Do Happy People Make Optimistic Investors?

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Abstract

Do happy people estimate risk and return on investments differently from unhappy people or do they all only rely on pure economic data? We survey investors on their subjective sentiment-creating factors, subjective expectations of future return and risk, investment plans, and actual trading. We find that non-economic sentiment-creating factors systematically affect the expectations, inducing systematic forecast errors. We analyze the effect of each sentiment-creating factor and develop an aggregate sentiment index. Contrary to theoretical predictions, return and risk subjective expectations are negatively correlated, while both are correlated with past returns. This momentum behavior may explain excess serial correlation in returns.

Keywords: sentiment-creating factors; sentiments; individual investors; mood; forecast errors; seasonal affective disorder; momentum behavior; serial correlation.

JEL classification: D81, G02, G10, G14.

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1. Introduction

There is ample experimental and empirical evidence that investors sometimes do not make decisions like efficient machines which maximize a given function. The empirical evidence shows that the stock market is correlated with some non-economic variables, e.g. the number of sunshine hours. In this paper we study the effect of various sentiment-creating factors on the subjective estimates of risk and return in the market with one month and one year outlooks. We do not cover all potential sentiment-creating factors, but most of the factors, which have been discussed in the literature, and add one important comprehensive sentiment factor not discussed before.

Investor sentiment is defined in the literature in various ways. The most general definition that encompasses the other existing definitions is probably the one suggested by Baker and Wurgler (2007). They define investor sentiment as "investors' belief about future cash flows and risk not justified by the facts at hand" (p. 129). Employing this definition, this paper directly tests for the existence of a sentiment effect on the individual level. Using data corresponding to a large number of individual investors, we analyze the individuals' sentiment and explore which sentiment-creating variables explain the differences in risk and return estimates across those individuals.

While numerous studies have shown that non-economic factors are correlated with stock prices, our survey findings shed light not only on correlation but also on causality: the individuals' sentiment-creating factors strongly affect expectations of future return and risk

which, in turn, create systematic forecast errors. In addition, unlike what economic theory predicts, on the individual level (but not on aggregate level where we have happy and unhappy people simultaneously making decisions), we find that a relatively high subjective expected return estimate is accompanied by a relatively low expected risk. Thus, when the subject is feeling very good and may be in a state of euphoria, she deviates from fundamental economic principles. The happier the subject, as measured by several subjective factors, the more optimistic she becomes, expecting a relatively higher future return and a relatively lower future risk for both U.S. and Dutch stock indexes. As returns are found to be also correlated with the return on the stock market in last five days before filling in the questionnaire (each subject has her filling date), we obtain a unique situation in which high past returns are accompanied by high perceived expected future returns and low perceived expected future risk. This, in turn, encourages buying stocks, which may be (depending on the proportions of happy and unhappy people) another source of the serial correlation in stock returns that has been documented in numerous studies and is only partially explained in the literature.

Evidence on the role of investor sentiment in the stock market usually belongs to one of two strands of studies. On the one hand, there is laboratory *experimental* evidence recorded on the individual level (where generally the subjects are students), which reveals that participants frequently make irrational, bounded rational, or inconsistent decisions which contradict the classic von-Neumann and Morgenstern expected utility paradigm. Generally, the subjects in these experimental studies choose from some hypothetical prospects, but typically sentiment is not analyzed in this setting.

On the other hand, many studies empirically show that *aggregate* investor sentiment, calculated from macroeconomic data, is significantly correlated with stock prices. These empirical studies, which are reviewed in Section 2, hypothesize that some non-economic variables irrationally affect investor sentiment, which, in turn, affects stock prices. However, this hypothesis is usually based on circumstantial inference and causality remains ambiguous, as the direct relation between the individual's sentiment-creating factors and the individual's perception of the future market return (which affects investment activity and prices) has not been studied.

Unlike the macro empirical studies, in this study we directly examine causality by analyzing the link between the individual's stock market sentiment (i.e. the individual's subjective market judgment) and the sentiment-creating factors reported by each individual. We also explore the effect of the individual's sentiment on her plans to trade in the stock market. To the best of our knowledge, this is the first study that examines, on the individual level, the direct relations between sentiment-creating factors, the individual's estimates of future return and risk and the individual's investing behavior, where the analysis is not confined to laboratory experiments but rather conducted on a sample of individuals who actually trade in the stock market.

Yet, we use the previous published results and in particular the findings in the macro empirical studies as a springboard for establishing some of the hypotheses tested in this paper on the individual level and incorporate all the suspected sentiment-creating factors which have been reported in various studies into one comprehensive questionnaire.

In the present study we employ representative panel-sampling data to examine the effect of various sentiment-creating factors on individuals' attitudes towards the stock market and the effect they have on forecast errors. The cross-section analysis relies on the Longitudinal Internet Studies for the Social Sciences (LISS) panel of CentERdata at Tilburg University.[2] This panel consists of a sample of about 5,000 households, which is representative of the population of the Netherlands. After a preliminary screening to select those individuals who hold stocks in their investment portfolios, we submitted three rounds of questionnaires to about 900 individuals during a time span of about one year (which allows us to test for seasonality effects), as well as a follow-up questionnaire in each subsequent month. Each individual was asked questions regarding the stock market: her next month subjective return expectation, next year subjective return expectation (of both the Dutch AEX stock index and the U.S. S&P 500 stock index), and her future subjective volatility expectations corresponding to these two stock indexes.

In addition, each individual reported on several sentiment-creating factors, some of which were found to be correlated with stock prices in previous empirical studies at aggregate level. These factors include the individual's contemporaneous general feeling (which has not been tested before) and the recent results of the individual's favorite soccer team. They also include the individual's perception of contemporaneous weather and whether the individual is "a spring person" in general and suffers from Winter Blues in particular. Since the questionnaire has been filled out three times during the year, we can test for the effect of the season of the year on

[2] For studies which rely on similar internet panel data that is representative of the population in the Netherlands see, for example, Veld and Veld-Merkoulova (2008), Guiso, Sapienza, and Zingales (2008), Bellemaere, Kröger, and Van Soest (2008), Von Gaudecker, Van Soest, and Wengström (2011), and Van Rooij, Lusardi, and Alessie (2011).

sentiment. Similarly, as the subjects filled out the questionnaire on different days, we can test for the effect of the day of the week on sentiment, which is particularly interesting as, unlike the usual macro empirical studies, we also have data corresponding to the weekend non-trading days. Finally, each individual reported whether she planned to buy or sell stocks in the coming month. In a follow-up questionnaire each individual reported whether she actually bought or sold stocks during the relevant month. Thus, each individual has simultaneously reported on her stock market return and risk subjective expectations, her subjective perception of the contemporaneous sentiment-creating factors, and her actual investment behavior. This information allows us to analyze whether and in which direction these factors affect the individual sentiment corresponding to the stock market and whether this sentiment systematically affects forecast errors as well as actual investment behavior.

In practice, investors who need to make investment decisions probably put some weight on objective data and some weight on subjective sentiment. It can rightfully be claimed that it is obvious that happy people may put less weight on objective market data and tend to increase subjective expected return estimates, and that unhappy people would do just the opposite. Furthermore, the more sophisticated investors may be able to separate economic decisions from emotions. The surprising result of this paper is not the direction of the sentiment effect but its magnitude and consistency: comparing the cumulative distributions of return expectations of the various individuals, we find a First degree Stochastic Dominance (FSD), where the subjective return expectations of the respondents who score highly on the non-economic sentiments are

systematically higher than those of respondents experiencing lower sentiments, namely the two cumulative distributions do not cross.

The statistical analyses reveal a strong and significant association between several sentiment-creating factors and the individuals' expectations of future return and risk in the stock market. Moreover, when we aggregate various non-economic sentiment-creating factors (feelings, weather, SAD, and soccer results) in one index, we find that the overall sentiment level is significantly related to expected stock returns, expected volatility, forecast errors and to the stock buying plans of individuals. Namely, a high level of sentiment leads to higher expectations of returns, lower expectations of volatility, higher forecast errors, and more likely intentions to buy (rather than sell) stocks.

Thus, the results of this paper support the growing group of economists who advocate that investors are not "efficient machines" (see Akerlof and Shiller, 2009) who always maximize some economic function, which, in turn, may explain many observed anomalies and unexpected economic phenomena.

The remainder of this paper is organized as follows. Section 2 presents the data and the sample. Section 3 presents the sentiment-creating variables and the hypotheses tested in this study, while reviewing the relevant literature. The empirical results are reported in Section 4. Section 5 concludes.

2. Data and the sample

The LISS panel is a representative sample of individuals living in the Netherlands.[3] The panel is based on a true probability sample of households drawn from the population register.[4] In this study, we focus on investment decisions and the attitude towards the stock market corresponding to individuals who actually invest in stocks. Therefore, in a preliminary stage, which took place in October 2010, 7,428 members of the panel[5] were asked whether they held equity in their investment portfolios. The 929 subjects who reported that they held equity in their portfolios were later approached six times during a time span of 10 months, three times with a full questionnaire and three times with a follow-up questionnaire (the questionnaires are presented in Appendix). Panel A in Table 1 reports the sample size and the number of subjects who completed the questionnaire in each round.

[Please insert Table 1 here]

Overall, 577 individuals submitted at least one complete questionnaire (389 of them submitted three complete questionnaires), providing us with a total number of 1,465 complete questionnaires.[6] We also have access to all personal data of the participants, collected by the LISS panel.

[3] The participants are paid 15 euro per hour to participate in monthly internet surveys.
[4] Detailed information about the LISS panel can be found at: www.lissdata.nl and in Scherpenzeel and Das (2010).
[5] These 7,428 members belong to approximately 5,000 households. This result means that some households have more than one member in the panel (e.g. husband, wife, and child over 16 years old).
[6] To explore the effect of sentiment across time and season of the year, the regression analysis employs a time series panel data, i.e. all complete observations from all rounds. As most individuals submitted a questionnaire in each round, we make sure that this procedure does not use identical observations three times, and that correlation between individual answers and potential heteroskedasticity do not affect our results. First, the individuals reveal different and generally uncorrelated expectations across time. For example, the correlation coefficients corresponding to the next month return expectations on the AEX Index in November, February and June are 0.25, 0.15, and 0.32, for the

Panels B and C report the demographic and financial characteristics corresponding to the 577 subjects. By construction, the sub-sample that we study does not represent the general population of the Netherlands but rather the population who actually trade in the stock market. Indeed, the sample is biased towards older, wealthier, and better educated married male individuals. For example, 65% of the subjects are males, the average age is 56 years old, 88% are home owners and 53% hold either a college or university degree.[7]

According to the sentiment hypothesis, sentiment-creating factors affect the sentiment of an individual, which, in turn, affects her investment decisions. To study the sentiment hypothesis on the individual level, in each round the subjects were asked three sets of questions. In the first set the subjects reported their subjective expectations regarding the stock market. In the second set of questions the subjects reported on their past and future plans to buy and sell stocks as well as their realized investment activity in the following month (reported in the follow-up questionnaires). These questions allow us to explore whether the sentiment characterizing the individuals' beliefs affected their investment plans and their actual trading. In the third set of questions the subjects reported on their assessment of several sentiment-creating factors as well

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three possible pairs of filling-out dates, respectively. This finding makes sense, as sentiment-creating factors may change during a period of almost a year, and obviously the seasonality also changes. Second, our regressions also include an individual's category control variable which accounts for this relatively small correlation, a control variable corresponding to the individual's tendency in general towards optimism or pessimism, which further reduces the possible dependency of the results across the three rounds and finally, an individual's category scale variable which accounts for heteroskedasticity. Finally, as subjective expectations may be driven by the macroeconomic conditions in each round rather than by different opinions across individuals, the regression analysis also includes dummy variables corresponding to the questionnaire round as well as variables corresponding to the stock market performance to control for macroeconomic conditions.

[7] These numbers are in line with those of a survey study of Graham, Harvey, and Huang (2009) who use data from the UBS/Gallop investor survey from November 1996 to November 2002. The investors in their sample are on average 49 years old; 60% of them are college graduates and 26% have postgraduate education.

as on their general tendency towards optimism or pessimism. These questions allow us to explore whether the individuals' beliefs about future returns and risk are associated with their mood and feelings as derived from the various sentiment-creating factors. Finally, the system reported the day and time the subjects filled out the questionnaire, which allows us to accurately calculate for each individual the forecast error as the difference between the subjective expectations and realized returns and risk as well as to test for the day of the week effect.

Panels A and B in Table 2 report the descriptive statistics corresponding to the first two sets of questions and the third set of questions, respectively.

[Please insert Table 2 here]

As can be seen from Panel A, the subjects reported their subjective expectations corresponding to both future return and future risk (volatility). They reported on short-term next month expectations and the relatively longer term next year expectations of both the AEX index, which consists of 25 stocks that are representative of Euronext Amsterdam, and the S&P 500 index, which consists of 500 stocks that are representative of the U.S. market.

