Mental Models in Financial Markets: How Do Experts Reason About the Pricing of Climate Risk?

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April 25, 2025

ABSTRACT

We investigate financial experts' beliefs about climate risk pricing and analyze how those beliefs influence stock return expectations. In a comprehensive survey, we elicit experts' beliefs using both structured and open-ended questions. We establish that most experts share the view that climate risks are insufficiently reflected in stock prices, yet they hold heterogeneous beliefs about the source and persistence of the mispricing. Through the analysis of open text responses, we delineate distinct mental models used by financial professionals to interpret and predict the asset pricing implications of climate risks. Differences in experts' mental models explain variation in return expectations in the short-term (1-year) and long-term (10-year). Furthermore, we document that experts' political leanings and geography determine the type of mental model they hold. In a last step, we show that one widely held mental model, which is based on second-order beliefs, causally affects experts' return expectations using an information provision experiment.

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We are grateful to Peter Andre, Constantin Charles, John Campbell, Sam Hartzmark, Paul Heidhues, Alex Imas, Ulrike Malmendier, Chris Roth, Peter Schotman, and Johannes Stroebel for very helpful comments and suggestions and Andrea Amelio, Khanh Hoang, Alexander Laubel, Leonardo Arias Lievano, Robin Musolff, and Sjur Løne Nilsen for great research assistance. Funding by the Deutsche Forschungsgemeinschaft (DFG) through CRC TR 224 (Project A01) and under Germany's Excellence Strategy - EXC 2126/1 - 390838866 as well as by Netspar is gratefully acknowledged. Paul Smeets acknowledges financial support from the Dutch Research Council (NWO) under grant number VI.Vidi.221E.011.

I. Introduction

The correct pricing of climate risks constitutes a fundamentally important function of financial markets amidst the ongoing climate transition (Krueger, Sautner, and Starks, 2020; Hong, Karolyi, and Scheinkman, 2020; Stroebel and Wurgler, 2021; Giglio, Maggiori, Stroebel, Tan, Utkus, and Xu, 2023). Financial markets are a primary vehicle to steer capital flows towards green and away from brown firms and projects. For an efficient allocation of capital flows, correct pricing is crucial. However, a key challenge lies in documenting how climate risk impacts asset valuation, given the scarcity of empirical data (Giglio et al., 2023).

In this paper we use expert beliefs as a valuable data source. Through a comprehensive online survey we provide direct evidence of finance professionals' beliefs about the current and future ability of financial markets to correctly price climate risks. We document that, while there is substantial heterogeneity, most finance experts believe that climate risks are insufficiently reflected in stock prices. We further uncover disagreement about the source and persistence of the mispricing. Delving deeper, we then use both structured and open-text elicitations (Stantcheva, 2021; Andre, Haaland, Roth, and Wohlfart, 2022; Andre, Schirmer, and Wohlfahrt, 2023; Haaland, Roth, Stantcheva, and Wohlfart, 2024) to uncover mental models used by finance experts to interpret and predict the asset pricing implications of climate risks. Furthermore, we document that differences in experts' mental models are linked to their return expectations. Return expectations are of paramount importance in financial markets. They guide individual investment behavior of market participants (Beutel and Weber, 2022; Giglio, Maggiori, Stroebel, and Utkus, 2021b; Kuchler, Piazzesi, and Stroebel, 2023), and pronounced heterogeneity in return expectations in the aggregate, as documented in Giglio et al. (2021b), can help explain key market phenomena such as excess volatility, excessive trading, and mispricing (Hong and Stein, 2007; Laudenbach, Weber, Weber, and Wohlfahrt, 2023; Daniel, Klos, and Rottke, 2023). Further, we show that one widely held mental model, which is based on beliefs about the beliefs of other (second-order beliefs), causally affects experts' return expectations using an information provision experiment. Thus, we identify mental mod-

els as a microfoundation of finance professionals' heterogeneous expectation formation in the domain of climate finance and establish the important role of second-order beliefs in their expectation formation.

