

The Beliefs of Others – Naive Realism and Investment Decisions*

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Abstract

We show that investors use their beliefs about the stock market expectations of others in their investment decisions. These second-order beliefs play a role beyond own risk and return expectations. However, second-order beliefs are inaccurate and exhibit several well-known psychological biases. We document these in a panel survey of active private investors, who are asked for their return expectations and their beliefs about the return expectations of others. First-order and second-order beliefs differ greatly and investors have only a vague idea what other market participants are thinking. Among the biases we observe is investors' belief that their own opinion is relatively more common among the population. They further assert that others who hold divergent expectations are biased. We interpret these findings as evidence for a false consensus effect and a bias blind spot. The influence of second-order beliefs on investment decisions is mediated by the identified biases.

JEL-Classification Codes: C90, G01, G11, G17

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1 Introduction

In financial markets where prices are determined by the interaction of market participants, the expectations of investors are an important factor. We are interested in investors' beliefs about the expectations of others, commonly referred to as *second-order* beliefs. Investors may find second-order beliefs very useful to gain a more complete understanding of financial market movements. Compared to (for example) weather forecasters, they need to estimate a combination of fundamental values and others' beliefs regarding these values. While the weather remains unimpressed by the convictions of forecasters, investors do influence market prices by their opinions and actions.

This view of financial markets is closely related to the idea of the market as a beauty contest (Keynes, 1936) or voting mechanism (Graham and Dodd, 1934). In these models price movements come about by changes in investor beliefs and expectations that are not necessarily induced by changes in fundamentals. Investors instead try to gauge what other market participants are thinking by forming higher-order beliefs. The modern expression for these aggregated beliefs in the investor population is *investor sentiment* (Barberis, Shleifer, and Vishny, 1998); and second-order beliefs can thus be interpreted as personal estimate of current investor sentiment. They can lead to an adjustment of own beliefs (as per Bayesian updating) and to expectations becoming more homogeneous in markets. However, they can differ greatly from actual investor sentiment if the underlying judgments of others' beliefs are systematically biased and thus inaccurate.

The objective of this paper is to analyze the role of second-order beliefs in investment decisions. The main question in this context is whether investors find second-order beliefs informative beyond their own return and risk expectations. We furthermore assess the formation and accuracy of investors' second-order beliefs, their relationship to own (first-order) expectations, and their sensitivity to different market environments. We test for investors' susceptibility to commonly observed biases in second-order beliefs and investigate the repercussions of these biases on their investing.

To these ends we collect first and second-order return expectations in a longitudinal panel survey of private investors. The participants represent an especially interesting group as they are affluent self-directed online investors who frequently trade in stocks and other securities. The survey covers September 2008 to December 2009, a time period of widely varied returns in stock markets, which allows us to track investor expectations and second-order beliefs through different market environments. The survey is conducted every three months, and also elicits financial market views and psychological variables.

We reveal that second-order beliefs are indeed meaningful to investors. We analyze responses to an investment question which asks participants to divide a fixed amount between the stock-market and a riskless asset. The relationship between second-order beliefs and the amount of risky investment is positive, meaning that participants tend to invest more when they perceive others to be more optimistic. This suggests that they view financial markets as operating like a beauty contest or being positively influenced by investor sentiment.

Accurately estimating aggregate beliefs of others is likely to be difficult however, and this may render their use problematic. We first compare investors' first-order and second-order beliefs and analyze divergences between the two. For all survey rounds the majority of investors in our panel remain optimistic about the quarterly return prospects of the stock market. However, they believe their peers are far less sanguine, and thus hold inaccurate second-order beliefs. A test of individual accuracy of second-order beliefs reveals that investors' estimates of others' beliefs are mostly worse than a random guess.

To explain biases in estimating others' expectations we draw on the psychological paradigm of *naive realism* (Ichheiser, 1943; Ross and Ward, 1996), which holds that people take their own view on the world for objective reality. It provides a common framework for several well-known patterns in second-order beliefs, among them the false consensus effect (Ross, Greene, and House, 1977), which describes the tendency of people to overestimate the commonness of their own beliefs or behaviors, and the bias blind spot (Pronin, Lin, and Ross, 2002), which refers to people's unawareness of own judgmental biases.

We detect both biases in second-order beliefs of investors in the panel. In general participants perceive their own position as relatively more common in the investor population. Compared to investors with contrary first-order beliefs, they estimate a greater fraction of people to share their own expectations indicating a false consensus effect. As individuals' second-order beliefs may be driven by believing others are simplistically effected by negative or positive market environments, we check whether second-order beliefs are influenced by sentiment. We indeed find that the false consensus effect is especially pronounced for participants holding expectations in line with current market sentiment.

The bias blind spot is evident in investors' belief that their own expectations are based on more rational considerations than those of their peers. Participants also think that a surprisingly large fraction of others hold very unlikely expectations. These effects are stronger for investors holding beliefs contrary to current market sentiment. This subgroup of investors believe themselves to be in the minority and it would be a bold decision to stand against a well-informed crowd. Assuming others are biased allows them to maintain their opinion contrary to (perceived) sentiment.

We finally test for an interaction of the naive realism biases with participants' use of second-order beliefs in investing. We find that those investors who assume others to be biased incorporate second-order beliefs much less in their decision. Those who assume a consensus rely more on the estimated beliefs of others as they confirm their own views. Market views and financial literacy also play a role in the way investors incorporate second-order beliefs in their decision process.

In summary this paper contributes to the extant literature in several ways. We empirically investigate the neglected field of second-order beliefs in finance and introduce a unique data set of longitudinally surveyed real investors. We demonstrate the presence of known psychological biases in an environment where natural incentives should motivate accurate predictions, especially for those who believe second-order beliefs are useful. We also develop new bias measures that allow us to describe the working of false consensus effect and bias

blind spot more precisely. Finally we show the relevance of second-order beliefs and these effects for trading behavior.

Section 2 reviews economic and psychological literature on second-order beliefs and derives hypothesis for our analysis. Section 3 introduces the data set and the questions asked in the survey. Section 4 presents and discusses the results, a final section concludes.

2 Second-order beliefs in finance and psychology

2.1 The beauty contest, investor sentiment, and belief heterogeneity

The most well-known account of second-order beliefs in finance is Keynes' (1936) metaphor of the stock-market as a beauty contest. It implies that security prices react to market sentiment rather than to fundamentals, and that stock market predictions should be derived from the perceived beliefs of others. Keynes likewise argued that personal return expectations in the stock market will not materialize unless they are shared by a significant proportion of investors. In the words of Graham and Dodd (1934) the market works as a “voting machine” rather than a “weighing machine”.

Lately a model-theoretic discussion has evolved around the role of higher-order beliefs in asset pricing. Allen, Morris, and Shin (2006) strongly suggest prices to reflect average opinion and find higher-order beliefs useful in forecasting prices. Without assuming any irrationality, their model can explain financial market phenomena such as bubbles and underreaction. While others come to slightly different conclusions (cp. Banerjee, Kaniel, and Kremer, 2009; Makarov and Rytchkov, 2006), the importance of higher-order beliefs is generally acknowledged in these theoretic models. Consequently investors need to consider the opinions and expectations of other market participants as well as fundamentals of companies.

The literature on investor sentiment builds on this idea. Barberis et al. (1998) define investor sentiment broadly as “how investors form beliefs” (p. 308) and model overreaction and underreaction as a consequence of sentiment. Baker and Wurgler (2006) empirically find that investor sentiment influences the cross-section of stock returns. High sentiment stocks earn relatively low subsequent returns, while the result reverses for low sentiment stocks. This suggests that investor sentiment should be used as a contrarian indicator. However, due to noise trader risk it does not offer direct arbitrage opportunities. Chan and Fong (2004) investigate where and how the effects of such sentimental price pressures are likely to be observed and indeed they find that the effect is strongest for small and less liquid stocks (where arbitrage may be limited).