The last three columns in Panel A of Table 2 report the descriptive statistics corresponding to the second set of questions regarding the individual's past, planned, and future investment activity in the stock market. The trading activities are also diversified across choices; yet, in any given month the majority of individuals did not trade at all.

Panel B in Table 2 reports the descriptive statistics of the third set of questions regarding the sentiment-creating factors. The subjects reported on their general feeling when filling in the questionnaire, their subjective perception of the weather in the last two days, whether they

generally suffer from Winter Blues, their preferred season of the year, and their favorite soccer team's performance. The exact day (and hour) they filled in the questionnaire is automatically obtained from the system. The frequencies of the sentiment-creating factors reveal a tendency towards feeling good, a slight tendency towards perceiving the weather as good, and a clear spring preference, where about 40% reported that they manifest some degree of Winter Blues symptoms. Finally, the soccer results, which are relevant only to soccer fans (26% of the subjects), are more or less evenly diversified across the choices.[8]

To avoid biases due to the questions' format, the questions regarding the *subjective* sentiment-creating factors (i.e. apart from the question on Winter Blues) include an odd number of choices which are symmetrically distributed around a neutral choice. For example, the third choice corresponding to current feeling is "feeling normal (neither good nor bad) today", choices one and two correspond to feeling good, and choices four and five correspond to feeling bad. To obtain the most accurate answers possible and decrease potential biases, the questions include a wide range of choices.

3. The hypotheses

We employ five groups of sentiment-creating variables to directly study the effect of sentiment on the individual level. The first group explores a general feeling sentiment effect;

[8] Note that the General-feeling variable may be affected, among other things, by the other sentiment-creating factors. Also note that Winter Blues and the Spring-Autumn preference are both related to the tendency to suffer from Seasonal Affective Disorder (SAD), where the Winter Blues question directly asks about the specific psychological syndrome and the Spring-Autumn preference question indirectly asks about the individual's season of the year preference.

three groups explore the weather, Winter Blues, and soccer results sentiment effects, which have been found to be correlated with the stock market on the aggregate level; and the last group corresponds to the day of the week. The five groups of sentiment-creating variables and the corresponding sentiment effect hypotheses are presented below.

3.1. The general sentiment effect hypothesis

Numerous psychological studies show that mood, typically defined as coherent affective states which last for minutes or hours, can affect the decision-making process of an individual. In a recent review, Mitchell and Phillips (2007) conclude that even mild fluctuations in mood can have a significant influence on neural activation and cognition. Specifically, both positive and negative moods impair executive functions like planning ability, verbal fluency, and creativity, where positive mood generally causes heuristic processing and negative mood promotes systematic thinking.[9] To test the relations between the individual's general mood and sentiment, we employ the "General-feeling" variable, which ranges from 1 (feels great) to 5 (feels very bad), and test the following hypothesis:

H1: The individual's contemporaneous feeling state is correlated with the individual's stock market return (volatility) expectations. The better the feeling state, the higher the expected return and the lower the expected volatility.

[9] Mood also affects other aspects of behavior, like investment decisions (e.g. Kaplanski and Levy, 2010a), social judgments and memory in general (e.g. Ashby, Isen, and Turken, 1999; Dreisbach and Goschke, 2004; Oaksford et al., 1996) and willingness to take risks in particular (Etzioni, 1988; Hanoch, 2002; Mehra and Sah, 2002).

3.2. The weather sentiment effect hypothesis

Saunders (1993) and Hirshleifer and Shumway (2003) find that sunshine is positively correlated with stock returns on the New York Stock Exchange (NYSE) and on other markets worldwide, respectively. Cao and Wei (2005) find a negative correlation between temperature and returns. Goetzmann and Zhu (2005) find that the NYSE spreads widen on cloudy days. Thus, the empirical evidence suggests that weather and sentiment may be correlated.[10]

Several difficulties arise when analyzing the relations between weather and mood on the individual level. First, there are many weather factors, such as temperature, humidity, sunshine, etc., that may affect a person's mood. Second, working with individual data rather than aggregate data, it is necessary to account for the fact that what one individual considers as good weather another individual may consider as normal or even bad weather. Third, different individuals are exposed to different weather depending on where they live. Taking into account these difficulties, a key feature of the weather tests in this study is that they do not rely on objective weather conditions but rather on the individuals' own subjective perception of the contemporaneous weather. Namely, the subjects classify the weather conditions as they perceive them.

Finally, according to the psychological literature weather factors and mood are associated in a non-monotonic complex manner. For example, while higher temperature is associated with improved mood (Cunningham, 1979; Howarth and Hoffman, 1984), very high temperature is associated with bad mood (Goldstein, 1972), and this tendency also depends on the exposure to

[10] There is also some macro evidence to the contrary: Pardo and Valor (2003), for example, study the weather effect for the Spanish stock market and find that there is no influence of weather on stock prices.

outdoor weather and on the season of the year (Keller et al., 2005). To overcome the non-monotonic relations between weather and mood, when testing the sentiment-creating "Perceived-weather" variable on a standalone basis we mainly focus on very good and very bad weather categories. Thus, "Perceived-weather" is equal to 1 if the subject reports very bad weather (Choice 5), 3 if the subject reports very good weather (Choice 1), and 2 otherwise (Choices 2, 3, and 4). Employing the "Perceived-weather" variable, we test the following hypothesis:

H2: Current weather as perceived by the individual is correlated with the individual's stock market return (and volatility) expectations. The better the reported perceived weather, the higher the expected return and the lower the expected volatility.

3.3. The Winter Blues sentiment effect hypothesis

Kamstra, Kramer, and Levi (2003) find that returns on the stock market are significantly correlated with the season of the year. They advocate that SAD is responsible for depression and bad moods in a large portion of the population, which, in turn, affect willingness to take risk, hence affecting stock returns.[11] SAD is a cyclic illness characterized by episodes of fall and winter depression, also known as Winter Blues, alternating with periods of spring and summer normal mood or mild elation and behavioral activation.[12]

[11] Other seasonal patterns that are consistent with the SAD explanation are found in investment in safe government securities by Kamstra, Kramer, and Levi (2011), in analysts' stock earnings forecasts by Dolvin, Pyles, and Wu (2009) and Lo and Wu (2008), in initial public offerings by Dolvin and Pyles (2007), in flows of capital in and out of safe and risky categories of mutual funds by Kamstra, Kramer, Levi, and Wermers (2011), and, more generally, in financial risk aversion among people who suffer from SAD by Kramer and Weber (2011).

[12] According to Mersch et al. (1999), 3% of the Dutch population suffer from severe SAD and 8.5% suffer from mild SAD. These numbers are very similar to those obtained in our study (about 3% of the sample suffer from severe SAD and additional 6% suffer from SAD).

The "Winter-Blues" variable is equal to 1 if the individual does not suffer from SAD or 2, 3, and 4 if she mildly suffers, suffers or strongly suffers from SAD, respectively. Employing this variable, we test the following two hypotheses:

H3: a) Stock market return (volatility) expectations reported in the autumn and winter by individuals who suffer from Winter Blues are smaller (larger) than the expectations corresponding to individuals who do not suffer from Winter Blues;

b) Similar differences exist between the expectations of those who suffer from Winter Blues and filled in the questionnaire in the autumn or winter, and the expectations reported in the spring by all subjects.

3.4. The soccer sentiment effect hypothesis

Edmans, García, and Norli (2007) find that the results of important international soccer games are correlated with the returns on the stock markets of the relevant countries. Investigating 39 stock markets worldwide, they find a significant negative effect in the stock market of the losing country and an insignificant positive effect in the stock market of the winning country. Kaplanski and Levy (2010b) show that the FIFA World Cup creates a long-lasting negative effect that is exploitable. Similarly, Ashton, Gerrard, and Hudson (2003) find a significant association between the performance of England's soccer team and subsequent daily changes in the FTSE 100 index. More specific to the Netherlands, Witte et al. (2000) find that mortality from coronary heart disease and stroke significantly increased in the male Dutch population the day after the Dutch soccer team was eliminated from the 1996 European football championship.

They conclude that "important sporting events may provoke a sufficient level of stress to trigger symptomatic cardiovascular disease" (p. 1552).

To test the sport sentiment effect on the individual level, the subjects reported whether they are sport fans and, if so, which sport they like and how their favorite team performed in the last three days. In line with the results of Edmans, García, and Norli (2007), that the effect is more profound with regard to soccer games, and as most of the sport fans in the sample are soccer fans, we focus on soccer games.[13] Employing the "Soccer-result" variable which ranges from 1 (good result in an important game) to 5 (bad result in an important game), we test the following hypothesis:

H4: The individual's favorite soccer team's result is correlated with the individual's stock market return (volatility) expectations. The better the individual's favorite soccer team's result, the higher the expected return and the lower the expected volatility.

3.5. The day of the week sentiment effect hypothesis

The empirical psychological evidence reveals complex links between the day of the week and mood. While the weekend is associated with positive emotions, it is also characterized by low estimates of life satisfaction.[14] More closely related to the current study, Lakonishok and

[13] In unreported tests, we did not find a significant non-soccer sport sentiment effect.

[14] Rossi and Rossi (1977) show that positive emotions are higher on weekends and Egloff et al. (1995) find that pleasantness peaks on weekends. Kennedy-Moore et al. (1992) find that both positive and negative affect show weekend effects. Helliwell and Wang (2011) find that people are significantly happier, have more enjoyment, and laugh more, while feeling less worry, sadness, and anger, on weekends than on weekdays. On the other hand, Akay and Martinsson (2009) find a negative effect in the level of subjective well-being on Sundays.

Maberly (1990) find that the day of the week effect in returns[15] is accompanied by a relatively high volume of individual investor selling activity on Mondays, and Abraham and Ikenberry (1994) find that this activity mainly occurs early Monday morning (see also Jaffe, Westerfield, and Ma, 1989; and Chan, Leung and Wang, 2004). Thus, we explore whether Monday in general and Monday mornings in particular are correlated with individual sentiment.

In testing for the individual sentiment effect it is necessary to control for the day of the week. One example is sufficient to demonstrate why controlling for the day of the week is crucial: most soccer games are played over the weekend; hence, if there is a trading day of the week effect, it may induce a spurious soccer sentiment effect. Furthermore, our data provides a unique opportunity to test whether sentiment regarding the stock market is also correlated with the day of the week. In addition, unlike the usual macro empirical studies which rely on stock prices, we also have observations corresponding to Saturday and Sunday, days where there is no trading in the stock market. These data enable us to explore sentiment regarding the stock market over the weekend. The exact time and hour the questionnaire was filled out also enables us to test for a sentiment effect during the day, which is in particular interesting with regard to Mondays. Employing "days of week" dummy variables, we test the following hypothesis:

H5: The individual's stock market return (volatility) expectations are correlated with the day of the week.

[15] Cross (1973), French (1980), Gibbons and Hess (1981), and many others have documented that for decades the average return in the U.S. market was significantly lower on Mondays and significantly higher on Fridays than on other days. The same effect has been documented in more than 20 markets (see, e.g., Jaffe and Westerfield, 1985; Chang, Pinegar, and Ravichandran, 1993). In more recent decades the effect has substantially attenuated (Schwert, 2003) and even reversed in returns on large-cap stocks (Kamara, 1977).

3.6. The overall sentiment effect hypothesis

In the previous five sub-sections we have discussed five separate sentiment-creating variables that we hypothesize might influence the stock return and volatility expectations of the affected individuals. Although these factors are very diverse (ranging from soccer results to weather), they have one thing in common: all of them are not related to the economic phenomena and cannot be expected to affect stock market through any existing rational economic process. However, based on the previous psychological literature, we expect that some of these factors or their combination will influence the subjective expectations of stock returns and volatility of individuals. Therefore, our comprehensive sentiment hypothesis makes no distinction between the exact sources of non-economic sentiment, but rather focuses on the overall effect of these sentiments technically measured by the Individual Sentiment Index (ISI):

H6: Stock market return (volatility) expectations are correlated with the non-economic sentiment of individuals. The more positive the non-economic sentiment, the higher (lower) the expected market return (volatility).

3.7. The sentiment effect and the forecast error hypothesis

In previous sections we hypothesize that optimistic investors generally have higher estimates of mean return than pessimistic investors. It is also interesting to investigate how these estimates fare with the actual observed returns for each individual's estimation period. To investigate this issue we employ the *ex-post* risk and return forecast errors. This measure is

calculated as the difference between expectations and realized market return and risk. Our hypothesis is:

H7: Forecast errors corresponding to stock market return (volatility) are correlated with the non-economic sentiment of individuals. The more positive the non-economic sentiment the larger the overestimation errors and the lower the underestimation errors.

3.8. The sentiment effect, investment plans and actual investing

Finally, we investigate whether an individual's sentiment affects her immediate plans to buy and sell stocks as well as her actual investment activity during the following month. The hypothesis in this case is:

H8: Investment plans (actual investment activity) are correlated with the non-economic sentiment of individuals. The more positive is the non-economic sentiment, the higher the individual's tendency to buy rather than to sell stocks.