Our sample consists of financial professionals who have completed the CFA Institute's rigorous educational program and earned the renowned CFA certification. They work in various roles such as analysts, traders, fund managers, and CFOs. The sample is international and comprises professionals from the US, Europe, and Asia. This is a particularly interesting sample, because finance professionals have a significant impact on asset prices, moving most of the money in the market (Lakonishok, Shleifer, and Vishny, 1992; Basak and Pavlova, 2013).

We fielded a tailored survey with rich belief elicitations. The survey started with structured questions related to finance professionals' beliefs on the importance of climate risks for asset pricing and whether climate risks are correctly priced in financial markets. After eliciting these beliefs, we explored experts' reasoning about the pricing of climate risks through open-ended survey questions. This approach, following methodologies used in Stantcheva (2021) and Andre et al. (2022), allowed experts to articulate their beliefs on the factors contributing to any deviation from correct pricing of climate risks. We analyzed these responses with the help of trained research assistants who categorized the responses into various mental models, using a detailed coding manual. To complement these open-text insights, we included structured questions that delved into theoretical aspects of pricing factors. This comprehensive approach enables us to gain a nuanced understanding of the experts' beliefs on climate risk pricing in financial markets.

The final part of the survey aimed at providing causal evidence on the role of mental models in shaping return expectations. We do so for the example of one widely held model which includes second-order belief patterns. To better understand how such second-order beliefs causally affect return expectations, we conducted an experiment using an information provision intervention that was aimed at shifting experts' second-order beliefs exogenously.[1] We randomly assigned the survey participants into three conditions. The

[1]We elicit experts' second-order beliefs about how other financial experts that completed our survey answered questions about (i) the importance of climate risks and (ii) whether they are currently correctly

respondents in the first two conditions received information about how a sub-group of CFA Institute members view climate risks in terms of their importance for pricing and the current level of climate risk pricing, i.e., the first-order beliefs of a subset of previous survey respondents. In particular, one group received information from a sub-group of CFA members who on average thought climate risks are not sufficiently reflected in prices. The other group received information from a sub-group of CFA members who on average thought climate risks are too much reflected in stock prices. The third group, serving as a control, did not receive any information. Afterwards, we elicited respondents' excess return expectations for the MSCI World Climate Action Index compared to its general counterpart, the MSCI World Index. The MSCI World Climate Action Index represents the performance of companies that have been assessed to be leaders in the climate transition in their sectors and thus are generally less exposed to climate risks. We measure experts' short-term expectations over the next year (incentivized) and long-term expectations over the next 10 years (unincentivized), both times using a simple two-step procedure.

We unveil the following five key results about experts' climate risk beliefs and their relationships with return expectations. (i) While there is heterogeneity, many experts share the view that climate risks are not sufficiently reflected in stock prices. (ii) Experts hold heterogeneous beliefs about the source of the mispricing of climate risk. Results from the open text elicitations of mental models allow us to delve deeper into the origins of the heterogeneity in experts' beliefs. Based on textual analysis of experts' survey responses, we document distinct mental models which explain variation in experts' climate risk beliefs. Broadly, the mental models distinguish between factors related to (a) informational constraints and (b) experts' views about other market participants' beliefs (second-order beliefs).[2] These mental models are positively correlated with experts' return expectations. (iii) There is substantial disagreement about the persistence of climate risk mispricing among survey respondents, yet most experts expect mispricing of

priced. This allows us to measure experts' second-order beliefs in a direct and incentive compatible way. In addition, we can provide credible information to possibly shift these beliefs.

[2]Our structured elicitations of the underlying causes of mispricing validate these patterns.

climate risk to persist for several years. Moreover, the informational as well as behavioral frictions we identified in experts' mental models of climate risk pricing help to shed light on why trading against mispricing is difficult for sophisticated investors, such as our financial expert sample. (iv) Our study identifies political leanings and geography as significant factors determining which mental model about climate risk pricing experts hold. Specifically, we unveil that experts on the political left in the U.S. tend to hold mental models which include the belief that other market participants underestimate the importance of climate risks. In contrast, right-leaning experts are more likely to hold a mental model including the belief that others overemphasize these risks. Interestingly, these patterns are virtually absent in other regions. (v) We document that one widely held mental model which includes second-order belief patterns causally affects experts' return expectations. Moving beyond correlational evidence, we provide causal evidence that providing information on the beliefs of other participants impacts excess return expectations of the MSCI World Climate Action Index over its benchmark index, the MSCI World Index.