The implications of second-order beliefs for own investing behavior are thus not straightforward. While a beauty contest model would suggest aligning your investment with the crowd by selecting securities that one believes are or will be commonly regarded as attractive, objective investor sentiment research finds that high sentiment stocks subsequently perform poorly. Investor sentiment could thus also be interpreted as a contrarian indicator.

The most direct and intuitive way to measure sentiment is to survey investors. The return expectations we collect may therefore be interpreted as indicating current sentiment among the panelists. Fisher and Statman (2000) show that sentiment from such surveys is negatively related to future stock returns. This supports the view of sentiment as a contrarian indicator and stands in contrast to the beauty contest model, where the winning strategy is to pick the stocks that are commonly regarded most attractive.

In either case, individuals may believe knowing investor sentiment is helpful in predicting future returns. Experimental evidence confirms that expectations of investors can be informative beyond fundamentals and historical price data (Haruvy, Lahav, and Noussair, 2007). In order to use current market sentiment, investors must form second-order beliefs. We thus can see the practical relevance of second-order belief formation in their close connection to investor sentiment and the beauty contest view of financial market functioning.

However, we do not rely on investor sentiment to actually affect observed prices. It is sufficient that investors *perceive* market functioning as a beauty contest or as influenced by investor. Ongoing interest in analysts' recommendations and opinions of market pundits reflect this view. Brown and Cliff (2004, p.2) conclude from similar evidence that "market watchers and participants seem to believe in sentiment". Survey studies show that investors consider financial markets to be influenced by the opinion and expectation of other market participants. For example, Fisher and Statman (2002) find that investors believe markets may continue to rise due to sentiment driving prices, even though they recognize it is (fundamentally) already overvalued. Some participants in our panel confirm these results when asked for their view of how stock markets work (see section 4).

Social interaction between stock market participants is another facet of second-order beliefs in investing behavior. Hong, Kubik, and Stein (2004), and Brown, Ivković, Smith, and Weisbenner (2008) show that individuals' propensity to invest in stocks is influenced by the stock market participation of their peers. They identify sociability and word-of-mouth effects as drivers of these results. Kaustia and Knüpfer (2010) find a direct influence of neighbors' stock returns on investing behavior of individuals. Sources of these interaction maybe direct communication, verbal accounts, or beliefs about others. In financial markets (and elsewhere) people care for what other people do and what other people think. Whenever these actions or opinions remain unobservable, second-order beliefs play a vital role in social interaction.

Our first hypothesis thus is that investors believe second-order beliefs are relevant for their investment decisions. The direction of this influence can either be confirmatory, i.e. more positive second-order beliefs induce higher investment levels, which would reflect a belief in a beauty contest or voting mechanism. Or it could be negative, with more positive second-order beliefs resulting in lower investment levels if investors follow a contrarian investment strategy. The strength and direction of the influence should be mediated by investors' views on market functioning and by biases in estimating the expectations of others.

The former determines whether second-order beliefs play a role within the convictions of investors. The latter affects the perception the individual investor has of others's expectations and will be discussed in detail in the next section.

H1: Investors use second-order beliefs in making their investment decision.

H1a: The strength of H1 depends on how investors view market functioning and on the judgmental biases they make.

To estimate second-order beliefs accurately and to use them in decision making correctly, it is important to understand what causes differences in beliefs between individuals. Traditional finance literature generally links beliefs to information (e.g. Fama, 1970). According to Black (1986, p.531) "differences in beliefs must derive ultimately from differences in information." In this view, the beliefs of others simply reflect different information sets and meta-thinking is reduced to an attempt to infer others' information. Behavioral finance adds other sources of interpersonal differences to the picture. Perception, attention, memory, cognitive biases and limitations, and emotions have all been invoked to explain heterogeneity in beliefs.¹

Within the behavioral paradigm stock market expectations depend on participants' recall of previous events, the way they perceive new information, and on the attention they pay to the task at hand. Expectations further depend on participants' ability to process the various input factors sensibly, their proneness to judgmental biases, and the time and resources they spend on the task. Given these many and mostly unobservable factors which contribute to belief heterogeneity in financial markets, we consider it as unlikely that investors are able to correctly estimate beliefs of others.

H2: Second-order beliefs describe actual beliefs of other investors inaccurately.

¹Among the many existing studies consider exemplarily for attention: Barber and Odean (2008), memory: Biais and Weber (2009), perception: E.U.Weber, Siebenmorgen, and Weber (2005), cognitive biases and limitations: De Bondt and Thaler (1985), and emotions: Kempf, Merkle, and Niessen (2009).

2.2 Naive realism and judgmental biases

Financial economics' insights into second-order beliefs are useful to understand their role in stock markets, but lack predictions of how these beliefs are generated. Social psychology has argued that people perceive the world through a lense of naive realism — they *believe* that they experience and observe entities, events, and people in an objective and unbiased way (Ichheiser, 1943). Three basic tenets of naive realism were derived by Ross and Ward (1996): First is one's own felt objectivity and unmediated, factual interpretation of available evidence. As a consequence people secondly assert that others will share their beliefs and opinions, if they only analyze the situation in a reasonable manner. The third tenet of naive realism describes the reaction to disagreements in opinion. Given that the objectivity of one's own position is not contested, people often conclude that those who disagree with them either lack information, are unable or unwilling to process the facts at hand rationally, or are motivationally biased.

This framework leads to two specific biases we will examine in detail. As a result of the second tenet people will perceive their own judgments to be more common and appropriate than alternative responses. This false consensus effect manifests itself regarding personal traits, preferences, characteristics, and expectations of others (Ross et al., 1977). For example, adolescents who smoke provide higher estimates for the prevalence of smoking in the population than their non-smoking peers (Sherman, Presson, Chassin, Corty, and Olshavsky, 1983). In a meta-analysis of 115 items Mullen et al. (1985) show the pervasiveness and robustness of the effect.²

Causes of the false consensus effect broadly fall into four categories (Marks and Miller (1987)). The availability heuristic attributes it to the ease with which instances of (dis)similarity can be recalled. Given that people associate with other people of similar status, profession, and preferences, selective exposure leads to a biased assessment of the

²It has been argued that rational Bayesian updating using first-order beliefs leads to similar results (Dawes, 1989; Dawes and Mulford, 1996). However, the strength of the false consensus effect mostly goes beyond the (limited) informational value of own judgment (Krueger and Clement, 1994).

overall population. A second ingredient is the salience of one's own reasoning. Introspection emphasizes features supporting one's own position. Third, people tend to attribute their behavior and beliefs to situational rather than dispositional causes. Individuals assume that others will behave similarly in the same situation, neglecting differences in personality, tastes, and processing. Finally motivation plays a role as an existing consensus validates the correctness and appropriateness of an opinion. This way it bolsters self-esteem and perceived social support.

Despite the seemingly obvious applicability of this long established psychological bias to finance, we are not aware of many similar studies. Academic financial economists were shown to exhibit a false consensus effect when surveyed about the equity risk premium (Welch, 2000). Experimentally Hsee and E.U.Weber (1997), Faro and Rottenstreich (2006), and Borgsen and Weber (2008) investigate financial lotteries, where subjects have to predict risky choices of other participants. An integral component of such predictions are one's estimates of the risk tolerance of others. They find that a false consensus about risk tolerance and lottery choices exists, but can be moderated by different experimental designs. We anticipate a false consensus effect among the investor population when estimating the beliefs of other investors.

H3: Survey participants exhibit a false consensus effect in predicting future returns.

To gain a deeper understanding of the effect we will enhance the classic false consensus paradigm to analyze who is particularly prone to the effect. Usually the bias is defined in binary subgroups of the population (endorsers and non-endorsers of a statement, entrants and non-entrants of a financial lottery), meaning that *independent* of the position a person holds he or she will overstate the *relative* commonness of this position. However, in stock markets the prevalent market environment may give investors reason to believe in a specific consensus. Particularly those who submit return predictions in line with market sentiment will perceive this to be more of a consensus than those who hold contrarian views. We

define current market sentiment by several standard variables including market trend, news, consumer confidence, and implied volatility.