4. Empirical results

While more rigorous analysis is reported in the remainder of this section, Figure 1, which focuses on only one general sentiment-creating factor, demonstrates the main flavor of the results of this study. This figure draws the cumulative distribution functions (CDFs) of the next month subjective stock market return expectations corresponding to two groups of individuals: Group 1, which consists of all individuals who reported that they are "currently feeling great or good", and

Group 2, which consists of those individuals who reported that they are currently "feeling normal, bad or very bad".

[Please insert Figure 1 here]

If investors establish their future expected returns solely based on the economic facts at hand (e.g. growth and inflation forecasts, expected changes in interest rate, etc.), the sentiment corresponding to investors' contemporaneous feeling is irrelevant in forming their estimate of future returns (as rational economic models advocate). Hence, we would expect no difference, or, more precisely, only a random difference between the CDFs of the subjective return expectations corresponding to these two groups. However, Figure 1 reveals a striking result: the two CDFs do not intersect; namely, there is a First degree Stochastic Dominance (FSD), where the return expectations estimated by those who felt good are systematically higher than the return expectations estimated by those who did not feel good. Thus, the CDF corresponding to Group 1 is shifted to the right relative to the CDF corresponding to Group 2. The result is systematic, as the FSD is intact for the expectations corresponding to both the Dutch and the U.S. stock markets.[16] Thus, happiness as measured by general feeling creates more optimistic investors.

We continue our analysis by testing the significance of the various non-economic factors' effects and quantifying the relative impact of each factor on sentiment. We report the results on the relation between the sentiment-creating variables and the individuals' attitude towards the stock market. We find a significant association between the sentiment-creating variables and the individuals' subjective stock market expectations. This result suggests that sentiment plays an

[16] The FSD is also obtained for the following groups: weather is good, soccer result is good, soccer result is bad and suffering from Winter blues in November and February. For the sake of brevity these figures are not presented.

important role in the subjective formation of future return and risk expectations of investors. We then expand the analysis to include investors' plans to buy and sell stocks and their actual trading activity in the stock market during the following month.

4.1. The individual investor's return sentiment effects

If the sentiment-creating variables affect the individual's sentiment, they are expected to affect the individual's return expectations. To analyze these relations, we run the following Location-Scale (Heterogeneous Choice) ordered probit regression:

$$E\left(R_{t+1,i}\right) = \beta_0 + \sum_j \beta_j SENT_{j,i} + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i, \quad (1)$$

$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $\mathrm{E}\left(R_{t+1,i}\right)$, is the individual's subjective expectation corresponding to the return on the Dutch AEX index in the next period; $SENT_{j,i}$ is one of the sentiment-creating variables, as defined in the previous section; $CONTROLS_{k,i}$ are the control variables; and z_i is the *i*th individual category variable, where δ controls for autocorrelation and γ controls for heteroskedasticity.

The dependent variable in Regression (1) is the individual's subjective next month return expectation on the stock market given in the form of categories. This variable ranges from 1 to 6, where 1 stands for a very low (negative) expectation and 6 stands for a very high (positive) expectation (see Appendix). To avoid potential biases, when the subject selects the non-quantitative choice "Don't know/no opinion", this observation is excluded from the regression.

The main sentiment-creating variables ($SENT_{j,i}$) are the individual's "General-feeling", "Perceived-weather", "Winter-Blues", and "Soccer-Result". As the effect of the Winter-Blues variable depends on the season of the year, this variable is examined in November and February, i.e. in the autumn-winter period relative to the spring-summer period (June).

The control variables are roughly divided into four groups. The "day of the week" control variables are dummy variables intended to control for a sentiment effect across the days of the week. The "macroeconomic" control variables include dummies for the questionnaire period (November and February, where June is omitted) to control for endogenous factors which may simultaneously affect the expectations of all subjects in the sample. In addition, we specifically control for the stock market conditions by adding two variables: a "Five-day return" variable, which is equal to the return realized on the AEX index over the five trading day (one week) period preceding the exact date each subject completed the questionnaire, and the value of the AEX Volatility Index (VAEX) on that day, which, like the U.S. VIX index, measures the next 30 days' volatility expectation from the prices of options written on the AEX index.

The "test-specific" control variables are the time-invariant (rather than only November and February) Winter Blues variable and a dummy variable for subjects who are soccer fans. They control for any possible effect unrelated to sentiment, which may be correlated by coincidence with these two variables. For example, suppose that all the subjects who suffer from Winter Blues are generally more pessimistic than other subjects, unrelated to the season of the year. In this case, negative Winter Blues variables in November and February could be due to their general year-round pessimism tendency rather than to Winter Blues in November and

February. Therefore, we test the "Winter-Blues" variables in November and February while controlling for the "Winter-Blues" variable during the entire year. According to a similar logic, suppose that the soccer fans are generally more optimistic. In this case, in tests which include both soccer fans and subjects who are not soccer fans, a positive "Soccer-result" coefficient could be due to the general optimism tendency of this group rather than to the results of their favorite soccer teams. Therefore, in those tests we add a "Soccer fan" dummy variable that controls for a possible general effect related to soccer fans but not related to the performance of their favorite teams.

The "individual" control variables control for the individuals' characteristics, which may systematically affect their attitude towards the stock market. The "Gender", "Age" and "Gross monthly income" variables control for biases related to socio-economic factors, and the "Education" variable also controls for the financial expertise of the individual investor. These variables are found to be significant in some tests. In contrast, the following control variables are found to be insignificant in all tests (which for the sake of brevity are not reported): marital status, number of children living at home, rural vs. urban dwelling, and occupation. Therefore, these variables are not included in the regressions.

Finally, the last "individual" control variable controls for the individuals' optimism-pessimism tendency in general. Controlling for this tendency is important. For example, when the explanatory variable in Regression (1) is "General-feeling", optimistic individuals may tend to both feel good and at the same time be optimistic with regard to the stock market, resulting in a significant correlation between "General-feeling" and stock market expectations which is not

directly related to the individuals' contemporaneous sentiment but rather to their personality in general.

As the same individuals filled up to three questionnaires, we must control for autocorrelation and heteroskedasticity across individuals. To account for autocorrelation the regression also includes the *i*th individual category variable. To account for heteroskedasticity, i.e. the possibility of different variability across different individuals we use the Location-Scale model, where the coefficients corresponding to each individual are "scaled" by the variability of the individual's choices across time. Indeed, in most of the tests the individual scale variable is found to be significant. Other potential scale variables, including November and February dummies which account for different variability across time, were found to be insignificant. Therefore, these scale variables are not included in the regression.

Table 3 reports the result of Regression (1), where the dependent variable is the individual's subjective next month return expectation on the AEX index and the explanatory variables are the main sentiment-creating variables.

[Please insert Table 3 here]

Test 1 in Table 3 includes all sentiment-creating variables simultaneously. In line with all the individual sentiment hypotheses, General-feeling, the Perceived-weather, Winter Blues in November and February, and Soccer-result coefficients are all significantly negative at the 5% significance level. Thus, the better the individual's state of feeling, the better the weather from the subject's point of view, and the better the subject's favorite soccer team result, the higher the

individual's return expectations. Similarly, individuals who suffer from Winter Blues experience significantly lower return expectations in the autumn and winter.

These results are not induced by particular effects related to the season of the year, the day of the week, the contemporaneous conditions in the stock market, the specific group of individuals under consideration, their gender, income, age and education, or the individuals' tendency towards optimism, as all these factors are controlled for. These significant results will be later used to construct a comprehensive Individual Sentiment Index (ISI) which is composed of all these variables.

In testing the day of the week effect Sunday is omitted. The Monday and Tuesday coefficients are large and significantly positive at the 1% and 5% level, respectively. The coefficient for Wednesday is positive and significant at the 10%-level. The coefficients for the other days are also positive but insignificant. Thus, the individuals' return expectations are highest at the beginning of the week and they decrease over the week. The highest coefficient on Monday is consistent with the empirical evidence that individual investors are relatively more active on Mondays than on the other days of the week (see Lakonishok and Maberly, 1990; and Abraham and Ikenberry, 1994). Moreover, the fact that there is no significant difference between the other days of the week and Sunday suggests that this effect is probably not related to the weekend psychological mood effects but rather to a unique effect at the beginning of the week. Note also that the positive coefficient on Monday contradicts the day of the week effect in returns, where in the past the returns on Mondays were relatively lower than those on other days. Thus, the sentiment effect on expected returns cannot explain the weekend effect in returns.

However, when exploring the individuals' investment plans (see Section 4.7), we will show that the effect on investment plans confirms the day of the week effect in returns.

To test the robustness of the results and to account for the fact that General-feeling is probably affected by all other variables, which may reduce the significance of the results in the joint test, the other tests in Table 3 repeat Regression (1) each time with only one sentiment-creating variable and the control variables. As can be seen, the significant results presented above are robust to the other sentiment-creating variables. To be more specific, apart from the Soccer-result variable which is significant at the 10% level (p=0.051) all the other sentiment-creating variables' coefficients are significant at the 5% level.[17] Thus, the association between the sentiment-creating variables and the individual sentiment is not an artifact resulting from the cross-correlations between the sentiment-creating variables.

Several control variables in Table 3 are also significant. First, the November and February coefficients are generally large, positive and highly significant. This result is likely related to the turmoil in the stock markets in June 2011 due to worries about the end of the Federal Reserve's program of QE2, accompanied by the release of weak macroeconomic data in the U.S. and in particular in Europe. This result shows that the individuals in the sample are familiar with and knowledgeable about the stock market. This result is also notable from the positive and negative coefficients corresponding to the stock market five-day return and volatility (VAEX) control variables, respectively, which are generally significant. The education

[17] When testing the Perceived-weather variable with five categories, i.e. while also considering mild differences in weather, the sign and magnitude of this coefficient are similar to those reported in Table 3, however the coefficient is no longer significant.

and age coefficients are significantly negative and positive, respectively; however, both are small in absolute terms. Finally, the individual scale variable is highly significant suggesting that the variability is significantly different across individuals.

4.2. Asymmetric effects of sentiments and robustness tests

The psychological theory and the empirical evidence on investor sentiment advocate that the effects of positive and negative moods are not symmetrical (e.g. Bolte, Goschke, and Kuhl, 2003; Fredrickson and Branigan, 2005). To test for a possible asymmetry in the sentiment effects, in Test 1 of Table 4 the sentiment-creating variables in Regression (1) are dummy variables which are equal to 1 for good (or bad) categories and 0 otherwise, where the dummy variable corresponding to the neutral category is omitted. Thus, the original sentiment-creating variables are divided into two dummy variables corresponding to bad and good categories. To refine the analysis, the Winter-Blues variable is separately tested in November and February to explore whether there is a difference in the effect in the autumn and the winter. Finally, to account for the unique trading patterns on Monday mornings observed in other studies, the Monday variable is also divided into two dummy variables corresponding to Monday mornings (AM) and Monday afternoons (PM).

[Please insert Table 4 here]

Before we turn to discuss the results, recall that separating the regression to positive and negative sentiments reduces the number of observations in each category, hence some of the results may be less sharp in comparison to those reported in Table 3.

Test 1 in Table 4 reveals that consistent with the psychological theory the effect of "General-feeling" is not symmetrical. While the "General-feeling good" coefficient is large and significantly positive at the 1% level, the "General-feeling bad" coefficient is close to zero and insignificant. Thus, feeling good is clearly associated with more optimistic return expectations. However, no similar significant sentiment effect is observed with regard to feeling bad. This asymmetry confirms the psychological theory mentioned in the previous section that positive mood causes heuristic processing, which may result in systematic errors, whereas negative mood promotes systematic thinking, which eliminates such errors.

The "good" and "bad perceived-weather" coefficients are of the same magnitude, where the "good weather" coefficient is positive and significant at the 10% level and the "bad weather" coefficient is negative but insignificant. Thus, no strong asymmetrical effect is observed in weather. The same conclusion is intact as regards the Soccer-result variable. The "good" and "bad soccer result" coefficients are positive and negative, respectively; they are both relatively large in absolute terms but insignificant.

The "Winter-Blues" coefficients corresponding to November and February are negative, relatively large in absolute terms, and significant. This result suggests that suffering from symptoms of Winter Blues is associated with less optimistic return expectations both in the autumn and the winter.

Finally, the day of the week dummy variables reveal a very similar sentiment effect to the one observed in Table 3, where the return expectations are more optimistic at the beginning of the week than those at the end of the week, with the highest coefficient corresponding to Monday

AM. The Monday AM and Monday PM coefficients are both significantly positive at the 1% level.[18] Thus, we find a day of the week sentiment effect which starts on Monday morning.

To test whether the seasonal sentiment effect is related to a general preference for spring or specifically to Winter Blues, Test 2 in Table 4 compares the "Winter-Blues" variable with the "Spring-preference" variable. While the Winter Blues coefficient is significantly negative, the Spring-preference coefficient is also negative but relatively small and insignificant. Thus, the seasonality sentiment effect is related to Winter Blues rather than to a more general preference for spring.

