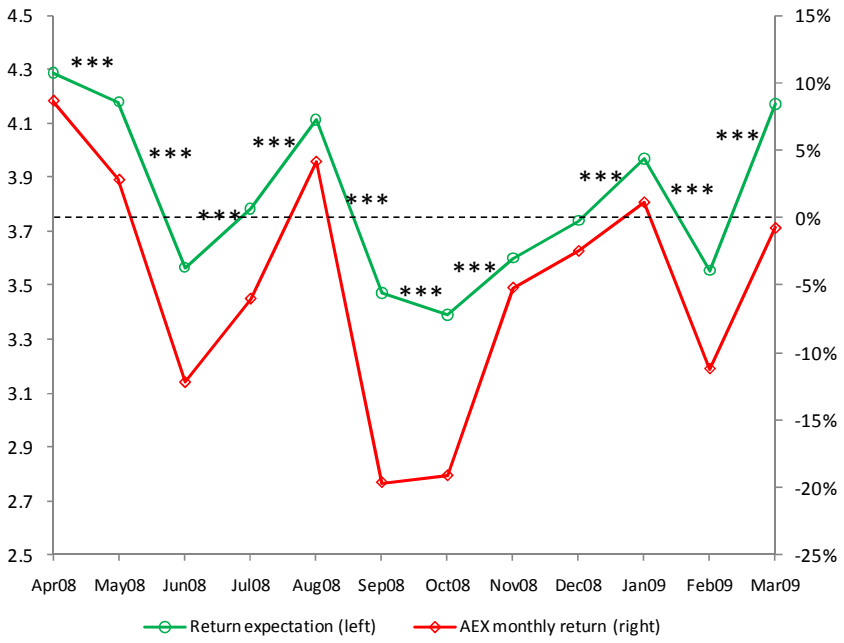

Figure 1. Return Expectations. Return expectations are measured on a 7-point Likert scale (see Table 3); shown is the sample mean. A small value indicates low return expectations, whereas a large value indicates high return expectations. AEX return is the total return of the Dutch stock market index.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

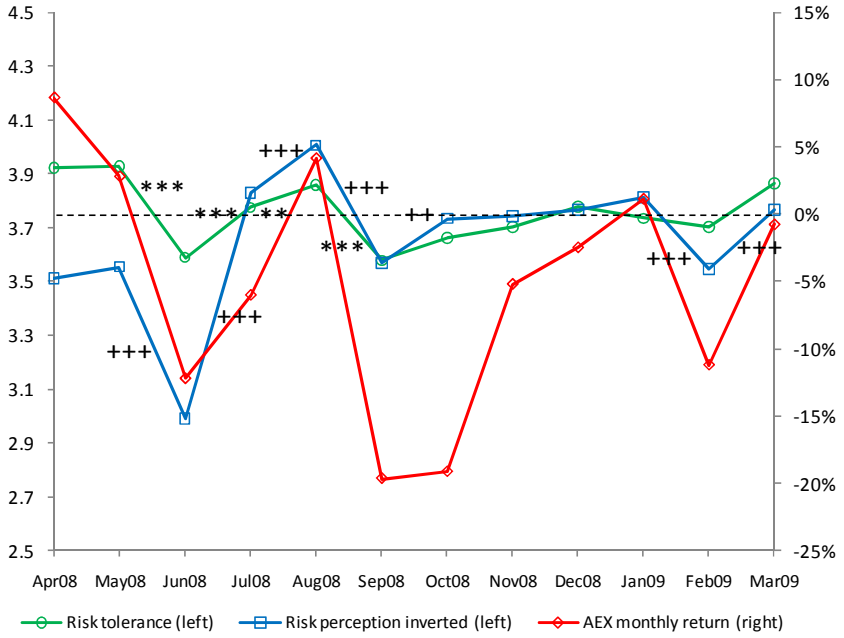

Figure 2. Risk Tolerance and Risk Perception. Risk tolerance and risk perception about investment prospects are measured on a 7-point Likert scale (see Table 3); shown is the sample mean. For illustrative purposes, risk perception is shown on an inverted scale. A small value indicates low risk tolerance or high perceived risk, whereas a large value indicates high risk tolerance or low perceived risk. 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 tolerance (risk perception) at the 10%, 5%, and 1% levels, respectively.