Our paper contributes to the burgeoning literature on climate finance (Choi, Zhenyu, and Jiang, 2020; Hong et al., 2020; Calvet, Gianfrate, and Uppal, 2022; Giglio, Kelly, and Stroebel, 2021a; Starks, 2023). As the climate transition intensifies, financial economists are increasingly examining the impact of climate change on financial markets. Numerous studies have explored the asset pricing consequences of climate risks (e.g. Hong, Li, and Xu, 2019; Bolton and Kacperczyk, 2021; Van der Beck, 2023; Berk and Van Binsbergen, 2024; Eskildsen, Ibert, Jensen, and Pedersen, 2024). However, the relatively short time series on climate risk pricing, coupled with rapidly evolving technological advances and regulations, makes accurately pricing climate risks a significant challenge (Giglio et al., 2021a; Eskildsen et al., 2024). Another way to assess the pricing of climate risks is therefore to study investors' beliefs on how climate risks are currently priced and will be priced in the future. The research on beliefs has primarily focused on measuring retail investor beliefs about climate finance (e.g. Riedl and Smeets, 2017; Giglio et al., 2023). Notable exceptions that study institutional investor beliefs include Stroebel and Wurgler

(2021), who found that most investors think the market underprices climate risks, and Krueger et al. (2020), who show that institutional investors prefer risk management and engagement over divestment to address climate risks. We provide rare empirical evidence on the beliefs of finance experts regarding the current and future capability of financial markets to accurately price climate risks. By examining the mental models of these professionals, we gain insights into the perspectives of sophisticated investors, uncovering their short-term and long-term beliefs that are not easily captured in observational data, including the behavioral factors influencing pricing implications. Furthermore, these experts' beliefs are essential inputs for both rational expectation models and behavioral models in macroeconomics and finance. Our study leverages a comprehensive global sample of CFA-certified finance professionals, who significantly influence asset prices and control substantial market movements (Lakonishok et al., 1992; Basak and Pavlova, 2013). Our findings highlight that most finance professionals believe markets do not yet fully reflect climate risks in prices, indicating that markets are still on an off-equilibrium path (Pastor, Stambaugh, and Taylor, 2021). This misalignment underscores the urgent need for better data, improved models, and heightened awareness among market participants to achieve accurate pricing of climate risks.

Moreover, we contribute to the literature on expectation formation in finance (Shiller, 1981; Giglio et al., 2021b; Bordalo, Gennaioli, La Porta, O'Brien, and Shleifer, 2023).[3] Individual expectations are central to the study of financial markets, because they guide investor behavior and aggregate markets. Which factors drive observed heterogeneity in individual expectations, i.e., disagreement, is one of the remaining questions in this stream of literature. We collect rich beliefs data covering directly elicited, incentivized return expectations and higher-order expectations as well as reasoning based on open-text responses to address this question in the context of climate finance. This allows us (i) to identify mental models as microfoundation of finance professional heterogeneous expectation formation in the domain of climate finance and (ii) to establish the important

[3]Relatedly, Malmendier and Nagel (2011) study the role of experiences for belief formation and decision-making. See also Bourveau and Law (2021) and Kong, Lin, Wang, and Xiang (2021) on the role of analysts' experiences.

role of second-order beliefs in their expectation formation.[4]