Finally, while the probit model assumes that the dependent variable distribution is the symmetrical normal distribution, it is easy to see from Table 2 that the distribution of the next month return expectations is not symmetrical. To account for this possible bias Test 3 in Table 4 employs the ordered log-log model that allows for asymmetry in the dependent variable distribution. As can be seen, the results are generally robust to the employed model. All the sentiment-creating variables coefficients are negative, where the only meaningful differences with Test 1 in Table 3 are that the "Soccer-result" coefficient is significant at 1% level and the "Perceived-weather" coefficient is no longer significant (p-value of 0.11).

[18] In an unreported test, we find similar results when Monday is divided into three variables corresponding to filling out the questionnaire before the market opens, when the market is open, and after the market is closed, where all three variables are found to be significantly positive.

4.3. Return forecast errors and sentiment effects

In this sub-section we show that the biased return expectations create forecast errors by running Regression (1) while replacing the return expectation dependent variable with the individual's forecast error. To calculate the return forecast error for each return expectation we calculate the return on the AEX in the following month (22 trading days). We then define the forecast error as the return expectation less the next month actual realized return, where these two variables are grouped in categories.

Table 5 reports the result of Regression (1), where the dependent variable is the individual's next month return forecast error corresponding to the AEX index and the explanatory variables are the main sentiment-creating variables.

[Please insert Table 5 here]

Test 1 in Table 5 includes all sentiment-creating variables. In line with the individual sentiment hypotheses, all the sentiment-creating variables coefficients are negative suggesting that sentiment and forecast errors are correlated. The significance of the various coefficients varies across the variables, where the Perceived-weather, Soccer-result and the Winter Blues in November and February coefficients are significant at the 5%, 1%, and 10% level, respectively, and the General-feeling coefficient is insignificant (p-value = 0.11).

Recalling that General-feeling is probably affected by the other sentiment-creating variables and to account for other potential cross-correlations, in the other tests in Table 5 the sentiment-creating variables are separately tested. Indeed, in Test 2 the General-feeling

coefficient on a standalone basis also becomes significant at the 5% level, and Tests 3 to 5 reconfirm significant effects of Perceived weather, Soccer result, and Winter Blues.

In testing the day of the week effect the Monday coefficients are positive and relatively large, but significant at only the 10% level. Thus, the forecast errors are more positive on Mondays, but this phenomenon is less significant than the Monday effect on return expectations.

Two other interesting results emerge from Table 5. First, forecast errors are significantly positively and negatively correlated with the market five-day return and volatility (VAEX) control variables, respectively. Thus, recent market performance significantly affects forecasts errors. Second, forecast errors are significantly negatively correlated with education. Namely, the forecast errors made by more educated subjects are relatively lower than those made by less educated subjects.

4.4. Aggregated sentiment results

So far, we find that the sentiment-creating variables and the individuals' next month return expectations as well as the forecast errors of the domestic stock market are significantly associated. A natural question emerging from the results is how broad these effects are. Do the effects corresponding to the Dutch market, where the subjects in the sample mainly invest, differ from those corresponding to other markets? Are the effects the same for short-term and long-term expectations? Table 6 reports the tests that explore the effects of sentiment on the U.S. stock market and the long-term next year expected returns.

[Please insert Table 6 here]

To avoid unnecessary repetition by testing each sentiment-creating variable separately, and to overcome the small number of observations corresponding to some variables, in Table 6 we replace the various sentiment-creating variables used as the explanatory variables in Regression (1) with a comprehensive Individual Sentiment Index (ISI).[19] The ISI is constructed from the first principal components of the correlation matrix of the original sentiment-creating variables.[20] Thus, the ISI is defined as follows:

$$ISI =$$

$$0.768General\ feeling + 0.439Perceived\ weather +$$

$$0.687Winter\ Blues\ in\ Nov.and\ Feb. - 0.176Soccer\ result \quad (2)$$

The ISI coefficients in Tests 1 and 2, where the dependent variable is the next month expected return on the AEX and S&P 500 indexes, are significantly positive at the 1% and 5% level, respectively. Thus, the higher the ISI, the more optimistic the next month return expectations and vice versa. This effect exists in expectations corresponding to both the domestic (Dutch) market and the foreign (U.S.) markets. In contrast, in Tests 3 and 4, where the dependent variable is the next year return expectation on these indexes, the ISI coefficient is insignificant. Thus, the sentiment effect corresponding to long-term expectations is generally insignificant.[21] This difference in results may suggest that the process of making long-term predictions is

[19] The results with each sentiment-creating variable are available from the authors on request.
[20] For consistency, in constructing the ISI the Perceived-weather variable is the raw five-category variable which relates also to mild changes in the perceived weather. In an unreported test we find that if we employ this variable only for extreme weather categories, all the results for the ISI are even stronger.
[21] As several choices corresponding to the next year return expectations reveal only a very small number of observations (see Table 2), we also run the regression when close choices are combined. However, the results in those cases are very similar to the results reported above.

different than that of making short-term predictions, and this process is less affected by sentiment. The results corresponding to the other variables are similar to those in Table 3 with the exception that in some tests the gender and personal income coefficients are also significant and the scale variable is insignificant, in particular with regard to long-term expectations. This finding further supports the claim that the process of making long-term predictions is different than that of making short-term predictions This process is not only less affected by sentiment but is also more affected by other factors that are correlated with gender and income.

The results corresponding to forecast errors are consistent with the results in Table 5. The ISI coefficients in Tests 5 and 6, where the dependent variable is the next month return forecast error on the AEX and S&P 500 indexes, are significantly positive at the 5% and 1% level, respectively. Thus, the return forecast errors and sentiment are positively correlated.

To summarize, all four sentiment-creating variables are significantly associated with the individual's subjective return expectations and forecast errors. Specifically, higher sentiment as reflected by the sentiment-creating variables leads to more optimistic expectations and higher forecast errors. These results confirm the sentiment effects hypotheses. In addition, we find a novel significant "day of the week sentiment effect", where individuals are significantly more optimistic about future stock returns at the beginning of the week than at the end of the week; hence, making higher forecast errors. Finally, these effects are significant only for short-term return expectations.

4.5. Risk expectations

So far, we find that the sentiment-creating variables are significantly associated with the individuals' subjective returns expectations. However, another important factor affecting investment decisions is risk expectations. In this sub-section, we explore the relations between individual sentiment-creating variables and the individuals' subjective risk expectations and risk forecast errors.

The subjects in the sample reported on their subjective volatility expectations, where the expected volatility categories are defined in terms of volatility relative to the all-month mean volatility; these are ordered from low volatility (Choice 1) to high volatility (Choice 5). Table 7 reports the results of Regression (1) where the dependent variable is either the volatility expectation or the risk forecast error and the ISI is the main explanatory variable.

[Please insert Table 7 here]

The ISI coefficient in Test 1, where the dependent variable is the next month expected volatility on the AEX index, is significantly negative at the 1% level. Thus, a higher ISI (or a more positive sentiment level) leads to individuals' lower next month volatility expectations. The ISI coefficient in Test 2, where the dependent variable is the next month expected volatility on the S&P 500 index, is also negative but is significant only at the 10% level. In Tests 3 and 4, where the dependent variable is the next year volatility expectation on these indexes, the ISI coefficients are negative and significant at the 5% and 1% level, respectively. Thus, the sentiment effect corresponding to volatility expectations seems to exist also with regard to the long-term expectations. One possibility for this result is that subjects understand risk less in

comparison to returns. Therefore in making predictions with regard to risk they are more exposed to heuristics and hunches that are affected by sentiment.

The dependent variable in Tests 5 and 6 is the next month volatility forecast error corresponding to the Dutch market and the U.S. market, respectively. The volatility forecast error is calculated as the individual's next month volatility expectation less the actual realized volatility, estimated as the standard deviation of returns over the preceding month (22 trading days), where these two variables are grouped into categories.[22] In both tests the ISI coefficients are significantly negative at 5% and 1% level, respectively. Thus, a higher ISI (or a more positive sentiment level) leads to individuals' lower forecast error of the next month volatility and this result hold for both the Dutch and the U.S. markets.[23]

Finally, the day of the week effect in the tests in Table 7 is also significant, where the Monday coefficients and in some tests also the Tuesday and Wednesday coefficients are significantly negative. Thus, the volatility expectations at the beginning of the week are significantly lower than those at the end of the week. The volatility expectations are generally significantly lower in November 2010 and February 2011 than in June 2011, which corresponds to more economic uncertainty in June 2011. Periods of positive market returns are also followed by lower volatility expectations.

[22] Realized volatility is grouped into the five verbal volatility expectation categories by calculating return standard deviations quintiles corresponding to the period of 2000-2010.

[23] We did not repeat the tests with next year forecast errors because in each round the subjects filled the questionnaires during a relatively short period of less than a month. Therefore, the differences in realized annual volatility corresponding to the different subjects are very small implying that the tests would be the same as if we test risk expectations.

To summarize, the volatility expectations sentiment effect is similar to the return expectations sentiment effect but in the opposite direction. In the next sub-section, we show that this result may create systematic investment errors which may contribute to the empirically observed serial correlation in stock returns.

4.6. Risk and return expectations: The classic model versus the sentiment effect

In this sub-section we explore the relations between risk expectations and return expectations and show that these relations can be another source for the serial correlation in stock returns.

Figure 2a presents the empirical CDFs for each volatility expectation category, where the subjects are ordered according to their next month returns expectations.

[Please insert Figure 2 here]

Figure 2a reveals the striking effect of sentiment on the perceived risk-return association, where there is a *negative* risk-return relation. Namely, the CDFs corresponding to the subjects who considered that the market was relatively less risky are located to the right of the CDFs corresponding to the subjects who considered the market to be more risky. In line with this result, the ANOVA analysis reveals an F-statistic of 65.0, which strongly rejects the hypothesis that all mean expected returns corresponding to the five risk expectations categories are identical ($p<0.000$).[24] This result means that those who believe the market is less risky also believe the expected returns will be relatively high. Hence, we observe negative risk-return relation, which is

[24] We have also run t-tests for different pairs of expected returns. Apart from one case (Choices 4 and 5), the null hypothesis is rejected at the 1% significance level.

in contradiction to portfolio theory but consistent with the individuals' sentiment effects obtained so far. Let us elaborate.

Markowitz (1952) portfolio analysis and the Sharpe-Lintner Capital Asset Pricing Model (CAPM) theoretically advocate that the higher the expected return on an asset, the larger the risk that accompanies it.[25] Thus, when sentiment does not play a role, a positive association between risk and return is theoretically and empirically expected. However, according to the results in Figure 2a, when we consider subjective expectations, which are also influenced by sentiment, the relation is in the opposite direction: when the subject is optimistic and expects relatively high future returns she also perceives the future risk (volatility) to be relatively low. Thus, sentiment induces a negative expected risk-return relation.

In addition to the sentiment effect, the return expectations are also correlated with the realized return on the stock market in the five days prior to filling out the questionnaire. Figure 2b presents the CDFs for each return expectation category, where the subjects are ordered according to the realized returns on the AEX index over the five days preceding the day the subject filled out the questionnaire (recall that the subjects were free to choose when to fill out the questionnaire during the month and that they also filled out the questionnaire three times in three different months). Notably, the CDFs corresponding to the subjects who expected higher future returns are located to the right of the CDFs corresponding to the subjects who expected lower future returns. The ANOVA analysis reveals an *F*-statistic of 20.6, which strongly rejects

[25] Although there are various views regarding the appropriate risk factors in the literature (e.g. the size of the firm, the variance, beta, or some combination of these variables, see Banz, 1981; Levy, 1978; Merton, 1987; and Fama and French, 1992), all these risk factors directly or indirectly measure the volatility of the future value of the asset under consideration.

the hypothesis that all mean five-day returns corresponding to the six returns expectations categories are identical (p<0.000).[26] Thus, individuals expect higher returns following stock market run-up.

These combined findings have important implications. First, when a subject is in euphoria, she may execute poor investment decisions. While in practice return and risk are positively associated (which may prevent investing), positive sentiment makes the subject believe both that a high mean return is forthcoming and that risk is relatively low. This effect may induce overinvestment in the stock market when sentiment is high and underinvestment when sentiment is low. Thus, sentiment effects involve economic costs. Of course, we do not rule out that some subjects in the sample have more expertise on financial matters and know that a positive risk-return relation must prevail.

Second, adding to this phenomenon the correlation of expected returns with the market past returns implies investors' momentum behavior, which may be another source for the empirically observed serial correlation in stock returns documented in numerous studies.[27] Positive past returns in the stock market are accompanied by overinvestment by subjects who expect both high future returns and low future risk, and negative realized returns are accompanied by underinvestment by subjects who expect both low future returns and high future

[26] In unreported tests, we find very similar and significant correlation between volatility expectations and market expected volatility as reflected in the VAEX. These results are available from the authors on request.

