The Beliefs of Others – The Financial Crisis and Stock Market Expectations*

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March 2010

Abstract

The financial crisis caused great uncertainty in global stock markets. In a panel survey of active private investors we collect return expectations and beliefs about the return expectations of others. The crisis is characterized by strongly heterogeneous expectations and inaccurate second-order beliefs. Investors believe their own opinion is relatively more common among the population and assert that investors who disagree with them are biased. We interpret these findings as evidence for a false consensus effect and a bias blind spot in the judgment of investors. Second-order beliefs influence risk taking decisions of investors in allocating money between the stock market and riskless assets. This influence is mediated by the identified judgmental biases.

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

Keywords: Expectations, Financial Crisis, Stock-Market, Second-Order-Beliefs, False Consensus Effect, Bias Blind Spot, Investor Sentiment

*We are grateful to Barclays Stockbrokers for providing access to their online investor client base and for support with design and execution of the survey. We thank Greg Davies, Peter Brooks, Alen Nosić, Alexandra Niessen, Michael Ziegelmeyer, and seminar participants at the University of Mannheim. Research reported in this article was supported by the European Institute of Savings (OEE) and Deutsche Forschungsgemeinschaft (DFG, grant We993).
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1 Introduction

Investors should allocate their investable wealth according to their beliefs about the expected return and risk of prospective investments. Given that prices in financial markets are determined by the interaction of market participants, the beliefs of other investors may be an important factor for them to consider. This requires developing beliefs about others’ beliefs, commonly referred to as second-order beliefs. We explore the role of second-order beliefs in generating return expectation and in risk-taking behavior of investors. This paper analyzes how investors form such beliefs, what biases they succumb to, and finally how this influences their investing decisions.

In principle, those better able to predict and understand financial market movements have a large advantage over those who do not. Compared to (for example) weather forecasting, stock-market forecasting adds another level of complexity because investors need to consider not only a fundamental parameter value, but rather a combination of fundamental values and others’ estimates regarding that value. While the weather remains unimpressed by the convictions of forecasters, investors may influence market prices by their views and actions. It is thus unlikely an individual could correctly predict market movements without knowing, at some level, the beliefs of others.

While the implications of first-order beliefs (own expectations) are generally clear – higher return expectations should motivate higher investment allocations, whereas higher risk expectations should have an opposite effect – the role of second-order beliefs is less straightforward. In a pure rational expectations model or in a market which is efficient there seems to be little value in second-order beliefs. Market prices reflect all available information, and nothing is to be learned from the expectations of other investors. We will not touch on the much disputed issue whether the market is indeed in equilibrium or whether conditions of market efficiency are fulfilled (see Malkiel (2003) for a theoretic discussion and Doran, Peterson, and Wright (2010) who survey finance academics). Instead we focus on the beliefs of individual investors. We maintain that to understand their expectations and risk
taking behavior it is less important, how the market actually functions than how investors perceive it to function.

Investors in general do not disregard the views of others. For example they consume analysts’ recommendations and forecasts of general market movements. It has been documented that some consider financial markets as influenced by the opinion and expectation of other market participants (Fisher and Statman (2004)). Records on trading behavior (Odean (1999)) show that investors churn their portfolios considerably, which is indirect evidence that they search for securities for which their own expectations are particularly favorable. They seem to believe that mis-pricings are present in the market, produced by other investors seeing the prospects of an asset differently. This is related to the concept of investor sentiment, which is possibly predictive for security prices (Barberis, Shleifer, and Vishny (1998), Baker and Wurgler (2006)). We use the term sentiment here to mean the aggregated beliefs of the investor population. Second-order beliefs then reflect what investors perceive this common sentiment to be. The informative-ness of second-order beliefs for trading behavior and price movements has also been tested experimentally (Haruvy, Lahav, and Noussair (2007), Hales (2009)). Thus second-order beliefs are likely to be relevant for individual investor behavior, if not for aggregate markets.

Accurately estimating beliefs of others is likely to be difficult however, and little is known how investors form and use these beliefs. We begin by comparing first-order and second-order beliefs and analyze differences between the two. 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 of second-order beliefs, among them the false consensus effect (Ross, Greene, and House (1977)) and the bias blind spot (Pronin, Lin, and Ross (2002)). We use both established and specially developed measures to demonstrate these effects in financial market return prediction. We then explore whether there is an effect of second-order beliefs on risk taking behavior, and
whether this effect depends on mentioned biases and on personal views on how financial markets work.

For this purpose we collect first and second-order return expectations in a longitudinal panel survey among 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 a time period of high stock market uncertainty, beginning in 2008 with the financial market crisis and lasting through downfall and recovery of the market in 2009. The survey is conducted every three month, and also elicits psychometric variables and views of financial market functioning to explain observed effects.

We find the unusual market situation is reflected by very heterogeneous expectations. They range from investors expecting a continuation of the decline to others believing stock prices to rally strongly. But even amid one of the most severe financial crises in history a majority of investors in the panel remained optimistic about quarterly return prospects of the stock market. However, they believed their peers were far less sanguine, and thus held inaccurate second-order beliefs. Optimists and pessimists alike think that the majority of other investors expect the market downturn to continue.