H3a: The false consensus effect is mainly present among investors with expectations consistent with current market sentiment.

To better understand those investors who hold contrarian views, we now turn to the third tenet of naive realism. It seems unlikely that investors can believe that a majority of well-informed, rational market participants hold beliefs widely divergent from their own. This would undermine their own position for two reasons: first, there is the informational value of others' expectations. Second, if one believes that market sentiment influences asset prices (in the sense of a voting mechanism), one should also adjust one's own expectations towards others.

The naive realism model presents a solution for this dilemma — it posits that survey participants will regard their own stock market expectations as unbiased, and the opinions of those who disagree with them as biased. This asymmetry in the perception of bias has been coined the “bias blind spot” (Pronin et al., 2002). Blindness here refers to the inability to recognize potential bias in one's own judgments, and thus asserting bias in others (Kruger and Gilovich, 1999). In its self-serving capacity the bias blind spot has been linked to the better-than-average effect, the tendency of people to view themselves as better than average in various domains (Alicke and Govorun, 2005). But non-egotistical causes for the bias blind spot have been proposed as well. Observing discrepancies in opinions requires an explanation for how the differences have been generated. Regarding others as biased is a simple strategy to resolve this dissonance. A reliance on introspection partakes in and adds to this explanation. The search for traces of bias in oneself often proves fruitless as non-cognitive processes are involved in biased judgments (Pronin and Kugler, 2007). This introspection illusion keeps the self-image of an unmediated view on reality intact.

Menkhoff and Nikiforow (2009) extend the bias blind spot approach to finance. In an experimental study with fund managers, they show that participants see themselves as less

prone to fall for financial biases such as home bias, herding, or the disposition effect. This result holds almost equally for endorsers or non-endorsers of behavioral finance.

H4: Investors are subject to a bias blind spot in generating expectations.

As noted before, the mental need to resolve dissenting opinions is more pronounced for those investors who regard their position as a minority position. We thus expect a stronger bias blind spot for these investors.

H4a: The bias blind spot is stronger for survey participants expressing a view contrary to current market sentiment.

Our hypotheses allow to study the judgmental biases through different market environments and to make predictions for their occurrence among different groups of investors. The dataset we use to test our hypotheses will be described in detail in the next section.

3 Dataset and survey questions

In collaboration with the Behavioural Finance team at Barclays Wealth, we conduct a panel survey of online self-directed investors at Barclays Stockbrokers, a UK direct brokerage provider. The first survey started in September 2008, shortly before what is in retrospect widely regarded as the climax of the financial crisis (the events around Lehman Brothers and AIG in the US, Northern Rock, HBOS, and other banks in the UK). Subsequent rounds occurred in three month intervals in December 2008 and throughout the year 2009. Figure 1 shows a chart of FTSE all-share index and the timing of the rounds. The survey covers the sharp stock market decline in late 2008 as well as the recovery in spring and summer 2009. The great variation in terms of realized returns resembles a remarkable natural experiment for studying reactions to market uncertainty, and is a strength of our dataset. It augments our testing of the role of investor sentiment and market phases, as we expect considerable changes for these variables throughout the survey period.

In the initial survey a stratified sample of the banks client base was invited via e-mail to participate in the online questionnaire (for details on the sampling procedure see Weber, E.U.Weber, and Nosić, 2010). In total 617 clients of the bank participated in at least one round, 200 have participated in at least 4 rounds, and 67 have participated in all 6 rounds. We have a minimum of 198 observations for each of the six rounds.

Investor surveys like ours have been pioneered by Lease, Lewellen, and Schlarbaum (1974) and were more recently used e.g. by Dorn and Huberman (2005), Glaser and Weber (2005), and Amronin and Sharpe (2006). Survey methodology has gained in importance and acceptance in finance, and has delivered notable evidence also in other subfields such as corporate finance (Graham and Harvey, 2001; Lins, Servaes, and Tufano, 2009).

Panel A of table 1 shows demographic statistics of survey participants. The older, more affluent, and male-dominated sample does not reflect the general British population (for an explicit comparison consider again Weber et al., 2010). But it does represent typical investor populations found in other studies (cp. the examples mentioned above). In particular most investors in our sample are experienced and do well in a financial literacy test.³ Investors report that they spend on average six hours a week on trading or researching potential investments. About a third states they have significant training in finance, economics, mathematics or statistics. We are thus confident that participants are not only able to understand and answer the questions meaningfully, but have also developed independent expectations and opinions about market prospects.

The focus for this study will be on the following questions:

1. *We would like you to make three estimates of the return of the UK stock market (FTSE all-share) by the end of the next three month.*

- *Your best estimate should be your best guess.*

³We use four questions by van Rooij, Lusardi and Alessie (2007) and obtain on average 87.3% correct responses (while van Rooij et al. (2007) report 65.5% for average households).

- *Your high estimate should very rarely be lower than the actual outcome of the FTSE all-share (about once in 20 occasions)*
- *Your low estimate should very rarely be higher than the actual outcome of the FTSE all-share (about once in 20 occasions)*

Please enter your response as a percentage change.

2. Think carefully about the best estimate question above, and how other people in this survey will respond. What percentage of respondents to this survey do you think will give a response falling into each of the categories below?

- *Fall 10% or more.*
- *Fall 3% to 10%.*
- *Stay about the same.*
- *Rise by 3% to 10%.*
- *Rise by 10% or more.*

Question one asks participants to forecast the three-month return of the UK stock market. They have to submit a best estimate as well as a high and a low estimate, which together yield a 90%-confidence interval. The question design is similar to Glaser and Weber (2007) and allows to calculate implicit expected volatility and miscalibration of investors. We use the best estimate to represent an investor's first-order belief about stock market return and the confidence interval as the range of outcomes he perceives as likely. Question two elicits second-order beliefs for the best estimate with survey respondents serving as the reference population. Second-order beliefs are to be stated in five intervals ranging from large losses to large gains. Due to space and time considerations question 2 was omitted in round 5 of the survey (September 2009).

In our investment task question participants have to allocate a hypothetical endowment between the UK stock market and a riskless asset. In offering the FTSE all-share for investment and in using a time horizon of three months the task corresponds to the previously

estimated expectations and serves to analyze investment decisions in dependence of first and second-order beliefs. Apart from the answers to question one and two we use risk tolerance and subjective risk perception as controls. Further descriptions of these variables and the investment task can be found in Brooks, Davies, and Egan (2008) and Weber et al. (2010), who use the same dataset.

To reveal if individuals believe that market functioning reflects the influence of sentiment and therefore the value of second-order beliefs, we ask for participants' agreement to several statements:

1. *It is possible for skilled investors to earn above-average risk-adjusted returns.*
2. *Price movements are completely unpredictable.*
3. *There are often temporary mis-pricings of stocks in the market.*
4. *The best way to invest is to just buy and hold a market index.*
5. *When making investing decisions, it is better to be in the minority than the majority.*
6. *When many people are saying the same thing about markets, it makes me believe they are correct.*

The first four statements relate to the notion of efficient markets and its implications for investment behavior. However, as panel B of table 1 shows, survey participants strongly believe in the presence of mis-pricings, the predictability of price movements, and the possibility to earn above-average risk-adjusted returns. Accordingly, they do not regard index investing as the best way to invest. We did not ask directly how investors assume mis-pricings to come about, and whether the ability to earn above-average returns and predict prices are seen as a consequence. But the very definition of mis-pricings is that they occur by trading activity driving prices away from "correct" values. When trading activity is based on (first-order) beliefs of investors, second-order beliefs or investor sentiment are a natural source for predicting these price movements. We interpret investors' answers to statements 1–4 as indicating this view of market functioning.