[27] The main explanation for serial correlation is nonsynchronous trading (Fisher, 1966) where transactions occur infrequently; hence, stocks exhibit a delayed price adjustment. However, Atchison, Butler, and Simonds (1987), Schwert (1990), Lo and MacKinlay (1990), Kadlec and Patterson (1999), and others show that nonsynchronous trading cannot explain the entire observed autocorrelation. Indeed, other explanations include market inefficiencies, time-varying expected returns, time-varying leverage, and incentive fees with high water marks (see Getmansky, Lo, and Makarov, 2004).

risk. This explanation is closely related to the time-varying expected returns explanation for autocorrelation as demonstrated by Leroy (1973), Rubinstein (1976), and Lucas (1978).

4.7. Individual sentiment, investment plans, and actual investments

So far, we find that sentiment-creating factors affect individual sentiment about the stock market expected return and expected volatility. Does sentiment affect individual investors' plans to buy and sell stocks? Does it affect actual investment? The hypotheses tested in this sub-section assert that an individual's sentiment affects her immediate plans to buy and sell stocks as well as her actual investment activity during the following month.

To test these questions, the subjects were asked about their investment plans for the coming month as well as their actual investment activity in that month in a follow-up questionnaire. While we predict that sentiment affects immediate investment plans, we do not have a prediction with regard to actual investment in the following month. The reason is that things change during a one-month period: the "Perceived-weather" and "Soccer-result" variables create only short-term sentiment effects, the duration of the "General-feeling" sentiment effect is unknown, and only the "Winter-Blues" sentiment effect is expected to last more than a few days.

Panel A in Table 8 reports the results of Regression (1) where the dependent variable is the individual's investment plan for the coming month, ranging from 1, for a plan to only buy stocks, to 5, for a plan to only sell stocks (see Appendix). The explanatory variable in the first four tests is the next month or the next year subjective expected return on the AEX index (Tests 1 and 2) and on the S&P 500 index (Tests 3 and 4), which are affected by sentiment-creating

factors.[28] Choice 6 ("Currently I do not intend to make any stock transaction") is combined with the neutral choice ("I intend to buy as many stocks as I intend to sell stocks").

[Please Insert Table 8 here]

As can be seen, the expected return coefficients are significantly negative in all tests, suggesting that individuals' higher expected return is significantly associated with plans to buy rather than sell stocks

As the individual's expected return is affected by sentiment, this result may imply that sentiment also affects investment plans. To directly test this hypothesis, as well as to further examine the Monday effect,[29] in the last test in Panel A the explanatory variables are the ISI and the Monday dummy variables. The ISI coefficients is significantly negative at the 5% level, which directly shows that higher sentiment is indeed significantly associated with plans to buy rather than sell stocks. The Monday AM coefficient is positive and relatively large (0.47) but insignificant (*p*-value = 0.10), whereas the Monday PM coefficient is negative and significant at the 5% level. Thus, although we have previously found that return expectations are highest on Monday mornings and volatility expectations are lowest at that time, there is some tendency of individuals to sell stocks on Monday mornings and this tendency is significantly reversed on Monday afternoons. Optimistic investors seem to postpone their buying plans, possibly because they fear from asymmetric information accumulated over the weekend. This result is in line with the result of Lakonishok and Maberly (1990), Abraham and Ikenberry (1994) and others that on

[28] In unreported tests we found that expected volatility and investment plan are generally uncorrelated.
[29] In unreported tests, the coefficients for other days of the week are generally insignificant.

Monday mornings there is relatively more selling rather than buying activity by individual investors.

Panel B in Table 8 reports the results of tests similar to those in Panel A, with one difference: the dependent variable is the individual's actual investment activity in the month subsequent to the date of filling out the questionnaire, where 1 stands for "only bought stocks" and 5 for "only sold stocks". For consistency, the choice "I did not make any stock transaction" is included with the neutral option. The results in this case are ambiguous. On the one hand, the expected return coefficients are negative and significant, suggesting that higher individuals' expected return is associated with actual buying rather than selling of stocks in the following month. On the other hand, the ISI coefficient in the last test is small and insignificant. Thus, although expected return affects actual investment in the following month, it is not directly proven that the sentiment component within the expected return affects it. As mentioned before, this result should not come as a surprise as in this study we mainly focus on short-term individual sentiment. Unfortunately, we do not have data on short-term investment corresponding to the first few days subsequent to filling out the questionnaires.

Finally, the Monday dummy variables are insignificant. This result is expected as the dependent variable in this test corresponds to actual trading activity over a full month; hence, there is no reason why the day and the time on which this variable is reported would affect it.

5. Concluding remarks

Since the famous experiment of Allais (1953), it is well documented that a high proportion of many subjects participating in laboratory experiments, in some situation, make irrational choices, contradictory choices, and choices which contradict expected utility. Macroeconomic studies have shown that stock prices are correlated with non-economic factors such as weather conditions, the season of the year, sporting events, and others. However, these macroeconomic studies that document price anomalies do not prove causality and in some cases are regarded with skepticism.

In this study we test for the first time, to the best of our knowledge, for causality on the individual level. We test whether the risk and return perceived by individual investors in the stock market are affected by sentiment-creating factors. The study is based on about 5,000 households of a representative sample of the population of the Netherlands, and the statistical analyses are based on 1,465 questionnaires completed by individuals.

It is expected that, in practice, making predictions regarding the stock market, one may employ a combination of objective data and sentiment. Moreover, it is expected that on average happy people will make higher predictions with regard to the expected return in comparison to unhappy people, despite that they are exposed to the same objective data. However, we were surprised by the intensity that sentiment plays in making such predictions.

We find that the happier the subject, the more optimistic she is with regard to the stock market. Specifically, we find that the better the general mood of the individual, the better the perceived weather, and the better the results of the individual's favorite soccer team in the days

close to the questionnaire completion date, the higher the predicted expected return in the U.S. market as well as in the domestic Dutch stock market. Seasonality also affects return expectations, where those who suffer from Winter Blues expected a much lower stock return. Furthermore, we find that these effects create systematic forecast errors. These results are very strong and consistent. For example, the distribution of expected returns of those who feel good is completely shifted to the right in comparison to the distribution of those who feel bad. Hence there is a First degree Stochastic Dominance of the expected return distributions induced by the feelings of the individuals rather than merely some mean effect.

Unlike what is expected by the classic economic model, we find that the expected risk and return are negatively correlated on individual level. When a person is in euphoria, she predicts a relatively high expected return and relatively low risk. This effect may induce overinvestment and hence lead to economic costs. The potential overinvestment effect is also supported by our finding that higher sentiment is associated with plans to buy more stocks. As the return during the previous five days is positively correlated with the predicted subjective return, we find a momentum behavior: high realized returns are followed by high expected returns and low perceived risk, which motivates stock buying. Thus, we provide another explanation for the observed serial correlation in stock returns. This conclusion is further corroborated by our finding that predicted positive return is accompanied by reported plans to purchase stocks and by the prevalence of actual buying activity in the period following high return expectations.

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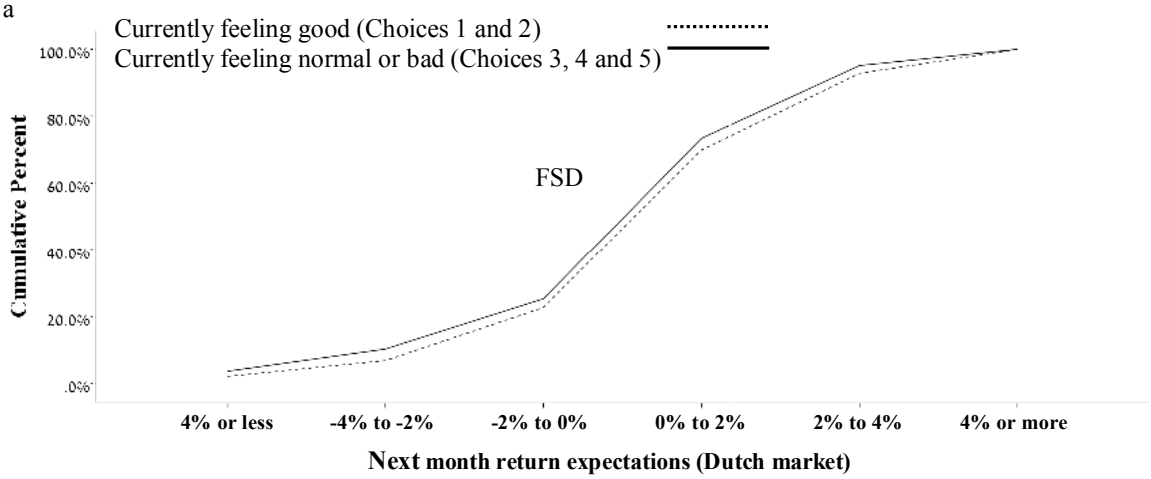
1a



1b

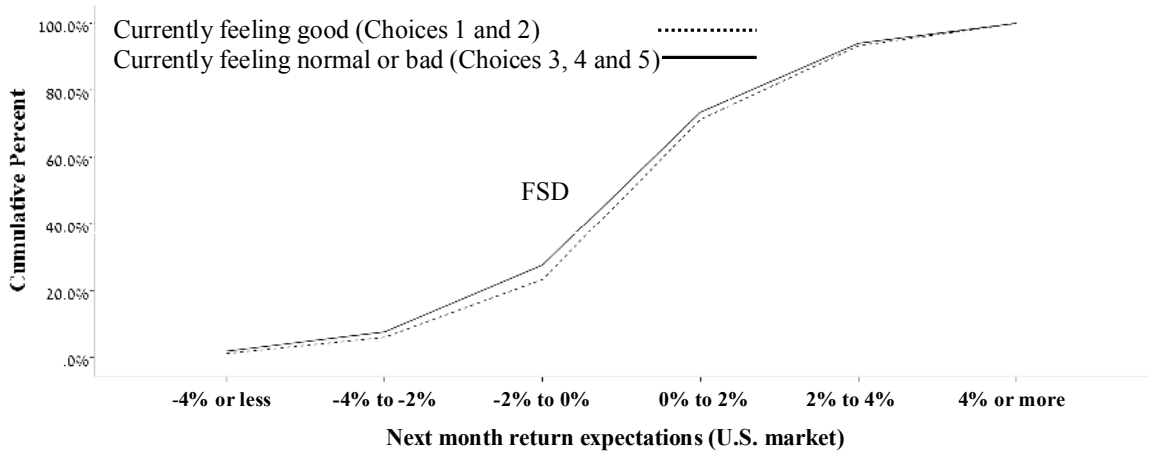
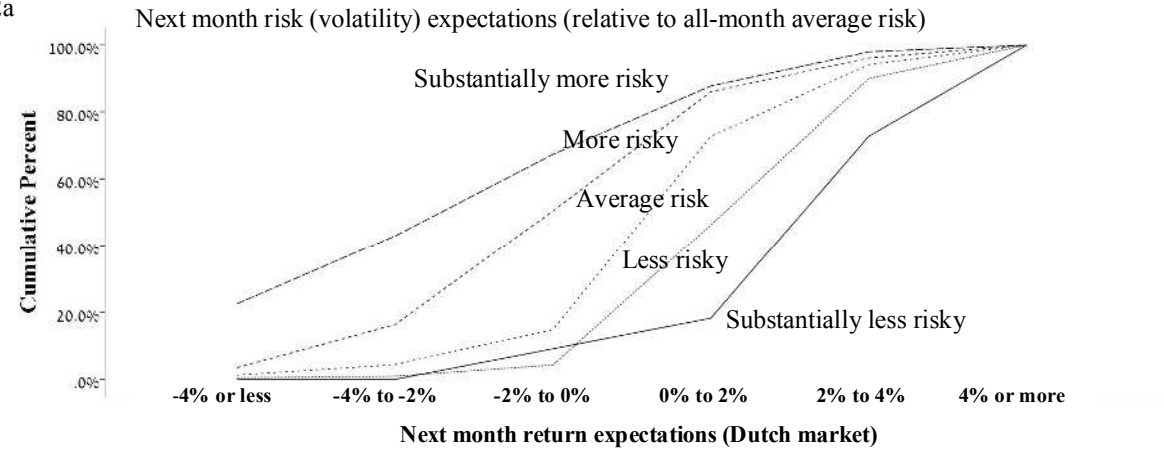


Figure 1. General feeling and subjective return expectations

The figures compare the cumulative distribution functions (CDFs) of the next month subjective return expectations corresponding to individuals categorized by their contemporaneous general feeling. In Figure 1a the subjective expectations correspond to the returns on the Dutch AEX index and in Figure 1b the subjective expectations correspond to the returns on the U.S. S&P 500 index.