The biases we detect in second-order beliefs are systematic. We clearly identify a false consensus effect, which holds that participants perceive their own position to be relatively more common in the investor population. That is, compared to investors with different first-order beliefs, they estimate a greater fraction of people to share their own beliefs. The effect is especially pronounced for participants holding expectations in line with current market trends and news.

Some investors face a different situation – they believe themselves to be in the minority. It is a bold decision to stand against a crowd of well-informed others, thus we test for the belief among these investors that others are biased in their expectations. The bias blind spot theory maintains that people assume those who disagree with them to be biased while their own opinion is not. We find that investors believe those peers who hold contrary opinions
to their own to consult less credible information sources and to hold very improbable expectations. Often a significant portion of second-order beliefs is excluded from own confidence intervals submitted with first-order beliefs.

We then analyze a hypothetical investment task which asks participants to divide a fixed amount between the stock-market and a riskless asset. The effects of second-order beliefs on this decision are in the expected direction, more positive second-order beliefs induce higher risk taking among investors. The dispersion of second-order beliefs as an indicator of uncertainty seems to be irrelevant for investing. We test for an interaction with the found judgmental biases and reveal 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.

In summary we contribute to the literature in several ways. We investigate empirically the neglected field of second-order beliefs in finance and introduce a unique data set of repeatedly 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 sentiment is influential. Moreover we 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 changes in market sentiment rather than to changes in 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 is supposed to work as a “voting machine” rather than a “weighing machine”. However, it is beyond the scope of our paper to discuss whether this view on financial markets is realistic or even theoretically true.

The literature on investor sentiment (Barberis et al. (1998), Baker and Wurgler (2006)) suggests that beliefs of the investor population as a whole influence market prices (see also Chan and Fong (2004) for a discussion of where and how the effects of such sentimental price pressures are likely to be observed). Survey-based sentiment measures actually use the expectations of investors as input data (see e.g. Fisher and Statman (2000)). At an individual level investors’ second-order beliefs form their view of current market sentiment and may thus be useful in return prediction. Experimental evidence confirms that beliefs of investors can be informative for an observer beyond fundamentals and historical price data (Haruvy et al. (2007)).

For the purpose of understanding individual investor behavior it is sufficient that an investor perceives the market functioning to include aspects of a beauty contest or a voting mechanism. The ongoing interest in analysts’ recommendations and opinions of market pundits may 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 (2004) 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 the way stock markets work (see section 4).

Evidence that investors indeed not only hold such convictions but also trade on them comes from reports on excessive trading and low diversification of investors (Odean (1999), Glaser and Weber (2007)). Although several explanations for this behavior are possible, the most straightforward is that investors search for mis-pricings in the market. From the individual perspective mis-pricings represent situations where first-order beliefs depart from market prices, i.e. when first-order beliefs diverge from second-order beliefs, or when swings in sentiment are expected to drive market prices in a particular direction. Direct evidence for differences in opinion as a source of trading activity comes from Chordia, Huh, and Subrahmanyam (2007). Social interaction between stock market participants may further contribute to the role of second-order beliefs in investing behavior (Hong, Kubik, and Stein (2004), Kaustia and Knüpfer (2010)).

Our first hypothesis thus is that investors believe second-order beliefs are informative for their investment decisions. The influence should be mediated by the way they regard the beliefs of others and the psychologic biases involved (see following section).

**H1:** Investors incorporate second-order beliefs into their investment decision.  
**H1a:** The strength of H1 depends on how investors view second-order-beliefs and on the judgmental biases they make.

To interpret second-order beliefs correctly it is important to know 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.” Following this view, 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 differ-
ences to the picture. Perception, attention, memory, cognitive biases and limitations, and emotions have all been invoked to explain heterogeneity in beliefs.

Within the behavioral paradigm stock market expectations depend on participants’ recall of previous events, news, 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 – mostly unobservable – factors and the specific biases we will discuss in the next section, 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.**

### 2.2 Naive realism and judgmental biases

Financial economic’s insights into second-order beliefs are useful to understand their role in stock markets, but lack predictions of how these beliefs are generated. In social psychology it has been argued that people perceive the world from a stance of naive realism – the belief 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, thoughtful, and open-minded manner. The third tenet of naive realism describes the reaction to disagreements in opinion. Given that the objectivity of one’s own position is usually not contested, people often conclude that those who disagree either lack information, are unable or unwilling to process the facts at hand rationally, or are motivationally biased.

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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 pervasive ness and robustness of the effect. Another term under which this egocentric bias is known is “social projection”, which suggests an underlying process of people projecting their own thoughts and beliefs on other people (Kruger (2000)).