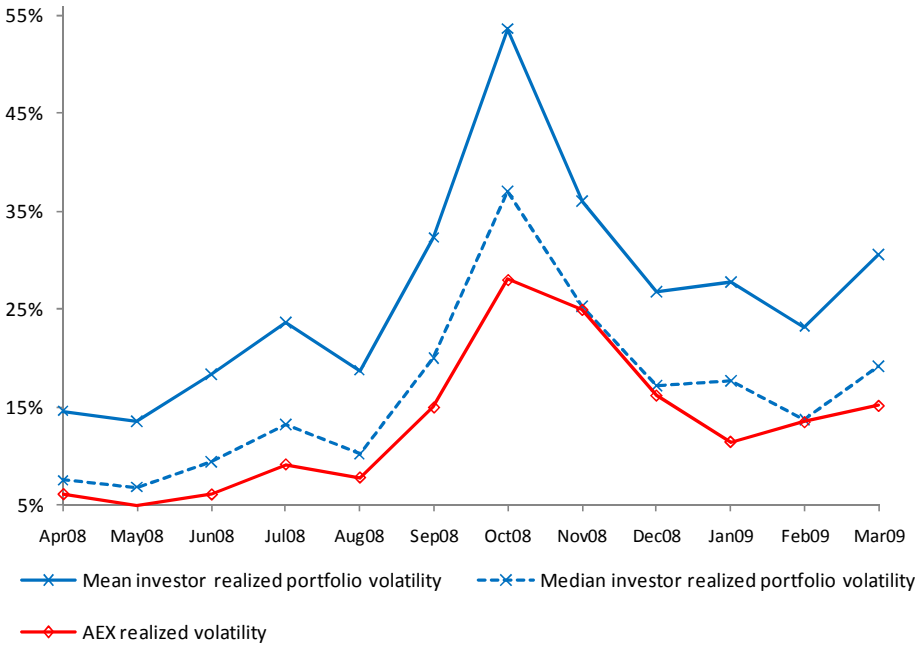

Figure 3. Investors' Monthly Return Volatility. Investor realized volatility is calculated based on the daily returns on their portfolio. AEX realized volatility is calculated for each month based on the daily total returns of the AEX index. All volatilities are depicted in monthly terms. Variables are defined in Table 1.

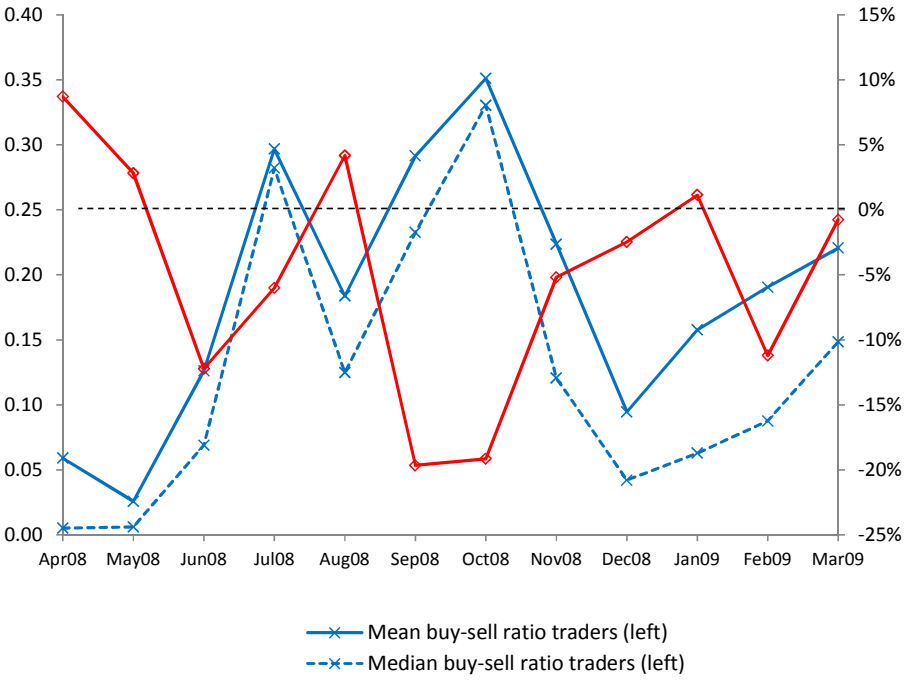

Figure 4. Investors' Buy Sell Ratio (Traders). AEX return is the total return of the Dutch stock market index. Variables are defined in Table 1.