2a



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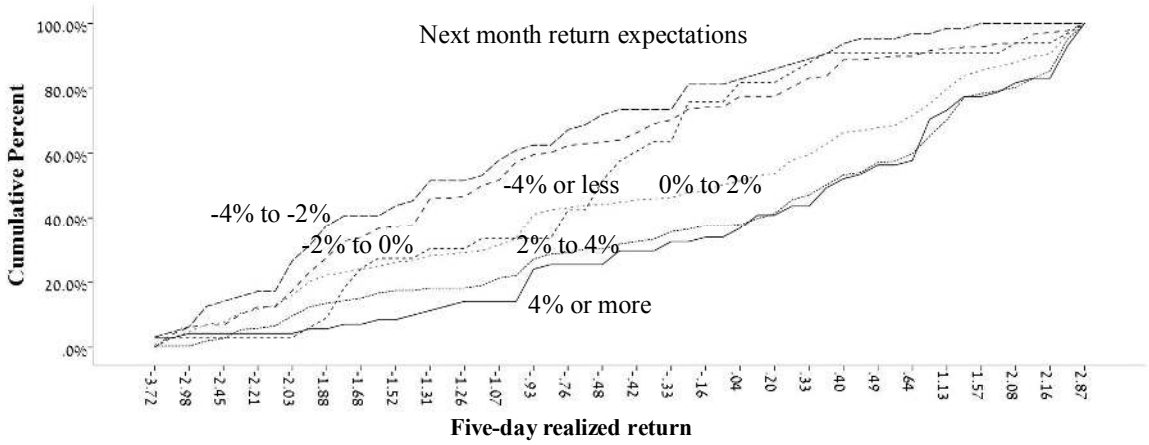

Figure 2. Risk-return subjective expectations' cumulative distribution functions (CDFs)

Figure 2a compares the cumulative distribution functions (CDFs) of the next month return expectations corresponding to individuals categorized by their next month risk (in terms of volatility) expectations. Figure 2b compares the CDFs of the five-day realized return on the Dutch AEX index corresponding to individuals categorized by their next month return expectations.

Table 1. The sample characteristics

The table reports the descriptive statistics of the sample population. Panel A reports the number of individuals approached and the number of individuals who completed the questionnaire in each round. Panel B reports the demographic characteristics of the sample, which is composed of the 577 individuals who have held stocks in their portfolio and submitted at least one completed questionnaire in one of the three rounds. Panel C reports the financial characteristics of those 577 individuals.

A. The sample population

	Total approached[1]	Complete questionnaire	Incomplete questionnaire	No response
A. Preliminary screening round:	7,428	5,316	0	2,112
Held stocks in October 2010 (the sample)		929		
B1. Round 1 in November 2010	929	755	124	50
B2. Round 2 in February 2011	918	714	108	96
B3. Round 3 in June 2011	804	612	64	128
Total in all three rounds	2,651	2,081	296	274
Missing personal data		616		
Total complete reliable observations		1,465	(filled by 577 individuals)	

[1]At each round, individuals who did not have stocks were not approached again.

B. Demographic characteristics

Gender		Have a spouse		Degree of urbanization		Education		Occupation		Age		Number of children at home	
Male	374	Yes	453	Very high	76	Primary	24	Employed	286	15-24	16	0	369
Female	203	No	124	High	162	High S. (vocational)	96	Retired	148	25-34	34	1	46
				Moderate	132	High S. (general)	64	Self-employed	41	35-44	81	2	106
				Low	116	Vocational	85	Homemaker	6	45-54	132	3	52
				Not urban	91	College	199	Unfit for work	21	55-64	171	4	4
						University	109	Student	15	65+	143		
								Unemployed	47				
								Volunteer	13				
Total	577		577		577		577		577		577		577

C. Financial characteristics

Portfolio value (000 Euro)		% of stocks in the portfolio		Made transactions in the previous month		Gross monthly personal income (000 Euro)		Type of housing	
0-20	318	0-20	147	Bought stocks	50	0	34	Home owner	510
20-40	84	20-40	75	Mostly bought stocks	22	0-0.5	12	Rent	65
40-60	48	40-60	76	Bought and sold stocks	19	0.5-1	38	Rent-free	4
60-80	28	60-80	46	Mostly sold stocks	9	1-1.5	43		
80-100	18	80-100	214	Sold stocks	19	1.5-2	49		
100-150	24	Do not know	19			2-2.5	72		
150-200	15					2.5-3	72		
200+	28					3-3.5	61		
Do not know	14					3.5-4	54		
						4-4.5	34		
						4.5-5	36		
						5-7.5	51		
						7.5+	21		
Total	577		577		119		577		577

Table 2. Descriptive statistics of sentiment variables

The table reports the descriptive statistics of the main variables employed in this study. The total number of observations from all three rounds is 1,465 questionnaires, complete with personal data, which were filled in by 577 individuals. The AEX and S&P correspond to the Dutch AEX index and the U.S. S&P 500 stock indexes.

A. Subjective expectations and trading activity

The individuals' beliefs about future returns and risk										Investment activity			
Next month return expectations			Next year return expectations				Next month risk expectations		Next year risk expectations				
Choice	AEX	S&P	Choice	AEX	S&P 500	Choice	AEX	S&P 500	AEX	S&P 500	Choice	Past trading	Future plans	Realized trading
1 (-4% or less)	33	15	1 (-15% or less)	4	2	Much less risky	11	9	18	15	Only buy	126	93	92
2 (-4% to -2%)	64	51	2 (-15% to -10%)	5	6	Somewhat less risky	222	166	341	218	Mostly buy	56	35	36
3 (-2% to 0%)	178	180	3 (-10% to -5%)	21	24	Average risk	594	455	462	379	Buy and sell	57	34	48
4 (0% to 2%)	551	463	4 (-5% to 0%)	103	135	Somewhat riskier	276	300	285	279	Mostly sell	15	22	18
5 (2% to 4%)	259	210	5 (0% to 5%)	654	521	Much riskier	55	61	67	86	Only sell	56	33	59
6 (4% or more)	71	63	6 (5% to 10%)	324	226	Total valid	1,158	991	1,173	977	Total valid	310	217	253
Total valid	1,156	982	7 (10% to 15%)	57	47	Don't know	307	474	292	488	Not active	1,155	1,248	1,212
Don't know	309	483	8 (15% or more)	16	13	Total	1,465	1,465	1,465	1,465	Total	1,465	1,465	1,465
Total	1,465	1,465	Total valid	1,184	974									
			Don't know	281	491									
			Total	1,465	1,465									
Valid choices statistics														
Mean choice	4.00	4.01		5.26	5.15		3.12	3.24	3.04	3.21		2.42	2.39	2.67
Median choice	4.00	4.00		5.00	5.00		3.00	3.00	3.00	3.00		2.00	2.00	2.00
Std. dev.	1.05	1.00		0.88	0.92		0.80	0.83	0.91	0.94		1.50	1.49	1.58

B.Sentiment-creating factors and control variables

Sentiment-creating variables									Control variables			
Currently feeling		Current weather		Suffering from		Spring-autumn		Favorite soccer team's performance		Questionnaire		Optimistic-pessimistic	
Great	42	Very	79	Do not suffer	883	Autumn preference	10	Good (Important)	71	Sunday	376	Highly optimist	38
Good	742	Good	405	Mildly suffer	460		10	Good	28	Monday	170	Optimist	580
Normal	610	Normal	674	Suffer	91		15	Neither	43	Tuesday	253	Neither	721
Bad	66	Bad	276	Strongly	31	Neither	477	Bad	12	Wednesday	219	Pessimist	115
Very bad	5	Very bad	31	Total	1,465		283	Bad (Important)	70	Thursday	181	Highly pessimist	11
Total	1,465	Total	1,465				329	Total	224	Friday	151	Total	1,465
						Spring preference	341			Saturday	115		
						Total	1,465			Total	1,465		
Valid choices statistics													
Mean choice	2.49		2.85				5.30		2.92				2.65
Median choice	2.00		3.00				5.00		3.00				3.00
Std. dev.	0.65		0.86				1.27		1.64				0.70

Table 3. Effect of sentiment on return expectations

The table reports the following ordered Location-Scale (Heterogeneous Choice) probit regression results:

$$E\left(R_{t+1,i}\right) = \beta_0 + \sum_j \beta_j SENT_{j,i} + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$

$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $E\left(R_{t+1,i}\right)$ is the *i*th individual's next month subjective return expectation corresponding to the Dutch AEX index; $SENT_j$ are sentiment-creating variables: General-feeling, Perceived-weather, Soccer-result, and Winter-Blues; $CONTROLS_k$ are control variables: the day of the week control variables, macroeconomic control variables, test-specific control variables, and individuals' control variables; and z_i is the *i*th individual variable, where δ controls for autocorrelation and γ controls for heteroskedasticity. Valid observations incorporate the total number of complete questionnaires (1,465) less subjects who have selected a non-quantitative choice ("Don't know/no opinion/not relevant"). One, two, and three asterisks stand for 10%, 5%, and 1% significance levels respectively.

	1.		2.		3.		4.		5.	
Sentiment-creating variable:	**All variables**		**General-feeling**		**Perceived-weather**		**Soccer-result**		**Winter-Blues**	
	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.
Sentiment-creating variables										
General-feeling (1-good)	-.10	.04**	-.10	.03**						
Perceived-weather (1-good)	-.23	.03**			-.26	.02**				
Soccer-result (1-good)	-.09	.04**					-.08	.05*		
Winter-Blues in Nov. & Feb. (1-none)	-.21	.02**							-.21	.02**
Control variables										
Day of the week control variables										
Monday dummy	.43	.00***	.44	.00***	.40	.00***	.43	.00***	.42	.00***
Tuesday dummy	.27	.01**	.27	.01**	.23	.03**	.29	.01***	.28	.01**
Wednesday dummy	.21	.06*	.21	.06*	.18	.11	.22	.05**	.22	.06*
Thursday dummy	.04	.73	.03	.81	.00	.99	.05	.67	.03	.80
Friday dummy	.10	.43	.10	.43	.06	.61	.04	.72	.09	.46
Saturday dummy	.20	.11	.19	.14	.19	.13	.21	.10	.19	.14
Macroeconomic control variables										
November dummy	1.15	.00***	.79	.00***	.81	.00***	.79	.00***	1.12	.00***
February dummy	1.07	.00***	.76	.00***	.76	.00***	.75	.00***	1.07	.00***
Five-day-return (AEX index)	.05	.04**	.05	.03**	.05	.03**	.06	.03**	.05	.05*
Volatility Index (VAEX)	-.06	.03**	-.05	.06**	-.05	.05**	-.05	.05**	-.05	.03**
Test-specific control variables										
Soccer-fan dummy	-.02	.73					-.04	.59		
Winter-Blues	.22	.00***							.20	.01***
Individuals' control variables										
Gender (1-male, 2-female)	-.07	.34	-.06	.38	-.06	.36	-.07	.32	-.07	.30
Education (1-low)	-.07	.00***	-.07	.00***	-.07	.00***	-.07	.00***	-.07	.00***
Age	.00	.05**	.00	.07*	.00	.05*	.00	.11	.00	.06*
Personal-income (1-low)	.02	.12	.01	.20	.01	.18	.02	.17	.02	.17
Optimistic-pessimistic (1-optimistic)	-.01	.77	.00	.98	-.02	.67	-.02	.57	-.04	.40
Location-Scale control variables										
The *i*th individual	.001	.59	.001	.42	.001	.43	.001	.47	.001	.36
The *i*th individual scale	-.002	.00***	-.002	.01***	-.002	.01***	-.002	.01***	-.002	.01***
Valid observations (3 rounds)	1156		1156		1156		1156		1156	
Likelihood-Ratio χ^2 and *p*-value	255.8	.00	238.5	.00	239.8	.00	237.9	.00	241.4	.00
Cox and Snell R^2	.20		.19		.19		.19		.19	

Table 4. The asymmetry of the sentiment effects and robustness tests

The table reports the following ordered Location-Scale probit (Tests 1 and 2) and ordered log-log model (Test 3) regression results: $E(R_{t+1,i}) = \beta_0 + \sum_j \beta_j SENT_{j,i} + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i$,

$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $E(R_{t+1})_i$, is the *i*th individual's next month subjective return expectation corresponding to the Dutch AEX index; $SENT_j$ are sentiment-creating variables: General-feeling, Perceived-weather, and Soccer-result, which are further divided into good and bad dummies, as well as Winter-Blues and Spring-preference; $CONTROLS_k$ are control variables: the day of the week control variables, where Monday is further divided to Monday AM and PM, macroeconomic control variables, test-specific control variables, and individuals' control variables; and z_i is the *i*th individual variable, where δ controls for autocorrelation and γ controls for heteroskedasticity. Valid observations incorporate the total number of complete questionnaires (1,465) less subjects who have selected a non-quantitative choice ("Don't know/no opinion/not relevant"). One, two, and three asterisks stand for 10%, 5%, and 1% significance levels respectively.