The last two statements explore whether people prefer to be in the minority or majority with regard to investment decisions and opinions (see table 1). If investors found this irrelevant, they would likely opt for the middle category. 46% (statement 5) and 16% (statement 6) do so, with these numbers probably being inflated by those who are just unsure and by a general central tendency bias. The remaining participants hold mixed opinions, consistent with the two alternative interpretations of second-order beliefs: beauty contest and investor sentiment. If anything, we observe a tendency towards acting and thinking contrary to the majority. The empirical analysis will show whether these opinions become effective in the investment task.

4 Results

4.1 A comparison of first-order and second-order beliefs

We first briefly analyze investors' first-order expectations, as they serve as a benchmark for later results. Participants submitted best estimates for return of the FTSE all share index over the next three month. Table 2 shows descriptive statistics for these estimates across rounds of the survey. The mean estimate is around 2% in September 2008, rises to 5.4% in March 2009, and stays on a relatively high level until it drops off to 3.4% in December 2009. On a yearly basis this return expectations appear high, which can be either a sign of over-optimism (Weinstein, 1980; Taylor and Brown, 1988) or of some investors misinterpreting the question in terms of annual values⁴.

The standard deviation and inter-quartile range of expectations increases dramatically within the financial crisis, and remains high throughout 2009. We can look beyond between-subject measures, as we also asked each individual for confidence intervals regarding return

⁴A comparison of three month and one year expectations (the latter where elicited for two rounds of the panel) reveals that most investors do differentiate between the time horizons. Moreover, as a potential mis-interpretation would occur across both own and others' expectations, it remains inconsequential for most of our analysis.

expectation. The average width of confidence intervals mirrors the cross-sectional standard-deviation over time, becoming larger for later rounds of the panel. Participants seem to learn from the crisis that extreme outcomes are not as unlikely as they previously thought.

For the following analysis of first-order and second-order beliefs, we define two groups of investors: optimists and pessimists. Optimists are participants who submit return expectations falling into the top two categories of the scale used for question 2, i.e. who expect the FTSE to rise at least by 3%. Similarly pessimists represent the bottom two categories, which correspond to a fall of the FTSE by at least 3%. Those in between we define as neutral. Figure 2 shows the proportions of optimistic and pessimistic investors (solid lines). Through all survey rounds investors are predominantly optimistic, their proportion ranges between 45% (September 2008) and 64% (March 2009). The fraction of pessimists is relatively stable and never exceeds one quarter of the population.

Individual first-order beliefs are persistent over time. The Pearson correlation between estimates in consecutive survey rounds is 0.32 ($p < 0.001$), and correlations remain positive for rounds further apart in time. A transition matrix using all five bins of question 2 reveals a probability to stay in the same belief category of 39% compared to 20% if allocation was random. Only rarely do very optimistic investors turn very pessimistic within three month time.

We begin our analysis of second-order beliefs with a simple illustration of how individuals responded to the question. Given the difficulty of the task, participants may use the question format to cue for reasonable responses or express ignorance (Schwarz, 1999). If investors do not have strong opinions about beliefs of others or attempt to communicate ignorance, we would likely see a lack of directionality and excessive use of the middle category (central tendency bias) in their estimates.

We find that only a small percentage of respondents expresses symmetry in second-order beliefs (10.7%). Table 3 shows that the middle category (-3% to $+3\%$) is slightly over-represented, but taking into account that average historical (three-month) return falls into

this category one may have expected even greater proportions allocated to this category. A positive correlation between symmetry of responses and estimated proportion in middle category confirms that these two facets of responses may indeed be related to ignorance or lack of opinion. However, for the majority of participants we conclude that they believe they know something about the expectations of other investors.

Table 3 shows the average distribution of second-order beliefs for all rounds. In the first two rounds participants believe that a greater proportion of investors are pessimistic than optimistic (see also the dashed lines in figure 2). In round three the relation becomes balanced and turns around slightly for round 4 and 6.⁵ It is clear that participants assume other investors are much more pessimistic than they actually are. Relative to actual expectations, second-order beliefs are too pessimistic for all rounds. Investors think that between 10 and 28%-points more pessimists are in the sample than there are, while they underestimate the fraction of optimists by 18 to 29%-points. All but one of the differences between first-order and second-order beliefs are highly significant.

If one calculates average expected return from categorical second-order beliefs according to the conversion rule stated in table 3, it becomes apparent that investors believe their peers to expect on average negative or zero returns. This is in contrast to previously reported first-order beliefs which were positive between 2% and 5.8%.

4.2 Investment decisions

While investors' second-order beliefs might be interesting in their own right, their relevance depends on their consequences for investing decisions. We now study market timing investment decisions in the investment task, which was part of the panel survey in each round. This task asks investors to divide a hypothetical £100,000 between the UK stock market (represented by FTSE all-share) and a riskless investment.

⁵Round 5 is excluded from further analysis as it did not contain the second-order belief estimation.

Weber et al. (2010) show that risk taking behavior in this investment task is driven by risk tolerance, risk perception and return expectations. We thus take these variables as given and include them as controls in our regression. Risk tolerance is measured by a psychometric risk-tolerance score (see Brooks et al., 2008). For risk perception we take subjective risk expectation expressed on a seven-point scale. Return expectations are three month best estimates for the FTSE all-share (first-order beliefs). As main variable of interest we consider second-order beliefs represented by expected return calculated from submitted belief distributions (using the conversion rule introduced before).

We employ a panel tobit regressions as the proportion of risky investment is censored on both sides. We use a model with individual random effects and add round dummies to account for round specific effects. Table 4 shows in column one the result of the baseline regression. Risk tolerance, return expectation, and risk perception have the expected influence on risk taking. The higher risk tolerance, the higher the proportion invested in the risky investment, and the higher risk expectation, the lower is risky investment. Return expectations positively influence the amount of risky investment. These factors are stable across all specifications we will discuss. The round dummies show that compared to round 1 in all subsequent rounds on average investors allocate a smaller amount to the risky investment, regardless of their expectations.

Beyond first-order beliefs second-order beliefs also impact the proportion invested in the stock market. The coefficient for the mean of second-order beliefs is positive and significant. This means participants consider perceived aggregated expectations of others as influential when making investment decisions. Interestingly the impact of second-order beliefs on investment behavior exceeds in magnitude the effect of first-order beliefs. The two are comparable as both are expressed in percent. With the necessary caution, given that the coefficients in a tobit model express the effect of the independent variables on the latent variable, an increase of 10%-points in second-order beliefs result in about 6.6%-points more

risk taking in the investment task. The result supports hypothesis H1, the more optimistic investors perceive others to be, the higher is their own investment in the stock market.

The positive coefficient for second-order beliefs is in line with the notion of a beauty contest. Participants invest more, when they believe others are holding positive expectations and are thus likely to invest more as well. In contrast investor sentiment literature suggests contrarian behavior, which we do not find in the data on average. While in the statements about market views (see section 3) investors were split between favoring the majority or minority position, their investment decisions clearly speak for acting with the majority.

As apparently investors rely on their second-order beliefs in investing, the question how investors generate these beliefs, how accurate they are, and which psychological biases are involved comes to the fore. Once we have discussed these issues in detail we will return to table 4 and the evaluation of H1a.

4.3 Accuracy of investors' estimates

Already the large discrepancies between first-order and second-order beliefs presented in section 4.2 raise concerns about the accuracy of second-order beliefs. Especially for the first rounds of the panel investors perceived others to be much more pessimistic than they actually were. We now turn from the summary statistics to the individual accuracy of participants.

We employ for each investor the sum of absolute errors between estimated second-order and actual belief distribution to look at individual level accuracy. The error measure $\delta = \sum_{i=1}^5 |\hat{p}_i - p_i|$ is calculated over the five categories, a δ of zero conveys the investor estimated the distribution perfectly, a δ of two corresponds to the maximal possible error. Table 5 displays the average error of participants, as well as the error produced by a simple guess of a uniform or normal distribution. Although there is great heterogeneity in accuracy only about a quarter of investors submit estimates that are more precise than a benchmark

of a naive random guess. We also test whether financial literacy helps in predicting the beliefs of others. The error for financially literate participants is on average 0.06 lower compared to the remaining participants ($p < 0.001$), but they are still far less accurate than the random benchmark.