Causes of the false consensus effect broadly fall into four categories (Marks and Miller (1987)). The availability heuristic implies that the ease with which instances of (dis)similarity can be recalled is an important factor. Given that people associate with other people of similar status, profession, and preferences, this selective exposure leads to a biased assessment of the overall population. A second ingredient to false consensus is the salience of one’s own position. Introspection makes certain features more salient, such as reasons supporting this position. Thirdly 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 bias to finance, we are not aware of many similar studies. Academic financial economists exhibit a false consensus effect when surveyed about the equity risk premium (Welch (2000)). Experimentally

\footnote{It 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)).}
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 to be present 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-endorser 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 news and recent trend of returns give investors reason to believe in a consensus. Specifically those who submit return predictions in line with market trends and news will perceive this to be more of a consensus than those who hold contrarian views. We define current market trend by the previous UK stock market return and use a news search to identify a negative or positive news environment. The influence of mass media on false consensus has been documented by Christen and Gunther (2003).

**H3a:** **The false consensus effect is mainly present among investors with expectations consistent with current market trend and news.**

In a financial crisis bad news is prevalent and a the market trend is negative. We thus expect pessimists to be especially subject to the false consensus effect. As the crisis subsides the effect should weaken as the situation improves.

To better understand those investors who hold contrarian views, we now turn to the third tenet of naive realism. It seems unlikely that these investors believe that a majority of well-
informed, rational market participants hold beliefs strongly 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, 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 thus keeps the self-image of an unmediated view on reality intact.

Applications of the bias blind spot include political opinions (Sherman, Nelson, and Ross (2003)), ethnic or religious conflicts (Ehrlinger, Gilovich, and Ross (2005)), and views on fairness (McPherson Frantz (2006)). Initially Pronin et al. (2002) demonstrated the bias blind spot by directly asking participants for their susceptibility to certain psychological biases of judgment and inference. They therefore established the bias blind spot as a meta-bias that precludes notice of other biases in oneself. Menkhoff and Nikiforow (2009) extend this 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 deal with 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 trend and news.

The dataset we use to test our hypotheses will be described in detail in the next section.

3 Dataset and survey questions

In cooperation with Barclays Stockbrokers, London, we conduct a panel survey of online self-directed investors. 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. 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 Nosić and Weber (2009)). 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 four 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) or Glaser and
Webster (2005). Survey methodology has gained in importance and acceptance in finance, and has delivered notable evidence also in other subfields such as corporate finance (e.g. Graham and Harvey (2001), Lins, Servaes, and Tufano (2009)).

Table I 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 Nosić and Weber (2009)). But it does represent typical investor populations found in other studies (cp. e.g. the examples mentioned above). In particular most investors in our sample are experienced and do well in a financial literacy test. 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 financial markets.

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.
   - 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.

\footnote{We use four questions by van Rooij, Lusardi and Alessie (2007) and obtain at least three right answers by 93\% of the subjects.}
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 (2005) 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 uncertainty of their estimate. Question two elicits second-order beliefs for the best estimate with survey respondents serving as reference population. Second-order beliefs are to be stated in five intervals ranging from large losses to large gains. Unfortunately, due to space and time considerations question 2 was omitted in round 5 of the survey (September 2009).

To reveal if individuals differed in their beliefs regarding determinants of market prices, we ask for participants’ agreement to the statement “stock-market prices are driven by a large number of small investors, rather than a few large investors.” We interpret the answers as an indication whether investors believe in an influence of sentiment in the stock market and thus second-order beliefs are relevant to them. With several statements about being different and its meaning in financial market we test for perceived “contrarianism” of participants.\footnote{Used statements are 1. When it comes to investing, my decisions are different than most people’s, 2. Being different than others makes me uncomfortable, 3. When making investing decisions, it is better to be...}
We also assess susceptibility to the bias blind spot using a design similar to Pronin, Gilovich, and Ross (2004). 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.

In an investment task 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 month 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 Nosić and Weber (2009), who use the same dataset.

4 Results

4.1 First-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 in the minority than the majority, 4. When many people are saying the same thing about markets, it makes me believe they are correct.
a sign of over-optimism (Weinstein (1980), Taylor and Brown (1988)) or of some investors 

misinterpreting the question in terms of annual values[5]

The standard deviation of expectations increases dramatically within the crisis, and 

remains high throughout 2009. The inter-quartile range also reflects this fact, varying 

substantially across rounds. We take this variation in expectations as an indication of 

investor disagreement or uncertainty (similarly dispersion in analyst forecasts is often taken 

as sign of investor uncertainty [cp. e.g. Abarbanell, Lanen, and Verrecchia (1995)]). We 

can look beyond between-subject measures, as we also asked each individual for confidence 

intervals regarding return 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 financial crisis that extreme outcomes are not 

as unlikely as they previously thought. Interestingly, investors adapt confidence intervals 

according to their first-order beliefs. In unreported results we find that those with rather 

extreme expectations on average submit wider intervals. Additionally intervals are not 

symmetric around the best estimate, but those with positive expectations allow for more 

negative outcomes and vice versa.

For the following comparison between first-order and second-order beliefs, we arrange 

first-order beliefs into the same categories we use to elicit second-order beliefs (question 2). 