Robustness test:		**1. Asymmetry of sentiment effects**		**2. Spring preference**		**3. Ordered log-log model**	
		Co.	Sig.	Co.	Sig.	Co.	Sig.
Sentiment-creating variables (Dummies)							
General-feeling (1-good)	Good	.17	.01***			-.10	.04**
	Bad	.00	.99				
Perceived-weather (1-good)	Good	.23	.07*			-.18	.11
	Bad	-.24	.24				
Soccer-result (1-good)	Good	.16	.24			-.12	.01***
	Bad	-.18	.21				
Winter-Blues in Nov. & Feb. (1-none)	Nov.	-.21	.03**	-.20	.03**	-.18	.05**
	Feb.	-.22	.04**				
Spring-preference in Nov. & Feb. (1-Autumn)				-.06	.57		
Control variables							
Day of the week control variables							
Monday dummy	AM	.64	.00***	.42	.00***	.43	.00***
	PM	.42	.00***				
Tuesday dummy		.27	.01**	.26	.01***	.20	.07*
Wednesday dummy		.21	.06*	.22	.06*	.12	.31
Thursday dummy		.05	.70	.03	.82	.02	.85
Friday dummy		.10	.39	.09	.46	.05	.67
Saturday dummy		.20	.12	.19	.15	.20	.12
Macroeconomic control variables							
November dummy		1.16	.00***	1.14	.00***	1.06	.00***
February dummy		1.09	.00***	1.22	.00***	.97	.00***
Five-day-return (AEX index)		.05	.04**	.05	.06*	.05	.04**
Volatility Index (VAEX)		-.05	.03**	-.05	.03**	-.06	.02**
Test-specific control variables							
Soccer-fan dummy		-.01	.89			-.03	.68
Winter-Blues		.23	.00***	.21	.01***	.19	.01**
Spring-preference				-.01	.66		
Individuals' control variables							
Gender (1-male, 2-female)		-.06	.39	-.07	.30	-.14	.06*
Education (1-low)		-.07	.00***	-.07	.00***	-.04	.10
Age		.00	.05**	.00	.05*	.00	.11
Personal-income (1-low)		.02	.12	.02	.16	.00	.77
Optimistic-pessimistic (1-opt.)		-.01	.90	-.04	.38	.01	.75
Location-Scale control variables							
The *i*th individual		.001	.60	.001	.35	.001	.29
The *i*th individual scale		-.002	.00***	-.002	.01***	-.002	.02**
Valid observations (3 rounds)		1156		1156		1156	
Likelihood-Ratio χ^2 and *p*-value		261.1	.00	242.8	.00	230.2	.00
Cox and Snell R^2		.20		.19		.18	

Table 5. Individuals' return forecast error and sentiment

The table reports the following ordered Location-Scale probit regression results:

$$ERROR_{t+1,i} = \beta_0 + \sum_j \beta_j SENT_{j,i} + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$

$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $ERROR_{t+1,i} = E(R_{t+1}) - R_{t+1}$, is the *i*th individual's next month forecast error, defined as subjective return expectation corresponding to the Dutch AEX index less the realized return over this month; $SENT_j$ are sentiment-creating variables: General-feeling, Perceived-weather, Soccer-result, and Winter-Blues; $CONTROLS_k$ are control variables: the day of the week control variables, macroeconomic control variables, test-specific control variables, and individuals' control variables; and z_i is the *i*th individual variable, where δ controls for autocorrelation and γ controls for heteroskedasticity. One, two, and three asterisks stand for 10%, 5%, and 1% significance levels respectively.

	1.		2.		3.		4.		5.	
Sentiment-creating variable:	**All variables**		**General-feeling**		**Perceived-weather**		**Soccer-result**		**Winter-Blues**	
	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.
Sentiment-creating variables										
General-feeling (1-good)	-.08	.11	-.09	.04**						
Perceived-weather (1-good)	-.21	.05**			-.25	.02**				
Soccer-result (1-good)	-.10	.01***					-.11	.01**		
Winter-Blues in Nov. & Feb. (1-none)	-.16	.06*							-.15	.07*
Control variables										
Day of the week control variables										
Monday dummy	.18	.07*	.19	.06*	.15	.13	.19	.06*	.17	.08*
Tuesday dummy	.19	.09*	.18	.09*	.15	.17	.21	.06*	.18	.10*
Wednesday dummy	-.06	.59	-.06	.57	.10	.40	-.04	.69	-.07	.56
Thursday dummy	.01	.93	.00	.99	-.03	.83	.02	.88	-.00	.97
Friday dummy	-.03	.81	-.03	.81	-.06	.61	-.02	.86	-.04	.74
Saturday dummy	.10	.43	.08	.55	.08	.51	.11	.39	.07	.56
Macroeconomic control variables										
November dummy	.33	.05**	.05	.62	.07	.49	.05	.60	.28	.09*
February dummy	1.38	.00***	1.14	.00***	1.14	.00***	1.12	.00***	1.36	.00***
Five-day-return (AEX index)	.23	.00**	.23	.00***	.23	.00***	.23	.00***	.23	.00***
Volatility Index (VAEX)	-.12	.00***	-.11	.00***	-.11	.00***	-.11	.00***	-.12	.00***
Test-specific control variables										
Soccer-fan dummy	-.08	.23					-.09	.15		
Winter-Blues	.13	.09*							.11	.14
Individuals' control variables										
Gender (1-male, 2-female)	-.10	.15	-.09	.22	-.09	.20	-.11	.12	-.09	.19
Education (1-low)	-.09	.00***	-.08	.00***	-.09	.00***	-.09	.00***	-.09	.00***
Age	.00	.15	.00	.10	.00	.08*	.00	.20	.00	.11
Personal-income (1-low)	.01	.18	.01	.25	.01	.22	.01	.21	.01	.24
Optimistic-pessimistic (1-optimistic)	-.03	.44	-.03	.49	-.05	.25	-.05	.19	-.05	.23
Location-Scale control variables										
The *i*th individual	.001	.57	.000	.37	.001	.38	.001	.47	.001	.32
The *i*th individual scale	-.002	.01**	-.002	.02**	-.002	.01**	-.002	.01***	-.002	.01**
Valid observations (3 rounds)	1156		1156		1156		1156		1156	
Likelihood-Ratio χ^2 and *p*-value	792.2	.00	776.6	.00	778.0	.00	780.7	.00	775.7	.00
Cox and Snell R^2	.50		.49		.49		.49		.49	

Table 6. Time and market analysis of the individuals' sentiment effects

The table reports the following ordered Location-Scale probit regressions results:

$$1.\quad E\left(R_{t+1,i}\right) = \beta_0 + \beta_1 ISI_i + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$

$$2.\quad ERROR_{t+1,i} = \beta_0 + \beta_1 ISI_i + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$

$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $E\left(R_{t+1,i}\right)$, is the *i*th individual's next month or next year subjective return expectation corresponding to either the Dutch AEX index or the U.S. S&P 500 index and $ERROR_{t+1,i} = E\left(R_{t+1,i}\right) - R_{t+1,i}$, is the individual's next month return forecast error corresponding to either the Dutch AEX index or the U.S. S&P 500 index; *ISI* is the Individual Sentiment Index, which is composed of the sentiment-creating variables; $CONTROLS_k$ are control variables: the day of the week control variables, macroeconomic control variables, test-specific control variables, and individuals' control variables; and z_i is the *i*th individual variable, where δ controls for autocorrelation and γ controls for heteroskedasticity. Valid observations incorporate the total number of complete questionnaires (1,465) less subjects who have selected a non-quantitative choice ("Don't know/no opinion/not relevant"). One, two, and three asterisks stand for 10%, 5%, and 1% significance levels respectively.

Dependent variable:	Next month return expectations				Next year return expectations				Next month return forecast error			
	1. Dutch AEX		2. U.S. S&P 500		3. Dutch AEX		4. U.S. S&P 500		5. Dutch AEX		6. U.S. S&P500	
	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.
Sentiment-creating variable												
Individual Sentiment Index (ISI)	.12	.01***	.10	.05**	-.00	.99	.06	.28	.11	.02**	.14	.00***
Control variables												
Day of the week control variables												
Monday dummy	.43	.00***	.35	.00***	.29	.01***	.28	.02**	.18	.08*	.40	.00***
Tuesday dummy	.26	.02**	.15	.22	.15	.20	.08	.52	.17	.11	.64	.00***
Wednesday dummy	.20	.07*	.30	.02**	.23	.06*	.28	.04**	-.07	.51	.48	.00***
Thursday dummy	.02	.85	.09	.48	.04	.75	.02	.96	-.01	.91	.29	.02**
Friday dummy	.09	.45	.27	.05**	-.03	.82	.10	.50	-.03	.78	.19	.14
Saturday dummy	.20	.13	.14	.32	.15	.26	.22	.14	.09	.49	.14	.33
Macroeconomic control variables												
November dummy	.79	.00***	.32	.00***	.73	.00***	.42	.00***	.05	.58	-2.08	.00***
February dummy	.76	.00***	.50	.00***	.81	.00***	.69	.00***	1.15	.00***	.61	.00***
Five-day-return (AEX index)	.05	.03**	.05	.06*	.01	.66	-.00	.90	.23	.00***	.62	.00***
Volatility Index (VAEX)	-.05	.05*	.00	.86	-.05	.08*	.00	.94	-.11	.00***	.45	.00***
Test-specific control variables												
Soccer-fan dummy	-.02	.77	.02	.78	-.05	.50	-.14	.07*	-.08	.25	.02	.81
Winter-Blues	.16	.01***	.09	.13	.04	.56	.04	.60	.09	.10	.10	.11
Individuals' control variables												
Gender (1-male, 2-female)	-.08	.28	-.15	.06*	-.25	.00***	-.25	.00***	-.11	.12	-.12	.14
Education (1-low)	-.07	.00***	-.09	.00***	-.02	.34	-.01	.61	-.09	.00***	-.08	.00***
Age	.00	.05*	.00	.20	-.01	.00***	-.01	.01***	.00	.13	-.00	.41
Personal-income (1-low)	.02	.18	.03	.02**	.05	.00***	.04	.00***	.01	.27	.03	.01***
Optimistic-pessimistic (1-opt.)	-.02	.71	.02	.65	-.03	.57	.01	.91	-.04	.41	.05	.33
Location-Scale control variables												
The *i*th individual	.001	.44	.000	.97	.001	.43	.000	.87	.001	.40	.000	.77
The *i*th individual scale	-.002	.00***	-.002	.05**	-.001	.09*	-.001	.18	-.002	.01**	-.002	.06*
Valid observations (3 rounds)	1156		982		1184		974		1156		982	
Likelihood-Ratio χ^2 and *p*-value	242.9	.00	103.8	.00	205.3	.00	113.3	.00	780.2	.00	734.2	.00
Cox and Snell R^2	.19		.10		.16		.11		.49		.53	

Table 7. Effect of sentiment on individuals' risk expectations and forecast error

The table reports the following ordered Location-Scale probit regressions results:

$$1.\quad E\left(VOL_{t+1,i}\right) = \beta_0 + \beta_1 ISI_i + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$

$$2.\quad ERROR_{t+1,i} = \beta_0 + \beta_1 ISI_i + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$

$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $E\left(VOL_{t+1,i}\right)$, is the *i*th individual's next month or next year subjective volatility expectation corresponding to either the Dutch AEX index or the U.S. S&P 500 index and $ERROR_{t+1,i} = E\left(VOL_{t+1,i}\right) - VOL_{t+1,i}$, is the individual's next month volatility forecast error corresponding to either the Dutch AEX index or the U.S. S&P 500 index; *ISI* is the Individual Sentiment Index, which is composed of the sentiment-creating variables; $CONTROLS_k$ are control variables: the day of the week control variables, macroeconomic control variables, test-specific control variables, and individuals' control variables; and z_i is the *i*th individual variable, where δ accounts for autocorrelation and γ accounts for heteroskedasticity. Valid observations incorporate the total number of complete questionnaires (1,465) less subjects who have selected a non-quantitative choice ("Don't know/no opinion/not relevant"). One, two, and three asterisks stand for 10%, 5%, and 1% significance levels respectively.