We conclude that second-order beliefs of investors are a poor representation of first-order beliefs and thus confirm hypothesis H2, which stated that investors are inaccurate in estimating financial market expectations of others. Moreover their bias is systematically negative, as they hold too pessimistic beliefs about others' expectations. We will now continue by exploring the effects responsible for this bias.

4.4 False consensus effect

In most studies false consensus is demonstrated for binary choices between alternative judgments or behaviors. To apply the classic false consensus paradigm we therefore use the above defined groups of optimists and pessimist (leaving out neutral expectations). Table 6 shows how optimists and pessimist evaluate the beliefs of other investors. Each group thinks that their own expectations are shared by a relatively greater proportion of the population. Thus there is a positive difference between judgments of optimists and pessimists when the fraction of optimists is concerned and vice versa.⁶

This result is confirmed by positive correlations between own expectations and the mean of second-order beliefs. Independent of the way of calculation, using either numerical or categorical expectations, correlations are between 0.12 and 0.47 for the individual rounds ($p < 0.01$). The more positive participants' own view, the more positive they think the common evaluation of financial market prospects is. Krueger and Clement (1994) suggest another measure for a "truly" false consensus effect (TFCE), which is the correlation between the estimation error (estimated – actual beliefs) and the own position. The values

⁶Extending the analysis to all five categories of expectation, in general endorsers of a certain opinion submit significantly higher estimates for the prevalence of this opinion in the population.

for TFCE are reported in the last column of table 6. A positive correlation suggests the presence of a false consensus effect, which is the case for all ten prediction items. Collected evidence thus supports hypothesis H3 that a false consensus effect is present among investors.

Taking round 1 as an example figure 3 shows average second-order beliefs for strong pessimists (return expectation $< -10\%$) and strong optimists. Strong pessimists estimate about 40% of the population to be as pessimistic as they are, and optimism is an unlikely opinion from their point of view. Although less extreme, strong optimists share the pessimistic second-order beliefs and perceive themselves to be in the minority. While we find a relative false consensus effect for both groups only pessimists seem to believe in a real (absolute) consensus for their expectations. Moreover, this consensus is not backed by actual first-order beliefs which were mostly optimistic. We thus observe a consensus which is false in two ways, in absolute and relative terms.

To analyze this interesting feature of second-order beliefs, we have to depart from classic false consensus literature which usually defines the effect only as a relative bias (Ross et al., 1977). The argument of the classic paradigm is that it does not make sense to compare absolute second-order estimates for the own position, as these are influenced by actual consensus⁷. Given the low accuracy in estimating actual consensus we observe, we can treat participants as ignorant with respect to the estimation task. We define the absolute consensus error as the difference between second-order beliefs and actual beliefs in the population for one's own belief category, i.e. the fraction of participants an investor believes to share his opinion minus the fraction who actually does. This corresponds to the left panel of table 3 conditional on own first-order beliefs. On average this absolute false consensus amounts to 1.42 percentage points. It is significantly greater 0 ($p < 0.01$) and thus further

⁷For example in the case of smoking prevalence (Sherman et al., 1983), both smokers and non-smokers know that smoking is a minority activity. It follows naturally that non-smokers submit higher estimates for non-smoking than smokers do for smoking.

supports H3. Its rather low magnitude is due to the considerable number of participants we already referred to, who underestimate absolute consensus for their position.

4.5 Bias blind spot

We now turn to how individuals understand and explain beliefs divergent from their own. Some investors hold return expectations that are 12 or 13%-points apart from what they believe other investors are expecting. To justify this difference it is not sufficient to assume different information. If beliefs of others revealed information, a rational investor would be required to incorporate this information and the gap in beliefs would narrow or close. When investors disregard the beliefs of others however, it is likely that they suffer from a bias blind spot. They perceive other investors as biased and themselves as unbiased, which renders any adjustment of own opinion unnecessary.

Our approach to detect the bias blind spot follows Pronin, Gilovich, and Ross (2004). In round 6 of our survey respondents are asked to what degree their own expectations, and the expectations of those who disagree with them, have been influenced by a number of factors. Of the factors some represent normative or objective considerations (investing expertise, evaluation of economic conditions) and others nonnormative or biasing considerations (emotions, own recent performance). Typically own beliefs are attributed to objective thoughts, while beliefs of those who disagree are attributed to bias.

Table 7 shows that participants perceive economic conditions as significantly more important for their own expectations than for those of others. The opposite pattern can be observed for emotions and own recent performance. Investors believe they personally rely more on valid cues, while others are influenced more by biasing factors. In this capacity the bias blind spot is related to the better-than-average effect, the tendency of people to view themselves more favorable than others. Investing expertise is hence expected to yield a positive difference as well. However, we find that the result in this case is confounded by

own perceived financial expertise. Only investors who rate themselves highly in investing skill attribute a stronger influence of expertise to their own judgments.

From the results of table 7 we construct a bias blind spot measure aggregating the differences across factors (aligned in sign). We do not include investing expertise due to its confoundedness, and news and media for containing both factual information and normatively irrelevant aspects. Since this measure is available only for one round of the survey we use another more indirect approach to confirm these results. Confidence intervals submitted by investors define a range of outcomes they perceive as likely. Reversely beliefs of others outside these confidence intervals are seen as improbable and (presumably) biased. For each investor we calculate the proportion of own second-order beliefs that falls outside own confidence intervals and interpret the result as a sign for a bias blind spot.

The first row of table 8 reports the results for both bias blind spot measures. On average the asymmetry in belief attribution to normative and biased factors amounts to 2.8 response categories. There is great heterogeneity in this bias blind spot assessment, but only about a quarter of the participants is unbiased. Investors further assume on average that 22.4% of their peers hold return expectations that fall outside own confidence intervals and are thus unlikely. This fraction is large given that an investor with more accurate confidence intervals (e.g. from implied volatility) and accurate second-order beliefs would exclude a mere 2.5% of others. Both measures show a general presence of a bias blind spot among investors and thus confirm hypothesis 4.

4.6 Market sentiment and biases

We now analyze subgroups of the investor population. It was pointed out that the bias blind spot helps to resolve cognitive dissonance when facing a majority of others who hold different opinions. In contrast the feeling of being in the minority might moderate or offset the false consensus effect. Both biases thus seem to depend on the prevalent market sentiment and to affect groups of investors differently.

To test this proposition we construct a sentiment indicator based on four sentiment measures that have been proposed in the literature. Brown and Cliff (2004) find that recent stock market returns are an important determinant of sentiment. We take the past three month return of the FTSE all share as it is the object of elicited expectations and the time span allows for non-overlapping observations. Another directly market-based sentiment measure is implied volatility, which has been linked to investor fear (Whaley, 2000). We consider implied volatility of the FTSE 100 represented by the FTSE VIX index. Media reports have a strong influence on market sentiment as well (Tetlock, 2007), in addition their impact on false consensus has been documented (Christen and Gunther, 2003). We use a Google news search to identify positive and negative stock market news in the month of the survey rounds (for details see table 9). Finally consumer confidence has been established as a sentiment measure (Fisher and Statman, 2003; Lemmon and Portniaguina, 2006). We get UK consumer confidence data from Nationwide.

Table 9 reports the four sentiment measures for the rounds of our survey. The average interitem correlation is high (0.71), Cronbach's alpha is 0.91. This confirms that the items share a common underlying construct. We perform a principal component analysis and take the first principal component as a sentiment indicator. To combine several measures to an indicator has proven useful in investor sentiment research (cp. Baker and Wurgler, 2006). The values of the sentiment indicator are shown in the bottom row of table 9. It captures 79% of the variance of the individual measures. The general picture that emerges is that sentiment is negative during the first half of our survey and positive in the second half.