Figure 2 shows the resulting distribution of investors. Through all survey rounds investors 

are predominantly optimistic, with between 45% (September 2008) and 64% (March) ex-

pressing moderate or strong optimism. The fraction of pessimists never exceeds one quarter 

of the population, which holds true even if we take into account all participants expecting 

negative returns. With the escalation of the financial crisis estimates become more ex-

treme. In December 2008 41% believe in market movements of more than 10% in the 

subsequent three month, either positive or negative. Despite some apparent similarities

A 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.
the distributions of predictions for the different three month periods differ significantly ($\chi^2(20) = 85.5, p < 0.001$).

First-order beliefs are relatively stable over time. The Pearson correlation between estimates in consecutive survey rounds is 0.32 ($p < 0.001$), and correlations remain positive for rounds further distanced in time. A transition matrix using above mentioned categories also reveals persistency of beliefs. The average probability to stay in the same belief bin is 37% compared to 20% if allocation was random. Only rarely do very optimistic investors turn very pessimistic within three month time.

4.2 Accuracy of investors’ estimates

We postpone the discussion of hypothesis 1 as it involves additional data on investment behavior and start 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 (between 8% and 16%). Table 3 shows that the middle category (−3% to +3%) is slightly overrepresented, 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 expectations of other investors. Expressed confidence in their estimates of second-order beliefs is relatively low, however.\footnote{In the December 2009 round of the panel we asked investors ”How confident are you that your estimates of others’ forecasts are accurate?” On a seven-point scale (1-7) average response was 3.1.}

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. In round three the relation becomes balanced and turns slightly around for round 4 and 6.\footnote{Round 5 is excluded from further analysis as it did not contain the second-order belief estimation.} 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%. The large discrepancies between first and second-order beliefs support hypothesis 2. For further evidence we next consider individual errors in estimation.

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 \( \delta \) of zero conveys the investor estimated the distribution perfectly, a \( \delta \) of two corresponds to the maximal possible error. Table 4 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 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.

4.3 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 define two groups of investors by first-order return expectations. Investors who expect a stock market return of \(> 3\%\) are classified as optimists and we compare them with a group of pessimists, who expect a return of \(< -3\%\). These values correspond to the two top and two bottom categories used to elicit second-order beliefs (leaving out the middle category). Table 5 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.

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

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**Footnote:** Extending 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.
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 for TFCE are reported in the last column of table 5. 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.

To analyze this interesting feature of second-order beliefs, we have to depart from classic false consensus literature which usually defines the effect 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 consensus. For 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.

In our case however, accuracy in prediction was very low, so that we can basically treat participants as ignorant with respect to the actual distribution of return expectations. Instead we argue that they use news and return trends in the market to determine what current market sentiment might be. We retrieve the number of positive and negative news items using a Google news search with several positive and negative terms related to the
stock market for the relevant time period. Table reports details on this news search and provides the numbers of positive and negative news items found in the different month the survey was conducted. Additionally it shows previous three month returns of the UK stock market (FTSE all-share).

Combined we take current market trend and stock market news as sentiment indicator to explain false consensus effects for different groups of investors. We argue that only those investors who hold expectations in line with this news and trend indicator will perceive a (false) consensus for their opinion. They gain the impression that current market environment supports their views and that it is unlikely that others reach a different conclusion. Similarly those investors holding expectations opposed to the news and trend indicator are aware of it and assume less or no consensus for their views. To test this prediction which was already put forward in H3a, table 7 generalizes the evidence of figure 3 and provides additional measures for the false consensus effect between groups.

The estimates for the own position in panel A correspond to the black bars in the figure, i.e. which fraction of the population is believed to share one’s own opinion. Differences are large and highly significant for the first two rounds of the survey. Pessimists think that more than 30% of all investors share their views, while optimists’ estimates do not exceed 22%. In line with the very negative market trend and the prevalence of bad news (see table 3), pessimists have good reason to believe that their opinion reflects a consensus among investors. This confirms that opinions in line with news and return trend in the market lead to an over-estimation of consensus. The picture changes in later rounds, where the differences become mainly insignificant. Our sentiment measure would even predict a reversal, which is why we consider additional consensus measures below.

An effect that remains stable over all rounds are differences in consensus error, which measures perceived consensus minus actual consensus. In contrast to table 3 where this difference is displayed over all participants, the magnitude of consensus error conditional

\[ A previous example for the use of Google information in finance research is Da, Engelberg, and Gao (2009). \]
on own expectations is larger. This is due to the general presence of a false consensus effect. But given the negative numbers for optimists these group underestimates consensus for their opinion, while pessimists grossly overestimate it. Differences in the range of 10 to 33%-points are highly significant.

Panel B of table 7 evaluates how close investors perceive their own opinion to be to the mean opinion, another indicator of perceived consensus. We use the same conversion rule as above to calculate mean returns from second-order beliefs and compare them to investors’ best estimates for the same period. Alternatively we look at the distance between mean second-order beliefs and first-order belief as a categorical variable. Results are similar for both measures. Optimists think their own belief expectation and the mean belief of others fall apart by 5.5 to 12%-points. In round one for example they expect the market to rise by 7.8%, but assume a mean return expectation of $-2\%$ among other investors. For all but the last round pessimists think they are closer to the mean expectation, yet the gap narrows and finally reverses. A similar pattern is observed for categorical values.