Our findings also contribute to the work on market efficiency. We explore experts' views about how financial markets aggregate information. We document that many finance experts believe that current equilibrium prices do not reflect climate risk and that this mispricing will persist for many years to come. Pricing climate risk is conceptually very different to the pricing of conventional earnings-relevant news, which can be aggregated in prices by professionals within hours (Fedyk, 2024). It entails different risk categories and different risk exposures of assets as well as challenges due to data limitations, which will resolve only gradually over time (Giglio et al., 2023). Knowledge about sophisticated investors' beliefs on the time horizon of climate risk mispricing helps assessing consequences for asset pricing in and out of equilibrium (Pastor et al., 2021; Pastor, Stambaugh, and Taylor, 2022). Relatedly, our results can speak to the elasticity of the market in the domain of climate finance by investigating the demand. Koijen and Yogo (2019) posit that due to large, slow-moving investors, markets can become inelastic. This gives rise to uninformed capital flows impacting prices. We uncover potential sources of such inelasticity in the domain of climate finance, namely that sophisticated investors are having a hard time assessing expected returns due to market frictions (data challenges) as well as behavioral frictions (mainly second-order beliefs), which could lead them to not adjust their holdings much in response to price changes. Our results imply that given these constraints, even professionals in the market are unlikely to be a stabilizing force to absorb fluctuations in green assets (Gabaix and Koijen, 2021).

In the next section we outline our survey design and procedures. Section 3 presents our results and Section 4 concludes.

II. Expert Survey

Studying how financial experts reason about the pricing of climate risks and how this relates to return expectations requires (i) access to a sample of financial profession-

[4]Outside the realm of finance, Mildenberger and Tingley (2019); Andre, Boneva, Chopra, and Falk (2024, forthcoming) show that second order beliefs play an important role in driving people's willingness to find climate change and associated policy attitudes.

als, (ii) rich measurement of experts' mental models about the pricing of climate risks, (iii) precise, ideally incentivized, measurement of return expectations and (iv) exogenous variation of key elements of experts' mental models in order to establish causality. We designed our study with these goals in mind. The complete survey can be found in Appendix B.

A. Sample

We recruited our survey participants with the help of CFA (Chartered Financial Analysts) Institute. The survey was distributed via email to every member of the CFA Institute with a valid email address and consent to be contacted by CFA Institute for such purposes. The members of the CFA Institute consist of financial professionals who underwent the institute's education program and are certified chartered financial analysts. Their job titles cover, for example, analysts (26.1%), portfolio managers (17.7%), Chief Investment Officers (CIOs, 5.7%), personal financial advisors (3.9%), Chief Executive Officers (CEOs, 3.8%), Chief Financial Officers (CFOs, 3.5%), and traders (3.2%). Summary statistics for the 1,989 professionals that constitute our main sample can be found in Table VIII and Table IX of Appendix C. Importantly, more than 60% of respondents indicated that they encounter issues related to asset pricing on a daily basis in their professional life.

B. Survey Design

Survey Structure. After respondents gave their informed consent, the survey started with some introductory questions on the function they have in their current job and how frequently they deal with pricing questions. Afterwards, the main parts of the survey consisted of (i) multiple-choice type questions related to the importance of climate risks for pricing and the level of (mis)pricing of climate risks, (ii) elicitation of how respondents reason about why climate risks are (not) correctly priced in an open text format, (iii) structured questions related to (mis)pricing factors from theory, including incentivized elicitation of second-order beliefs, (iv) incentivized measurement of return

expectations and (v) an information intervention to manipulate respondents' second-order beliefs, followed by a second, post-treatment, measurement of return expectations.

Climate Risks. As a starting point, we elicit two fundamental beliefs respondents can hold about the pricing of climate risks.[5] We measure i) beliefs about the relevance of climate risks for the pricing of stocks as well as ii) views on the current reflection of climate risks in stock prices. To capture this, we ask the following two questions. First we ask: *"In your opinion, how important are climate risks for the pricing of company stocks?"*. Respondents could answer on a 5-point Likert scale, ranging from "Not at all important" to "Extremely important". Second, we ask: *"In the stock market, do prices currently reflect climate-related risks correctly?"*. Here, respondents could either indicate that they do think climate risks are fully reflected in prices, or that they are reflected too much, or that they are reflected too little.[6]