As second-order beliefs can be interpreted as participants' estimates of investor sentiment, we check whether they are consistent with our sentiment indicator. Indeed the correlation between mean second-order beliefs and market sentiment is 0.72, much higher than between mean first-order beliefs and sentiment (0.44). Investors seem to believe that others are forming their expectations by simplistically taking over the prevalent market sentiment.

We can now divide the investor population into those holding expectations in line with investor sentiment and those who hold expectations contrary to sentiment. For the first three rounds of the survey pessimists are in line with market sentiment, for the last three rounds optimists are in this position. Each group should be particularly prone to the false consensus effect at different points in time. Table 8 shows that the absolute and relative false consensus error is larger for investors with expectations in line with market sentiment. They overestimate the absolute consensus for their position by 7.2 percentage points, and relative to other participants by 8.2 percentage points. Investors with expectations contrary to prevalent market sentiment still show a relative false consensus effect, but on absolute terms they even underestimate the consensus for their position. Differences between the two groups are significant and in the predicted direction.

Results for the two bias blind spot measures are reversed. Investors with expectations contrary to market sentiment attribute beliefs of others less to normative factors and more to biasing factors than their own beliefs. They also exclude a greater proportion of other investors from their own confidence intervals. Differences are again strongly significant. This is likely due to the fact that “contrarians” need to justify their own minority beliefs by assuming bias in others. The opposed directionality of false consensus and bias blind spot in dependence of market sentiment simultaneously supports H3a and H4a. The distinct pattern allows to predict the occurrence of judgmental biases in different market phases.

4.7 Consequences of psychological biases for investing

The important role of second-order beliefs for investing has been established before (see section 4.2). It should be clear that inaccuracy and biasedness of second-order beliefs provide a threat to sound decision making of investors. But also the false consensus effect and bias blind spot itself should alter the way second-order beliefs are used in investing, as expressed by H1a.

In a next step we thus interact second-order beliefs with the judgmental biases described in the previous sections. Of the two bias blind spot measures we take the bias blind spot from confidence intervals as it is available for all rounds. For the false consensus effect we take relative false consensus, i.e. the degree the prevalence of one's own position is overestimated compared to the average estimate of all participants. For both measures we create dummy variables and interact these dummies with expected return from second-order beliefs. The natural prediction is that investors, who perceive others as biased, will rely on second-order beliefs to a lesser extent than those who do not. In contrast a felt consensus is expected to increase the impact of second-order beliefs as it lends support to own expectations and reduces the ambiguity in the decision.

We perform a similar interaction for market views of investors by using the first principal component of their answers to statements 1-4 (see section 3). A higher value here signifies a view more in line with efficient markets, which would contradict a role of second-order beliefs in investing. Finally we consider financial literacy, as financially literate participants may trust more in their own expectations than in the expectations of others.

Columns (2) to (6) of table 4 present the results of the described regressions. Indeed the signs of the coefficients are as expected and the magnitude of the effects is large compared to the baseline regression. Investors who view the market as more efficient, perceive others as biased or have higher financial literacy rely less on second-order beliefs, while a perceived consensus strengthens the influence of second-order beliefs. The effects are stable to the inclusion of all interactions in the full model of column (6)⁸. However, we are reluctant to emphasize this result too much as the significance of the interactions is at best weak. Overall the directionality of the results provides some evidence that the judgmental processes involved when coming up with second-order beliefs impact the way second-order beliefs are used in investment decisions. We take this as tentative support for H1a.

⁸Market view is not considered in this regression as it overly reduces the number of observations

5 Conclusion

Investors exhibit systematic errors in forming second-order beliefs, yet appear to use these biased estimates in making investment decisions. They regard themselves as objective in judging stock market prospects, and believe others either to agree with their views or to hold somewhat biased expectations. Still they only have a very vague idea of the beliefs of other investors. The accuracy in estimating second-order beliefs is on average worse than a random guess. Investors mostly hold relatively optimistic expectations, while believing others are strongly influenced by current sentiment. We consider two biases to explain this asymmetry, a false consensus effect and a bias blind spot. We show a strong false consensus effect for the participants in our study. Its significance exceeds typical findings in psychology (see Mullen et al., 1985), which might be due to the nature of our financial judgment task. While people often have an idea of actual consensus (e.g. for smoking prevalence) and only slightly over- or underestimate it in direction of their own behavior, it is more challenging to guess return expectations of others in a volatile market environment. It is thus likely that investors rely on the same evidence both for own judgments and second-order beliefs.

We find pronounced differences in false consensus conditional on own expectations. We develop absolute consensus as an additional measure, which compares estimates to actual expectations of investors. Only investors with views in concert with current market sentiment assume a majority of other investors to share their views. We argue that these differences are produced by the market environment in different rounds of our survey. A sentiment indicator based on return trend, implied volatility, news, and consumer confidence, makes a case for a negative stock market outlook in the first half of the survey and a positive one thereafter. Investors in line with this sentiment indicator easily gain the impression that most people agree with them.

Conversely investors standing against current sentiment underestimate the commonness of their responses. They see themselves as minority and remote from mean expectation. To justify their expectation against a perceived majority a mental excuse is needed. Con-

sequently contrarian investors believe that the majority accept trends, news and events at face value and fall for the more obvious prediction of stock markets to follow current sentiment. This implicit bias blind spot becomes explicit when asked for plausible ranges of stock market outcomes. Investors exclude a substantial fraction of their beliefs about others' expectations from what they themselves perceive as likely. We interpret this as investors thinking of these people as biased, as otherwise they would hold more reasonable expectations.

A general tendency to assume that others are using less credible information sources is confirmed by the weights investors give to certain factors for their own judgment and the judgment of disagreeing others. Investors consider normative considerations such as economic conditions or investing expertise (when controlled for own expertise) as more important for their expectations than others' expectations. We find the opposite pattern for biasing factors such as emotions or own past performance. The bias blind spot seems to be anchored both in the perception of holding expectations against the current market sentiment, and a more general propensity to act contrary to mainstream opinion.

Finally we show that second-order beliefs influence investing decisions. The more optimistic about stock returns participants assume other investors to be, the more money they allocate themselves to stocks. If investors perceive a consensus, i.e. first-order and second-order beliefs are aligned, then the impact of second order beliefs is even stronger. Quite logically investors who see other market participants as biased rely less on second-order beliefs. The effect further depends on investors' financial literacy and view of market functioning.

There are several implications of our findings. First, if one interprets joint investor expectations as a form of market sentiment, then actual and perceived sentiment can be two very different things. Investors are largely unaware what others are thinking, and if they base strategies on their second-order beliefs, such as market-timing, they will most likely fail. Second, given that most investors submit too narrow confidence intervals (miscalibration), it

would help them to consult other opinions and to widen own confidence intervals accordingly. Confidence intervals that account for the full range of second-order beliefs are usually large enough and thus less susceptible to miscalibration. Third, financial intermediaries and advisors should be aware of these financial judgment biases. This aids them in identifying own biases and biases on the side of their clients. It further prevents them from projecting their own expectations on their clients and to be more careful with predictions in general.

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Table 1: Descriptive statistics

Panel A – Demographics	n	Mean	Median	Std.Dev.	Min	Max
Age (in years)	613	51.4	53	12.9	21	84
Gender (male=1)	617	0.93	1	0.25	0	1
Couple (married or cohabiting=1)	616	0.74	1	0.44	0	1
Investment experience (in years)	197	19.6	20	10.3	1	41
Wealth (categories see below)	502	4.80	5	2.39	1	9
Income (categories see below)	494	3.88	4	1.80	1	8
Panel B – Market views	n	Mean	Agree	Neutral	Disagree	
Statement 1 (alpha)	154	5.37	135	8	11	
Statement 2 (unpredictable)	154	3.48	37	24	93	
Statement 3 (mispricings)	154	5.53	134	11	9	
Statement 4 (index best)	154	3.03	25	36	93	
Statement 5 (minority investing)	193	4.15	61	89	43	
Statement 6 (majority beliefs)	192	3.16	48	31	113	

Notes: Number of observations varies due round when questions were asked or refusals.