With the proximity measures a real reversal takes place, i.e. the group always assumes they are closer to the mean opinion that holds expectations in line with current market trends and news. We interpret these findings as evidence for hypothesis H3a. The false consensus effect is mainly present or particularly profound for investors who hold beliefs that correspond to market sentiment.

4.4 Bias blind spot

We now turn to how individuals understand and explain beliefs divergent from their own. Table 7 shows that some investors hold return expectations that are 12 or 13%-points away from what they perceive other investors are expecting. To justify this difference it is not sufficient to assume different information sets. An individual investor would then be required to incorporate the beliefs of others according to their informational value, as beliefs reveal information. When investors disregard the beliefs of others, it is likely that
they suffer from a bias blind spot. If other investors are perceived as biased, departing from their opinion is not problematic.

Our approach to detect the bias blind spot follows Pronin et al. (2004). In round 6 of the survey we ask participants which factors influenced their own judgments, and the judgments of those who disagree with them. Table 8 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 it is related to the better-than-average effect. Investing expertise was hence expected to yield a positive difference as well. However, we find that the result in this case was confounded by own perceived financial expertise. Only investors who rated themselves highly in investing skill attributed a stronger influence of expertise to their own judgments.

From the results of table 8 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 9 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 between 16% and 27% of their peers hold return expectations that fall outside own confidence intervals and are thus
unlikely. This fraction decreases over the rounds as confidence intervals become larger. Both measures show a general presence of a bias blind spot among investors and thus confirm hypothesis 4.

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. We resort again to the market sentiment indicators used before (see table 6). In the first rounds optimists take a view against market trends and news, while later pessimists are in this position. These groups are thus expected to be particularly prone to a bias blind spot. Table 9 displays bias blind spot measures depending on own expectations. Indeed bias blind spot from belief attribution (BBS) is significantly larger for pessimists, who in round 6 hold the anti-sentiment position. They regard other investors as biased, because they recognize that a majority investors may stand against them. Results from confidence intervals in general support this picture. As expected we find unusually high values for optimists in round 1, no differences in round 2 and a reversal afterwards. In round 3, 4 and 6 pessimist exclude a relatively higher proportion of others from their confidence intervals. Given our sentiment measure we would have expected the reversal to occur later and the difference in the last rounds to be stronger.

It might be the case that while market sentiment was appropriate for reflecting consensus factors, it is less appropriate for explaining when investors perceive themselves holding a minority position. We thus consider the questions for the propensity to hold contrarian views outlined in section 3, combine them to a contrarian index, and test for a link to the bias blind spot. Figure 4 displays a strong positive relationship, the correlation between the two measures is 0.43 ($p < 0.01$). Those investors who think that they hold contrarian views assume others to be biased. This is reasonable as this mental model allows them to justify their minority opinion.

Figures for proportions outside confidence intervals are de-meaned by first-order beliefs, as more extreme first-order beliefs technically result into greater proportions outside confidence intervals. We further de-mean by round to make results comparable across rounds.
As a caveat contrarian views in the question format are unrelated to contrarian beliefs in return expectations. If we take the distance between first-order and mean perceived second-order beliefs to represent contrarianism in expectations, the result is unrelated to the bias blind spot from belief attribution. However, we do find positive correlations between contrarianism in expectations and the confidence interval measure (0.19 to 0.46 for individual rounds, all significant at $p < 0.01$). We conclude that there is evidence for hypothesis H4a, although some of the results depend on the definition of the employed measures.

4.5 Investment behavior

While the patterns revealed in investors’ second-order beliefs are interesting in their own right, their relevance depends on their consequences for investing decisions. We now study risk taking behavior 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.

Nosić and Weber (2009) show that for risk taking behavior in this investment task risk attitude, risk perception and return expectations play a role. We thus take these variables as given and include them as controls in our regression. Risk attitude 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 factor of interest we consider second-order beliefs represented by expected return and standard deviation of investors’ estimated second-order belief distribution (for the conversion of categorical values see the notes of table 3).

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 10 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.

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 common expectations of others as influential when making investment decisions. The standard deviation of the second-order belief distribution is not significant. It seems that a greater perceived belief dispersion is not interpreted as an indicator of higher risk or uncertainty. 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%-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.

In a next step we 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 individual 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 by median split 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

\[11\] Results for the bias blind spot from belief attribution are qualitatively similar.
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 financial literacy, as financially literate participants may trust more in their own expectations than in expectations of others.

Columns (2) to (5) of table 10 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. Financially literate investors and those who perceive others as biased rely less on second-order beliefs, while a perceived consensus strengthens the influence of second-order beliefs. 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.