Open text elicitation of views on pricing. A key element of our survey is that we measure how respondents reason about the pricing of climate risks using an open-ended question. This methodology has been successfully used in other contexts, for instance to measure how people reason about taxation (Stantcheva, 2021) or how to measure narratives about macroeconomic phenomena (Andre et al., 2022). The advantages and disadvantages of this approach are discussed in Ferrario and Stantcheva (2022) and Haaland et al. (2024). For our purposes, the key advantage of using open-text elicitation is that it does not prime respondents' reasoning in a specific direction and does not restrict respondents' answers in any way. Hence, open-text responses directly capture what comes to professionals' mind when asked. This method can also identify factors that professionals deem relevant but are ignored by the current state of the research field. Specifically, following the question whether prices currently reflect climate-related risks correctly (described above), we asked: *"Which factors do you think cause the deviation*

[5]For simplicity, we do not distinguish between different types of climate risks. Broadly speaking, climate risks can affect asset prices as physical risks, i.e., through potential future climate events impacting expected cash flows or discount rates (Addoum, Ng, and Ortiz-Bobea, 2023; Hong et al., 2019; Pankratz, Bauer, and Derwall, 2023) or transition risks, i.e., through potential changes in climate regulation (Starks, 2023).

[6]For this question we specified that respondents ought to take all stocks listed in the US stock market into account.

from correct pricing of climate risks? Please respond in full sentences." if the respondents indicated a mispricing.[7] Respondents could provide their answer in an open-text box. In a follow-up question, we then elicited expectations about when the potential mispricing will be resolved. Respondents could indicate a time horizon on a 8-point scale from "*3 months*" to "*more than 10 years*" as well as "*never*."

Structured elicitation of views on pricing. To complement the open-text elicitation, we elicit respondents' perceived importance of potential mispricing factors in a structured way. These questions are guided by potential pricing frictions based on standard finance theory. Respondents were provided with possible explanations for current mispricing and could allocate 100 points based on the importance of each explanation, where more important explanations should receive more points. We offered explanations covering classical market frictions, including data availability and quality challenges as well as limits to arbitrage to allow behavioral (i.e., individual) frictions to play a role. We also specifically elicit the importance of individual frictions, namely, other investors' non-standard beliefs and preferences. Respondents had the chance to add other explanations in an open text field if they wanted to. See Appendix B for details.

Information Intervention. In order to shed light on the causal impact of second-order beliefs on return expectations, we implemented an information intervention to exogenously manipulate respondents' second-order beliefs. We designed this intervention with two goals in mind: we focused on a type of second-order beliefs that (i) can be elicited in an incentive-compatible way and (ii) can plausibly be shifted with credible information. We hence focused on the beliefs about other survey participants' — i.e., other financial experts' — views on the importance of climate risks and the level of pricing of climate risks. We first elicited respondents' second-order beliefs about others' views on pricing and the other block elicited respondents' assessment of potential pricing factors from the literature in a structured way. We explained respondents that we conducted the survey that they are currently answering with 100 other members of the CFA Institute that we recruited for this study in the exact same way. Their task was to predict which

[7] In case a respondent indicated in the prior question that they believe that climate risks are correctly reflected in prices, we adjusted the open-ended question accordingly.

fraction of respondents gave which answer to the two fundamental questions about the pricing of climate risks (described above). Before they answered, we reminded them of the exact wording of the two questions we asked. We incentivized these questions (details provided at the end of this section). Below we display the two second-order belief elicitations:

"Question 1. The question we asked was the following: 'Do you think that climate risks are important for the pricing of stocks?' For each possible option, please estimate how many of the 100 CFA Institute members we asked gave that answer. Your answers need to sum up to 100."
"Question 2. Another question we asked was the following: 'In the stock market, do prices currently reflect climate-related risks correctly?' Note: Please answer to this question by taking all stocks listed in the US stock market into account. For each possible option, please estimate how many of the 100 CFA Institute members we asked gave that answer. Your answers need to sum up to 100."

After eliciting second-order beliefs, we randomized survey respondents into three conditions. In two information conditions, we provided them with information about how sets of 10 other members of the CFA Institute, respectively, were thinking about (i) the importance of climate risks for pricing and (ii) the current level of climate risk pricing. In a third CONTROL condition, respondents did not receive any information.