Wealth categories: (1) 0–10,000£ (2) 10,000–50,000£ (3) 50,000–100,000£ (4) 100,000–150,000£ (5) 150,000–250,000£ (6) 250,000–400,000£ (7) 400,000–600,000£ (8) 600,000–1,000,000£ (9) >1,000,000£.

Income categories: (1) 0–20,000£ (2) 20,000–30,000£ (3) 30,000–50,000£ (4) 50,000–75,000£ (5) 75,000–100,000£ (6) 100,000–150,000£ (7) 150,000–200,000£ (8) >200,000£.

One £ is approximately 1.60 \$, average gross yearly income in the UK is about 30,000£.

Statements are evaluated on a seven-point scale, from 1 (strongly disagree) to 7 (strongly agree). Column “Agree” comprises 5–7, “Disagree” 1–3 on that scale. Full statements can be found in the text.

Table 2: Expectations of investors

	n	Mean	Median	Std.Dev.	5% Perc.	95% Perc.	width of CI
Round 1 (Sep08)	479	1.99	2.00	7.88	-10.00	12.00	16.7
Round 2 (Dec08)	380	3.35	3.00	14.57	-15.00	20.00	23.4
Round 3 (Mar09)	223	5.42	5.00	12.84	-10.00	20.00	23.3
Round 4 (Jun09)	188	4.25	5.00	15.87	-10.00	15.00	29.2
Round 5 (Sep09)	217	5.81	5.00	19.95	-15.00	20.00	26.8
Round 6 (Dec09)	195	3.43	3.00	16.81	-10.00	15.00	26.7

Notes: The table states summary statistics for return expectations (best estimates) of investors in %. Width of CI (confidence interval) reports the average difference between high and low estimate in percentage points, inconsistent observations with low > high estimate are dropped.

Table 3: Average second-order beliefs

Round	second-order beliefs					differences second - first order				
	1	2	3	4	6	1	2	3	4	6
<= -10%	23.5	23.0	13.2	12.5	13.4	14.5***	6.4***	4.7***	0.3	3.2***
-10% to -3%	25.4	22.5	21.6	17.9	18.5	13.3***	15.7***	14.4***	10.4***	8.8***
-3% to 3%	27.3	25.7	30.1	31.4	33.2	-6.1***	2.6***	9.9***	13.8***	6.5***
3% to 10%	16.9	17.8	23.2	26.2	23.9	-14.4***	-10.7***	-10.9***	-16.9***	-12.5***
>= 10%	6.9	11.0	11.8	12.0	10.9	-7.3***	-14.0***	-18.2***	-7.7***	-6.0***
Exp. return	-3.0	-2.1	-0.1	0.4	0.0	-5.0***	-5.5***	-5.5***	-3.8***	-3.4***

Notes: Estimated proportions of expectations of others in %, differences to first-order beliefs in %-points. Expected return for second-order beliefs is calculated according to the following conversion rule for categorical responses: -15%, -6.5%, 0%, 6.5% and 15% respectively for the five categories. Differences are significant at *10%-level, **5%-level, or ***1%-level.

Table 4: Investment behavior

Risk taking behavior	(1)	(2)	(3)	(4)	(5)	(6)
Risk tolerance	0.026***	0.025***	0.026***	0.026***	0.023***	0.026***
Return expectation	0.208***	0.207***	0.188***	0.207***	0.194***	0.168***
Risk expectation	-0.043***	-0.041***	-0.041***	-0.043***	-0.046***	-0.040***
Second-order beliefs (SOB)	0.660***	0.828***	0.320	0.935***	1.171***	0.719*
Bias Blind Spot (BBS)		0.001				0.002
Interaction BBS*SOB		-0.310				-0.269
Relative FCE			0.010			0.018
Interaction FCE*SOB			0.633*			0.834*
Financial Literacy (FL)				0.014		0.011
Interaction FL*SOB				-0.571		-0.790*
Market view (MV)					-0.052	...
Interaction MV*SOB					-0.583	...
Round 2	-0.036**	-0.034*	-0.035**	-0.034*	-0.053*	-0.030*
Round 3	-0.110***	-0.112***	-0.107***	-0.108***	-0.129***	-0.106***
Round 4	-0.070***	-0.077***	-0.067***	-0.067***	-1.110***	-0.069***
Round 6	-0.043*	-0.032	-0.040*	-0.039*	-0.067**	-0.024
Constant	0.695***	0.691***	0.679***	0.682***	0.785***	0.656***
n	1430	1336	1430	1427	600	1333

Notes: The table shows coefficients of a panel tobit regression with random effects. Dependent variable is percentage of 100,000£ invested in UK stock-market. Risk tolerance is survey based risk tolerance score, return and risk expectations are investors first-order beliefs. Second-order beliefs is the estimated return expectation of other investors calculated from second-order beliefs. Bias blind spot is the proportion outside confidence intervals as a dummy variable (median split). Relative false consensus error is the individual FCE as a dummy variable (split at 0). Financial literacy is one for investors answering all four financial literacy questions correct, zero otherwise. Market view is first principal component of opinion expressed for questions 1-4 (see table 1) as a dummy. BBS, FCE, MV, and financial literacy are interacted with SOB. Round dummies control for round effects (round 5 is excluded as SOB were not surveyed in that round). Coefficients are significant at *10%-level, **5%-level, or ***1%-level.

Table 5: Accuracy in estimation

Absolute error	Sep 2008	Dec 2008	Mar 2009	Jun 2009	Dec 2009
Investor panel (mean)	0.72	0.70	0.70	0.66	0.57
Investor panel (10 perc.)	0.31	0.36	0.35	0.30	0.28
Investor panel (90 perc.)	1.18	1.13	1.08	1.01	0.87
Uniform distribution	0.49	0.33	0.49	0.46	0.46
Normal distribution	0.19	0.38	0.42	0.47	0.24
Better than uniform distr.	28%	6%	29%	26%	29%

Notes: Sum of absolute error $\delta = \sum_{i=1}^5 |\hat{p}_i - p_i|$ in estimates of investors (mean and 10th and 90th percentile). Uniform distribution assumes equal proportions per category, normal distribution uses mean and stdev. of historical returns. Better than uniform distr. is the fraction of investors more accurate than a uniform distribution.

Table 6: False consensus effect

		optimists	pessimists	difference	p-value	TFCE
Sep 2008 n = 319	proportion optimistic	29.4%	16.7%	12.6	< 0.001	0.33***
	proportion pessimistic	43.4%	60.0%	-16.7	< 0.001	0.33***
Dec 2008 n = 283	proportion optimistic	35.8%	20.3%	15.5	< 0.001	0.38***
	proportion pessimistic	39.8%	60.2%	-20.4	< 0.001	0.42***
Mar 2009 n = 176	proportion optimistic	39.9%	29.6%	10.3	< 0.01	0.24***
	proportion pessimistic	31.3%	43.3%	-11.9	< 0.001	0.29***
Jun 2009 n = 152	proportion optimistic	43.7%	28.0%	15.7	< 0.001	0.39***
	proportion pessimistic	25.9%	46.1%	-20.2	< 0.001	0.47***
Dec 2009 n = 142	proportion optimistic	38.3%	29.8%	8.5	< 0.01	0.22***
	proportion pessimistic	28.3%	42.8%	-14.5	< 0.001	0.40***

Notes: The table shows proportions of optimistic and pessimistic investors as estimated by optimists and pessimists, differences between the two groups and p-values of two-sample t-tests. TFCE (true false consensus effect, Krueger and Clement (1994)) is the correlation between estimation error and own position. Number of observations is after exclusion of participants with neutral expectation. Correlations are significantly different from 0 at *10%-level, **5%-level, or ***1%-level.