The effect of second-order beliefs (H1) seems to be independent of investors’ view on the way the market functions. A statement on how market prices are determined (see section 3) reveals that only a minority of investors believe that rather a large number of small investors drive prices (i.e. a voting mechanism takes place). Average agreement to the statement was 2.8 on a seven-point Likert scale (1-7). In unreported results we find no interaction of market view with second-order beliefs. Hence we cannot confirm a greater influence of second-order beliefs for those investors who think that sentiment plays a role in financial markets. We can also rule out a prior adjustment of first-order beliefs in the direction of second-order beliefs. An explanation for these findings might be that there exist several possible interpretations of sentiment or beliefs of others. The advice from a beauty contest model would be to follow the crowd, while sentiment is introduced as a contrarian factor in the sentiment literature. These conflicting views may result in a zero net effect for those who believe in a role of sentiment.
5 Conclusion

Investors are naive realists. 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. Naive realism describes the relative perception of oneself and others and is not to be confused with a general naivety in financial matters. Even the most sophisticated investors can be subject to naively realistic convictions. Indeed most of the participants in our survey have long investment experience, are financially literate, and engage regularly in stock trading.

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 themselves maintain rather optimistic expectations on average, while believing others are mainly pessimistic. 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 the middle of a financial crisis. 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. Only those feeling 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 phases of the financial crisis. We develop several measures to show which group perceives their own expectation to be close to common expectation. Pessimistic news and a negative market trend in the crisis make a case for a negative stock market outlook, which is why pessimists easily gain the impression that most people agree with them. In later rounds when news improve and the stock market recovers the picture changes. We do
not observe a complete reversal as presumably in the period we cover there is no market phase positive enough to mirror the negative extent of the financial crisis.

On the other hand mainly optimists underestimate the commonness of their responses. They see themselves as minority and remote from mean expectation. To justify positive expectations within a severe economic downturn more effort is needed. Optimists seem to believe that many others accept negative news and events at face value and fall for the more obvious prediction of a continuing decline of stock markets. This implicit bias blind spot becomes explicit when asked for plausible ranges of stock market outcomes. Optimists exclude a substantial fraction of their own second-order beliefs from what they themselves perceive as likely. We interpret this as optimists 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.

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.
References


Table 1: Demographics of survey participants

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean</th>
<th>Median</th>
<th>Std.Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>613</td>
<td>51.4</td>
<td>53</td>
<td>12.9</td>
<td>21</td>
<td>84</td>
</tr>
<tr>
<td>Gender (male=1)</td>
<td>617</td>
<td>0.93</td>
<td>1</td>
<td>0.25</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Couple (married or cohabiting=1)</td>
<td>616</td>
<td>0.74</td>
<td>1</td>
<td>0.44</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Investment experience (in years)</td>
<td>197</td>
<td>19.6</td>
<td>20</td>
<td>10.3</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>Wealth (categories see below)</td>
<td>502</td>
<td>4.80</td>
<td>5</td>
<td>2.39</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Income (categories see below)</td>
<td>494</td>
<td>3.88</td>
<td>4</td>
<td>1.80</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

Notes: Number of observations smaller 617 reflect refusals except in case of experience which was asked in a later round of the survey.

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£.

Table 2: Expectations of investors

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

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

<table>
<thead>
<tr>
<th>Round</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= -10%</td>
<td>23.5</td>
<td>20.0</td>
<td>13.2</td>
<td>12.5</td>
<td>13.4</td>
<td>14.5</td>
<td>6.4</td>
<td>4.7</td>
<td>0.3</td>
<td>3.2</td>
</tr>
<tr>
<td>-10% to -3%</td>
<td>25.4</td>
<td>22.5</td>
<td>21.6</td>
<td>17.9</td>
<td>18.5</td>
<td>13.3</td>
<td>15.7</td>
<td>14.4</td>
<td>10.4</td>
<td>8.8</td>
</tr>
<tr>
<td>-3% to 3%</td>
<td>27.3</td>
<td>25.7</td>
<td>30.1</td>
<td>31.4</td>
<td>33.2</td>
<td>-6.1</td>
<td>2.6</td>
<td>9.9</td>
<td>13.8</td>
<td>6.5</td>
</tr>
<tr>
<td>3% to 10%</td>
<td>16.9</td>
<td>17.8</td>
<td>23.2</td>
<td>26.2</td>
<td>23.9</td>
<td>-14.4</td>
<td>-10.7</td>
<td>-10.9</td>
<td>-16.9</td>
<td>-12.5</td>
</tr>
<tr>
<td>&gt;= 10%</td>
<td>6.9</td>
<td>11.0</td>
<td>11.8</td>
<td>12.0</td>
<td>10.9</td>
<td>-7.3</td>
<td>-14.0</td>
<td>-18.2</td>
<td>-7.7</td>
<td>-6.0</td>
</tr>
<tr>
<td>Exp. return</td>
<td>-3.0</td>
<td>-2.1</td>
<td>-0.1</td>
<td>0.4</td>
<td>0.0</td>
<td>-5.0</td>
<td>-5.5</td>
<td>-5.5</td>
<td>-3.8</td>
<td>-3.4</td>
</tr>
</tbody>
</table>