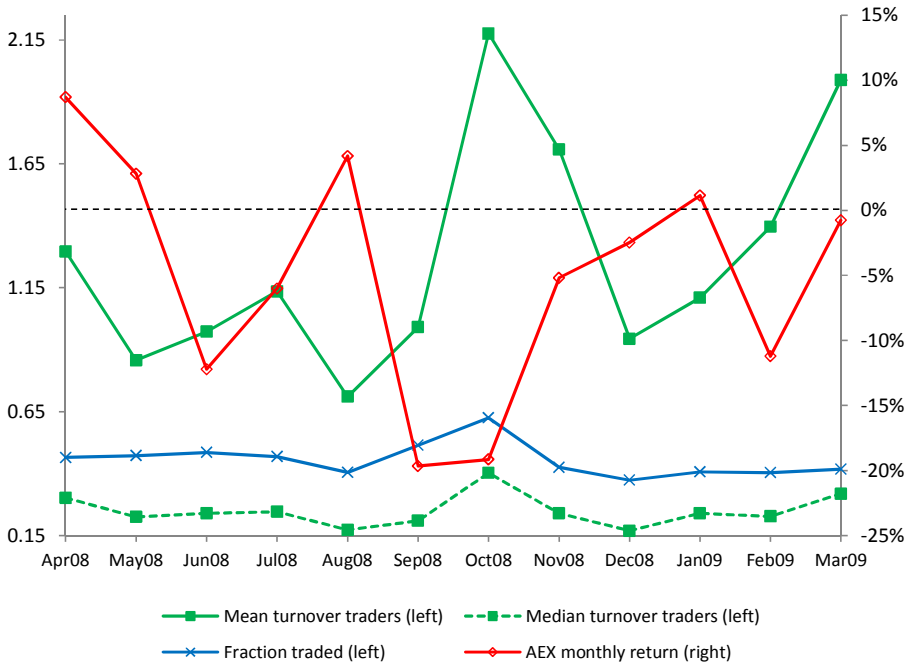

Figure 5. Trading Activity – Fraction of Investors that Traded and Turnover. AEX return is the total return of the Dutch stock market index. Variables are defined in Table 1.

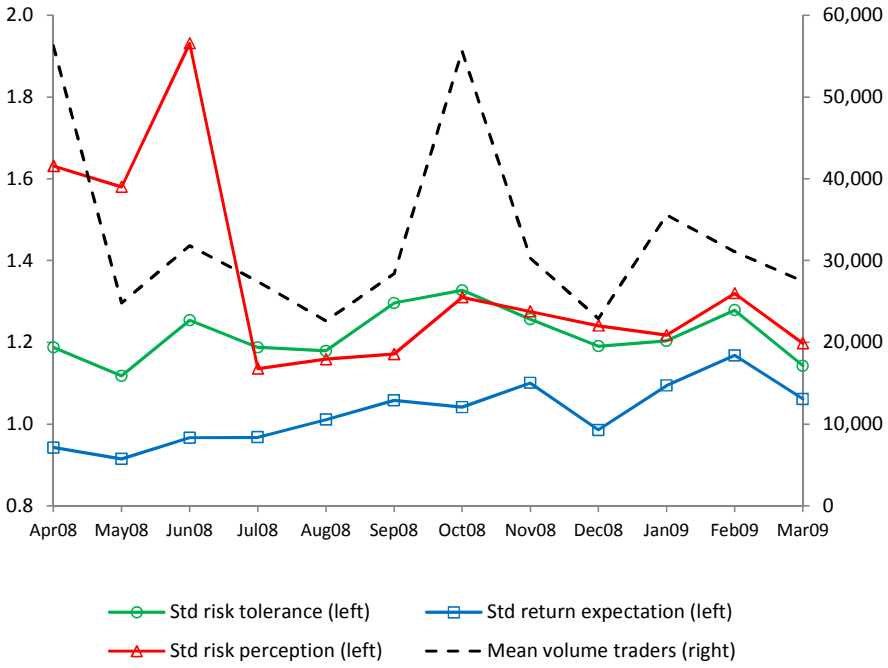

Figure 6. Divergence of Perceptions and Trading Volume. Shown are the monthly cross-sectional standard deviations of return expectation, risk tolerance, and risk perception, as well as the mean of the monthly volume (buy + sell) per investor. Variables are defined in Table 1.