Table 7: Belief attribution

Influencing factor	Own beliefs	Others' beliefs	Difference	p-value
Economic conditions	5.23	4.69	0.54	< 0.001
Investing expertise	4.55	4.69	-0.14	0.24
News and media	4.72	5.57	-0.85	< 0.001
Recent performance	4.13	5.14	-1.01	< 0.001
Emotions	3.88	5.18	-1.30	< 0.001

Notes: Estimated importance of factors for own beliefs and beliefs of others who disagree on a seven-point scale (1-7), differences, and p-values of one-sided t-tests.

Table 8: Biases and market sentiment

Measure	False Consensus Effect		Bias Blind Spot	
	Absolute FCE	Relative FCE	Belief attribution	Outside CI
All participants	1.4	6.7	2.82	22.4
In line with sentiment	7.2	8.2	2.44	18.9
Contrary to sentiment	-5.5	6.6	4.08	27.4
Difference	12.7***	1.6*	-1.64***	-8.5***

Notes: *Absolute FCE* is second-order beliefs compared to actual beliefs in the population, *Relative FCE* is second-order beliefs compared to average second-order beliefs, both for the own belief category. *Belief attribution* aggregates differences in self-other belief attribution (see table 7). *Outside CI* displays proportions of second-order beliefs that fall outside own confidence interval (CI) in %. Subgroups are investors who hold beliefs in line with and contrary to current investor sentiment (neutral beliefs not considered). Differences are significant at *10%-level, **5%-level, or ***1%-level.

Table 9: Market sentiment

	Sep 2008	Dec 2008	Mar 2009	Jun 2009	Sep 2009	Dec 2009
Recent return	-12%	-25%	-8%	14%	18%	3%
News (pos.-neg.)	-3100	1700	400	3900	3800	3700
Implied volatility	29.5	44.7	36.4	27.4	21.5	21.1
Consumer confidence	53	49	47	64	77	71
Sentiment indicator	-1.47	-2.24	-1.45	1.26	2.37	1.55

Notes: Recent return is previous three month return of UK stock market. News is the net number of news items retrieved via a Google News search using the term stock market combined with positive keywords (rally, rise, boom, grow, gain, positive, hope) and negative keywords (crash, fall, drop, fear, worries, negative, bad). Implied volatility is based on the FTSE 100 volatility index of NYSE Euronext. Consumer confidence is the consumer confidence index of Nationwide Building Society. Sentiment indicator is the first principal component of these four factors.

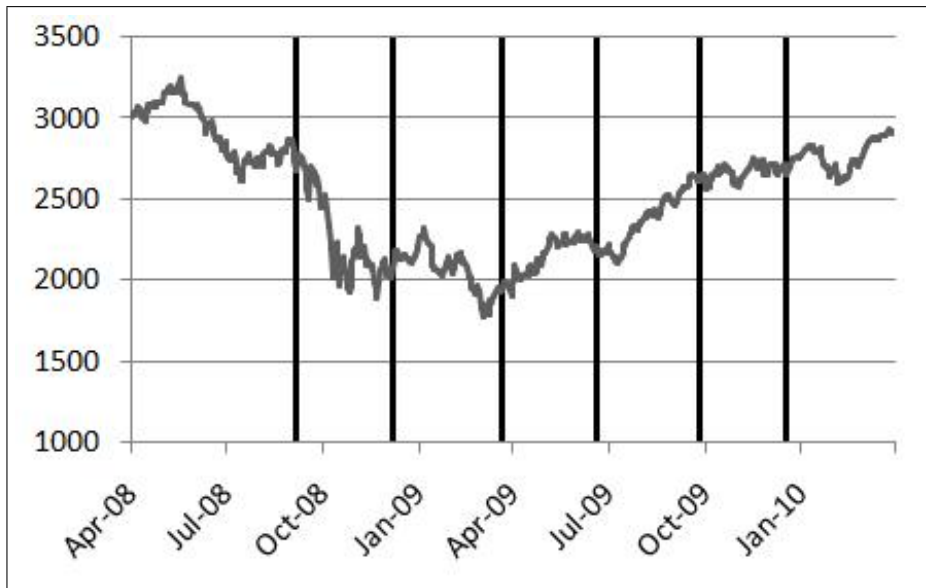


Figure 1: FTSE all-share and survey rounds

Notes: Vertical lines represent the days survey rounds started. Participants had around one week to complete the online questionnaire.

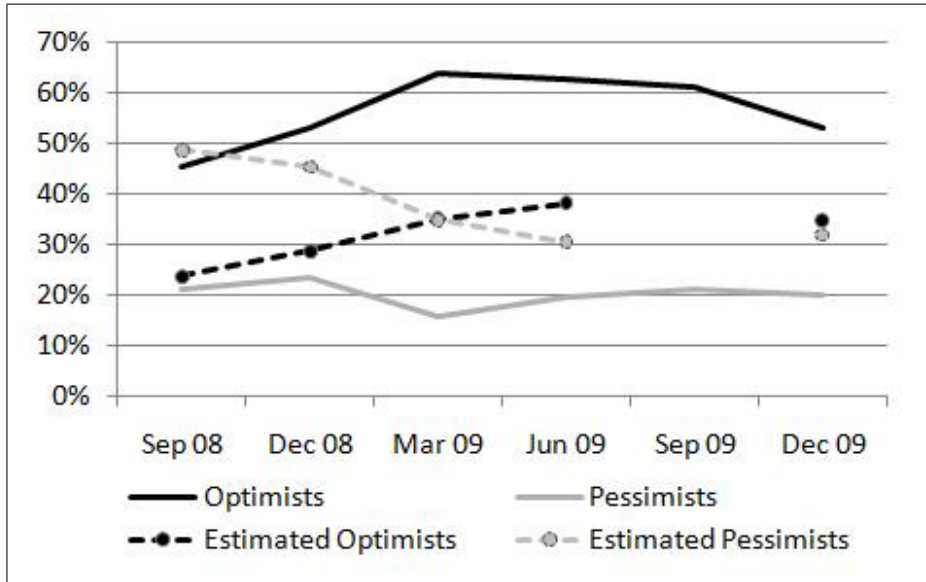


Figure 2: Actual and estimated investor expectations

Notes: The figure shows proportions of optimistic and pessimistic investors (solid lines) and the estimated proportions from second-order beliefs (dashed lines).

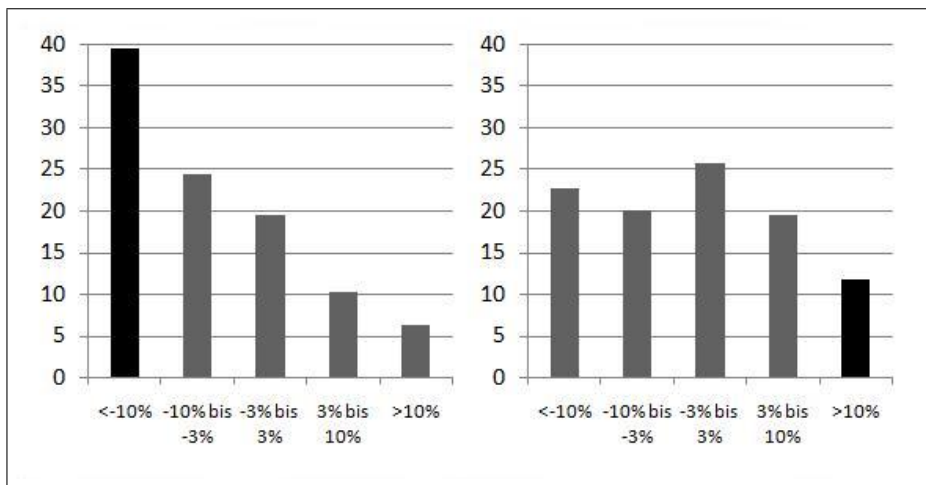


Figure 3: Second-order beliefs of pessimists vs. optimist

Notes: The left figure shows average second-order beliefs of strong pessimists, the right figure average second-order beliefs of strong optimists, both for survey round 1. The estimates for the own belief category are highlighted.