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: Accuracy in estimation

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor panel (mean)</td>
<td>0.72</td>
<td>0.70</td>
<td>0.70</td>
<td>0.66</td>
<td>0.57</td>
</tr>
<tr>
<td>Investor panel (10 perc.)</td>
<td>0.31</td>
<td>0.36</td>
<td>0.35</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>Investor panel (90 perc.)</td>
<td>1.18</td>
<td>1.13</td>
<td>1.08</td>
<td>1.01</td>
<td>0.87</td>
</tr>
<tr>
<td>Uniform distribution</td>
<td>0.49</td>
<td>0.33</td>
<td>0.49</td>
<td>0.46</td>
<td>0.46</td>
</tr>
<tr>
<td>Normal distribution</td>
<td>0.19</td>
<td>0.38</td>
<td>0.42</td>
<td>0.47</td>
<td>0.24</td>
</tr>
<tr>
<td>Better than uniform distr.</td>
<td>28%</td>
<td>6%</td>
<td>29%</td>
<td>26%</td>
<td>29%</td>
</tr>
</tbody>
</table>

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 5: False consensus effect

<table>
<thead>
<tr>
<th></th>
<th>optimists</th>
<th>pessimists</th>
<th>difference</th>
<th>p-value</th>
<th>TFCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 2008</td>
<td>proportion optimistic</td>
<td>29.4%</td>
<td>16.7%</td>
<td>12.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>n = 319</td>
<td>proportion pessimistic</td>
<td>43.4%</td>
<td>60.0%</td>
<td>-16.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Dec 2008</td>
<td>proportion optimistic</td>
<td>35.8%</td>
<td>20.3%</td>
<td>15.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>n = 283</td>
<td>proportion pessimistic</td>
<td>39.8%</td>
<td>60.2%</td>
<td>-20.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Mar 2009</td>
<td>proportion optimistic</td>
<td>39.9%</td>
<td>29.6%</td>
<td>10.3</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>n = 176</td>
<td>proportion pessimistic</td>
<td>31.3%</td>
<td>43.3%</td>
<td>-11.9</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Jun 2009</td>
<td>proportion optimistic</td>
<td>43.7%</td>
<td>28.0%</td>
<td>15.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>n = 152</td>
<td>proportion pessimistic</td>
<td>25.9%</td>
<td>46.1%</td>
<td>-20.2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Dec 2009</td>
<td>proportion optimistic</td>
<td>38.3%</td>
<td>29.8%</td>
<td>8.5</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>n = 142</td>
<td>proportion pessimistic</td>
<td>28.3%</td>
<td>42.8%</td>
<td>-14.5</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

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 6: Market sentiment

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend</td>
<td>-12%</td>
<td>-25%</td>
<td>-8%</td>
<td>14%</td>
<td>18%</td>
<td>3%</td>
</tr>
<tr>
<td>Positive news</td>
<td>15300</td>
<td>16300</td>
<td>15100</td>
<td>14000</td>
<td>13000</td>
<td>15100</td>
</tr>
<tr>
<td>Negative news</td>
<td>18400</td>
<td>14600</td>
<td>14700</td>
<td>10200</td>
<td>9200</td>
<td>11400</td>
</tr>
<tr>
<td>News (pos.-neg.)</td>
<td>-3100</td>
<td>1700</td>
<td>400</td>
<td>3900</td>
<td>3800</td>
<td>3700</td>
</tr>
</tbody>
</table>

Notes: Trend is previous three month return of UK stock market, news is 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) or negative keywords (crash, fall, drop, fear, worries, negative, bad).
Table 7: False consensus depending on own expectation

<table>
<thead>
<tr>
<th>PANEL A</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>estimate for own position</td>
<td>consensus error</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Strong pessimist (1)</td>
<td>39.5</td>
<td>36.1</td>
<td>20.0</td>
<td>26.1</td>
<td>19.5</td>
<td>30.5</td>
<td>19.5</td>
</tr>
<tr>
<td>Moderate pessimist (2)</td>
<td>33.9</td>
<td>31.5</td>
<td>29.9</td>
<td>27.1</td>
<td>25.0</td>
<td>21.8</td>
<td>24.7</td>
</tr>
<tr>
<td>Neutral (3)</td>
<td>29.9</td>
<td>31.1</td>
<td>38.5</td>
<td>44.8</td>
<td>37.2</td>
<td>−3.5</td>
<td>7.9</td>
</tr>
<tr>
<td>Moderate optimist (4)</td>
<td>21.7</td>
<td>21.5</td>
<td>25.4</td>
<td>31.4</td>
<td>25.8</td>
<td>−9.6</td>
<td>−6.9</td>
</tr>
<tr>
<td>Strong optimist (5)</td>
<td>11.9</td>
<td>17.5</td>
<td>16.9</td>
<td>17.9</td>
<td>15.5</td>
<td>−2.3</td>
<td>−7.5</td>
</tr>
<tr>
<td>Difference (1) - (5)</td>
<td>27.6***</td>
<td>18.6***</td>
<td>3.1</td>
<td>8.2**</td>
<td>4.0</td>
<td>32.8***</td>
<td>27.0***</td>
</tr>
<tr>
<td>Difference (2) - (4)</td>
<td>12.2***</td>
<td>10.0***</td>
<td>4.5</td>
<td>−4.3</td>
<td>−0.8</td>
<td>31.4***</td>
<td>31.6***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PANEL B</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>proximity of return</td>
<td>proximity in categories</td>
<td></td>
</tr>
<tr>
<td>Optimists</td>
<td>9.8</td>
<td>12.1</td>
<td>9.9</td>
</tr>
<tr>
<td>Pessimists</td>
<td>4.2</td>
<td>7.5</td>
<td>8.1</td>
</tr>
<tr>
<td>Difference</td>
<td>5.6***</td>
<td>4.6***</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Notes: Panel A: Estimated proportions of consensus for own opinion in %, and differences between estimated and actual consensus in %-points.
Panel B: Proximity of return is difference in %-points between own return expectation and mean second-order belief. Proximity in categories makes the same comparison using categorical values (distance in categories). Differences are significant at *10%-level, **5%-level, or ***1%-level.
Table 8: Belief attributions