Dependent variable:	Next month volatility expectations				Next year volatility expectations				Next month volatility forecast error			
	1. Dutch AEX		2. U.S. S&P 500		3. Dutch AEX		4. U.S. S&P 500		5. Dutch AEX		6. U.S. S&P 500	
	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.	Co.	Sig.
Sentiment-creating variable												
Individual Sentiment Index (ISI)	-.15	.01***	-.10	.08*	-.10	.05**	-.16	.01***	-.11	.04**	-.15	.01***
Control variables												
Day of the week control variables												
Monday dummy	-.25	.04**	-.33	.01***	-.22	.05*	-.37	.00***	-.73	.00***	-.43	.00***
Tuesday dummy	-.23	.08*	-.04	.74	-.11	.36	-.11	.42	-.54	.00***	-.15	.27
Wednesday dummy	-.34	.01**	-.32	.02**	-.25	.04**	-.27	.05**	-.39	.00***	-.36	.01***
Thursday dummy	.00	.98	-.17	.22	-.01	.92	-.11	.42	.03	.84	-.13	.35
Friday dummy	.10	.46	.01	.94	.02	.89	-.16	.27	-.16	.27	-.06	.70
Saturday dummy	-.22	.14	.28	.08*	-.01	.96	-.25	.12	-.30	.05*	-.36	.02**
Macroeconomic control variables												
November dummy	-1.04	.00***	-.33	.01***	-.58	.00***	-.04	.70	-.15	.21	.47	.00***
February dummy	-.81	.00***	-.49	.00***	-.73	.00***	-.52	.00***	-1.37	.00***	-.77	.00***
Five-day-return (AEX index)	-.05	.12	-.06	.05*	-.05	.09*	-.05	.01**	.01	.73	-.07	.03**
Volatility Index (VAEX)	.08	.01***	.03	.40	.04	.16	-.03	.41	.10	.00***	.07	.02**
Test-specific control variables												
Soccer-fan dummy	-.18	.03*	-.13	.12	-.10	.17	-.16	.06*	-.09	.26	-.09	.26
Winter-Blues	-.18	.01***	-.09	.19	-.14	.03**	-.13	.07*	-.13	.06*	-.15	.03**
Individuals' control variables												
Gender (1-male, 2-female)	-.05	.55	-.12	.20	.01	.88	-.03	.77	-.04	.66	-.09	.31
Education (1-low)	.05	.06*	.08	.01***	.02	.31	.04	.14	.02	.43	.08	.02**
Age	-.01	.00***	-.00	.93	-.01	.00***	-.00	.16	-.01	.01***	-.00	.97
Personal-income (1-low)	-.00	.91	-.02	.17	-.01	.55	-.03	.05**	-.00	.98	-.01	.33
Optimistic-pessimistic (1-opt.)	.01	.92	-.05	.38	.01	.91	-.08	.14	-.00	.99	-.03	.62
Location-Scale control												
The *i*th individual	.002	.04**	-.000	.92	.001	.51	-.000	.82	.002	.14	-.000	.99
The *i*th individual scale	.001	.26	.000	.99	.000	.64	.000	.72	.002	.04**	-.000	.68
Valid observations (3 rounds)	1158		991		1173		977		1158		991	
Likelihood-Ratio χ^2 and *p*-value	219.5	.00	87.3	.00	161.5	.00	76.3	.00	451.4	.00	347.4	.00
Cox and Snell R^2	.17		.08		.13		.08		.32		.30	

Table 8. Future expectations, future investment plans, and actual investment activity

The table reports the following Location-Scale probit ordered regressions results:

$$1.\ E(BS_{t+1,i}) = \beta_0 + \beta_1 E(R_{t+1,i}) \quad + \delta z_i + \varepsilon_i,$$
$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $E(BS_{t+1,i})$ is the next month plan to buy or sell stocks (Panel A) or the actual realized trading in that month (Panel B); $E(R_{t+1,i})$ is the next month or the next year subjective return expectation, corresponding to the Dutch AEX index or the U.S. S&P 500 index;

$$2.\ E(BS_{t+1,i}) = \beta_0 + \beta_1 ISI_i + \sum_k \beta_k CONTROLS_{k,i} + \delta z_i + \varepsilon_i,$$
$$\mathrm{Var}(\varepsilon_i) = e^{(\gamma z_i)},$$

where $E(BS_{t+1,i})$ is the next month plan to buy or sell stocks (Panel A) or the actual realized trading in that month (Panel B); *ISI* is the Individual Sentiment Index, which is composed of the sentiment-creating variables; and $CONTROLS_{k,i}$ are the Monday AM and PM control variables; and z_i is the *i*th individual variable. Valid observations incorporate the total number of complete questionnaires (1,465) less subjects who have selected a non-quantitative choice ("Don't know/no opinion"). In Panel A the choice "Currently I do not intend to make any stock transaction" is combined with the neutral choice ("I intend to buy as many stocks as I intend to sell stocks") and in Panel B the choice "I did not make any stock transaction is combined with the neutral choice ("I bought as many stocks as I sold"). One, two, and three asterisks stand for 10%, 5%, and 1% significance levels respectively.

A. Dependent variable is the next month investment plan

	Regression 1								**Regression 2**	
	Co.	Si.	Co.	Si.	Co.	Si.	Co.	Si.	Co.	Si.
Sentiment-creating variable										
Individual Sentiment Index (ISI)									-.11	.02**
The Dutch AEX index										
Next month return expectations	-.09	.03**								
Next year return expectations			-.17	.00***						
The U.S. S&P 500 index										
Next month return expectations					-.09	.05**				
Next year return expectations							-.20	.00***		
Day of the week dummy variables										
Monday AM dummy									.47	.10
Monday PM dummy									-.22	.03**
Location-Scale control variables										
The *i*th individual	.00	.10	.00	.10*	.00	.06*	.00	.07**	.00	.09*
The *i*th individual scale	.00	.89	.00	.87	-.00	.55	.00	.63	.00	.95
Valid observations (3 rounds)	1075		1138		960		945		1156	
Likelihood-Ratio χ^2 and *p*-value	7.9	.05	16.3	.00	8.4	.04	23.2	.00	16.5	.00
Cox and Snell R^2	.01		.01		.01		.02		.01	

B. Dependent variable is realized trading

	Regression 1								**Regression 2**	
	Co.	Si.	Co.	Si.	Co.	Si.	Co.	Si.	Co.	Si.
Sentiment-creating variable										
Individual Sentiment Index (ISI)									.03	.47
The Dutch AEX index										
Next month return expectations	-.09	.02**								
Next year return expectations			-.19	.00***						
The U.S. S&P 500 index										
Next month return expectations					-.16	.00***				
Next year return expectations							-.23	.00***		
Day of the week dummy variables										
Monday AM dummy									.17	.32
Monday PM dummy									-.09	.33
Location-Scale control variables										
The *i*th individual	.00	.90	.00	.92	.00	1.00	.00	.96	.00	.82
The *i*th individual scale	.00	.84	.00	.20	-.00	.81	.00	.84	.00	.98
Valid observations (3 rounds)	1081		1064		894		881		1081	
Likelihood-Ratio χ^2 and *p*-value	6.3	.10	17.1	.00	14.0	.04	24.1	.00	2.7	.75
Cox and Snell R^2	.01		.02		.02		.03		.00	

Appendix: Questionnaire

This appendix contains questions that we submitted to the members of the LISS panel. The original questionnaire was in Dutch and it is available from the authors on request.

Question A (Stock holder screening question)
What is the approximate total value of stocks in your current financial investment portfolio? Stocks are defined as stocks of individual firms and investments in equity mutual funds (including mutual funds that do not only invest in stocks, but also in other financial securities, for example bonds). They exclude investments in "investment mortgages". The total value is:
1 = I don't have any investments in stocks
2 = 0-20,000 Euro
3 = 20,001-40,000 Euro
4 = 40,001-60,000 Euro
5 = 60,001-80,000 Euro
6 = 80,001-100,000 Euro
7 = 100,001-150,000 Euro
8 = 150,001-200,000 Euro
9 = 200,001+ Euro

The remainder of the questionnaire only went to respondents that answered 2-9 on this question (thus, we excluded investors who don't have any stocks).

Question B
What percentage of your investment portfolio is held in stocks? Stocks are defined as stocks of individual firms and investments in equity mutual funds (including mutual funds that do not only invest in stocks, but also in other financial securities, for example bonds). They exclude investments in "investment mortgages". The total investment portfolio is defined as the sum of all your financial investments, such as stocks, bonds, savings accounts, checking accounts, cash, etc. (excluding your main residence and other property holdings).
1 = 0%-20%
2 = 21%-40%
3 = 41%-60%
4 = 61%-80%
5= more than 80%

Questions C, D (Next month return expectations questions)

What is your best forecast for the rate of return on the Dutch stock market as measured by the AEX index for the coming month (the AEX index consists of 25 Dutch stocks that are representative of Euronext Amsterdam, formerly known as the Amsterdam Stock Exchange)?

What is your best forecast for the rate of return on the U.S. S&P 500 index for the next coming month (the U.S. S&P 500 index is a basket of 500 U.S. stocks that is representative of the American stock market)?

1 = -4% or worse
2 = -4% to -2%
3 = -2% to 0%
4 = 0% to 2%
5 = 2% to 4%

6 = 4% or better
7 = Don't know/no opinion

Questions E, **F** (Next year return expectations questions)

What is your best forecast for the rate of return on the Dutch AEX index for the coming year (the AEX index consists of 25 Dutch stocks that are representative of Euronext Amsterdam, formerly known as the Amsterdam Stock Exchange)?

What is your best forecast for the rate of return on the U.S. S&P 500 index for the next coming year (the U.S. S&P 500 index is a basket of 500 U.S. stocks that is representative of the American stock market)?

1 = -15% or worse
2 = -15% to -10%
3 = -10% to -5%
4 = -5% to 0%
4 = 0% to 5%
5 = 5% to 10%
6 = 10% to 15%
7 = 15% or better
8 = Don't know/no opinion

Questions G, **H, I, J** (Volatility expectations questions)

How do you consider the Netherlands stock market risk (volatility) for the coming month relative to an average month (the degree of risk means by how much the market is expected to fluctuate)?

How do you consider the Netherlands stock market risk (volatility) for the coming year relative to an average year (the degree of risk means by how much the market is expected to fluctuate)?

How do you consider the U.S. stock market risk (volatility) for the coming month relative to an average month (the degree of risk means by how much the market is expected to fluctuate)?

How do you consider the U.S. stock market risk (volatility) for the coming year relative to an average year (the degree of risk means by how much the market is expected to fluctuate)?

1 = Much less risky
2 = Somewhat less risky
3 = Similar risk to other months
4 = Somewhat riskier
5 = Much riskier
6 = Don't know/no opinion

Questions K, L, M (Sport fan questions)
Are you a fan or a supporter of a sport club or individual sportsperson?
1 = Yes
2 = No
With which sport is this club or sportsperson associated?

If you are a supporter of multiple clubs or sportspersons, then please choose the club or sportsperson that you follow the most.
1 = Soccer
2 = Tennis
3 = Speed skating
4 = Grass hockey
5 = Cycling
6 = Swimming
7 = Darts
8 = Other (please specify)
9 = Not a sport fan (skip next question)

If your favorite sport team (person) has played in the last three days, how do you consider the game result?
1 = The result was good in an important game/tournament
2 = The result was good in a not very important game/tournament
3 = The result was neither good nor bad
4 = The result was bad in a not very important game/tournament
5 = The result was bad in an important game/tournament
6 = Not relevant (no game played or not a sport fan)

Question N (Weather question)
How would you describe the weather in the last two days?
1 = Very good
2 = Good
3 = Not particularly good and not particularly bad
4 = Bad
5 = Very bad

Question O (Spring preference question)
Do you generally feel better in the autumn or in the spring?
1 = I generally feel much better in the autumn
4 = I generally feel the same in the autumn as in the spring
7 = I generally feel much better in the spring

Question P (Winter Blues question)
Do you (ever) suffer from "Winter Blues"? Winter Blues is a disorder that occurs in the autumn and early winter and is characterized by symptoms such as difficulty concentrating, social withdrawal, loss of energy, sleep disturbance and other related symptoms.
1 = I don't suffer from Winter Blues at all
2 = I mildly suffer from Winter Blues
3 = I suffer from Winter Blues
4 = I strongly suffer from Winter Blues

Question Q (General feeling question)
At the moment, which sentence best describes your feelings?
1 = I feel great today
2 = I feel good today
3 = I feel normal (neither good nor bad) today
4 = I feel bad today

5 = I feel very bad today

Question R (Optimism-pessimism question)
In general, how do you consider yourself relative to other people?
1 = I am a very positive person relative to other people
2 = I am a more positive person relative to other people
3 = I am neither a more positive person nor a less positive person relative to other people
4 = I am a less positive person relative to other people
5 = I am a much less positive person relative to other people

Questions S, T (Past and planned investments questions)

If you made transactions in your stocks holdings during the last month, did you mostly buy or sell stocks? The term "mostly" should be interpreted in terms of the total monetary value of the transaction (amount of stocks times price of stock)
1 = I only bought stocks
2 = I mostly bought stocks, but I also sold stocks
3 = I bought as many stocks as I sold
4 = I mostly sold stocks, but I also bought stocks
5 = I only sold stocks
6 = Not relevant (I did not make any stock transactions)

In the next few days, do you intend to mostly buy or sell stocks? The term "mostly" should be interpreted in terms of the total monetary value of the transaction (amount of stocks times price of stock):
1 = I intend to only buy stocks
2 = I intend to mostly buy stocks, but I also intend to sell stocks
3 = I intend to buy as many stocks as I intend to sell
4 = I intend to mostly sell stocks, but I also intend to buy stocks
5 = I only intend to sell stocks
6 = Not relevant (Currently I do not intend to make any stock transactions)

Question U: (Realized investment question)

This is the follow-up question, which was asked one month after the main survey.

If you made transactions in your stocks holdings during the last month, did you mostly buy or sell stocks? The term "mostly" should be interpreted in terms of the total monetary value of the transaction (amount of stocks times price of stock)
1 = I only bought stocks
2 = I mostly bought stocks, but I also sold stocks
3 = I bought as many stocks as I sold
4 = I mostly sold stocks, but I also bought stocks
5 = I only sold stocks
6 = Not relevant (I did not make any stock transactions)