<table>
<thead>
<tr>
<th>Influencing factor</th>
<th>Own beliefs</th>
<th>Others’ beliefs</th>
<th>Difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic conditions</td>
<td>5.23</td>
<td>4.69</td>
<td>0.54</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Investing expertise</td>
<td>4.55</td>
<td>4.69</td>
<td>-0.14</td>
<td>0.24</td>
</tr>
<tr>
<td>News and media</td>
<td>4.72</td>
<td>5.57</td>
<td>-0.85</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Recent performance</td>
<td>4.13</td>
<td>5.14</td>
<td>-1.01</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Emotions</td>
<td>3.88</td>
<td>5.18</td>
<td>-1.30</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

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 9: Bias blind spot

<table>
<thead>
<tr>
<th>Round</th>
<th>BBS</th>
<th>second-order beliefs outside CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>All participants</td>
<td>2.82</td>
<td>26.8</td>
</tr>
<tr>
<td>Pessimists</td>
<td>4.08</td>
<td>-2.83</td>
</tr>
<tr>
<td>Optimists</td>
<td>2.44</td>
<td>4.87</td>
</tr>
<tr>
<td>Difference</td>
<td>1.64***</td>
<td>-7.71**</td>
</tr>
</tbody>
</table>

Notes: BBS is a bias blind spot measure that aggregates differences in self-other belief attribution. Proportions of second-order beliefs that fall outside own confidence intervall (CI) in %. For subgroups (optimists and pessimists) the proportions are de-meaned by round and first-order beliefs. Differences are significant at *10%-level, **5%-level, or ***1%-level.
<table>
<thead>
<tr>
<th>Table 10: Investment behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk taking behavior</td>
</tr>
<tr>
<td>Risk tolerance</td>
</tr>
<tr>
<td>Return expectation</td>
</tr>
<tr>
<td>Risk expectation</td>
</tr>
<tr>
<td>Second-order beliefs (SOB)</td>
</tr>
<tr>
<td>Std. deviation of SOB</td>
</tr>
<tr>
<td>Bias Blind Spot (BBS)</td>
</tr>
<tr>
<td>Interaction BBS*SOB</td>
</tr>
<tr>
<td>Relative FCE</td>
</tr>
<tr>
<td>Interaction FCE*SOB</td>
</tr>
<tr>
<td>Financial Literacy (FL)</td>
</tr>
<tr>
<td>Interaction FL*SOB</td>
</tr>
</tbody>
</table>

**Round dummies**

<table>
<thead>
<tr>
<th>Round</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 2</td>
<td>-0.036**</td>
<td>-0.033**</td>
<td>-0.035**</td>
<td>-0.033**</td>
<td>-0.030*</td>
</tr>
<tr>
<td>Round 3</td>
<td>-0.103***</td>
<td>-0.104***</td>
<td>-0.100***</td>
<td>-0.101***</td>
<td>-0.100***</td>
</tr>
<tr>
<td>Round 4</td>
<td>-0.069***</td>
<td>-0.074***</td>
<td>-0.066***</td>
<td>-0.067***</td>
<td>-0.068***</td>
</tr>
<tr>
<td>Round 6</td>
<td>-0.080***</td>
<td>-0.070***</td>
<td>-0.078***</td>
<td>-0.078***</td>
<td>-0.066***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.687***</td>
<td>0.678***</td>
<td>0.667***</td>
<td>0.675***</td>
<td>0.648***</td>
</tr>
</tbody>
</table>

**n**

|       | 1430 | 1336 | 1430 | 1427 | 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. Std. deviation of second-order beliefs is the variation within 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 (median split). Financial literacy is one for investors answering all four financial literacy questions correct, zero otherwise. BBS, FCE, 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.*
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 investor expectations

Notes: The figure shows actual investor return expectations sorted into five return categories for rounds 1-6.
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 pessimists, both for survey round 1.

Figure 4: Bias blind spot and contrarian beliefs

*Notes:* The figure shows bias blind spot from belief attributions plotted against degree of contrarian views.