In the two information conditions, we explained to respondents that they will receive information about how 10 other CFA members that we recruited for this study in the exact same way responded to the two questions on the pricing of climate risks. In one condition (which we denote treatment UP), the vast majority of the 10 participants stated that (i) climate risks are important for pricing and (ii) climate risks are currently not sufficiently reflected in prices. In the other condition (which we denote treatment DOWN), larger shares of the 10 participants expressed the view that climate risks are (i) rather unimportant and (ii) currently reflected too much in prices. Within each condition, all survey respondents were provided with identical information sets. At the very end

of the survey, i.e., after providing the information, we again elicited second-order beliefs (without incentives) as a manipulation check.[8]

Return Expectations. As our key outcome variable, we focus on return expectations for the MSCI World Climate Action Index. The MSCI World Climate Action Index represents the performance of companies that, using climate screening research, have been assessed to be leaders in their respective sectors in terms of climate transition, and thus are generally less exposed to climate risks. In order to net out non-climate related aspects of experts' return expectations as best as possible, we elicit respondents' *excess* return expectation for the MSCI World Climate Action Index relative to its parent index (MSCI World Index). Respondents' elicited excess return expectations reflect their expectations about the difference in returns between the MSCI World Climate Action Index and the generic MSCI World Index. Thus, differences between the two indices are driven by the change in risk-return characteristics due to climate action screening. We elicit respondents' excess return expectations over the next 12 months in an incentivized way (as described below). Measuring return expectations in surveys is challenging. In order to simplify the elicitation, we proceeded in two steps. We first asked whether returns of the MSCI World Climate Action Index over the next 12 months will be higher, lower, or about the same compared to the parent index. In a second step, we elicited quantitative expectations on the exact percentage points difference. To further simplify the quantitative elicitation, we provided respondents with a benchmark number, the average annual return of the parent index over the last 45 years (10.79%). In addition, we elicit unincentivized respondents' excess return expectation for the MSCI World Climate Action Index relative to its parent index (MSCI World Index) over the next 10 years.

Incentives. We incentivized the elicitation of second-order beliefs as well as return expectations. To avoid hedging motives, only one of the three decisions was randomly selected to be pay-off relevant. We explained incentives to respondents as follows: "*The bonus: We ask three bonus questions. After all surveys are completed, the computer will*

[8]We truthfully informed respondents that the groups of 10 other CFA members were randomly selected. We did not, however, specify the exact randomization procedure. In fact, we were drawing multiple groups of 10 and then selected two that would likely create dispersion in second-order beliefs, thereby strengthening our first stage.

randomly select one of the three questions and the five most accurate respondents to that question, i.e., whose predictions are closest to the truth, will be eligible for a voucher." Given that we are dealing with a high-income sample, we wanted to provide relatively high incentives. We hence opted for $250 restaurant vouchers.[9]

C. *Classifying Mispricing Factors From Open Texts*

To analyze the unstructured text data, we designed and implemented a tailored coding procedure. Table I presents an overview of the classification categories used. The coding scheme consists of 7 categories. For some categories, additional sub-categories existed. In addition, coders could select the categories "unsure" or "no category fits." Coders could select multiple categories, and for categories where sub-categories existed, coders were not forced to select a sub-category.[10] Based on existing literature on possible reasons for mispricing, open text responses from a pilot sample as well as an ex-post validation using large language models (LLM), we developed a comprehensive set of possible mispricing factors. These range from classical factors such as transaction costs and information challenges to behavioral factors which imply that market participants' non-standard beliefs or preferences impact pricing. Appendix A provides the full coding manual.

In line with existing work (Andre et al., 2022), research assistants then classified open texts according to these factors, following the detailed coding manual. The research assistants, apart from what was stated in the manual, were blind to the objectives of our study. To ensure high quality of the hand-coded data, we proceeded as follows. We instructed a total of three research assistants on the coding scheme and conducted a series of practice rounds with them, allowing them to ask questions and clarify the manual. Then each open text was independently coded by two of the research assistants. Conflicting coding decisions by these two research assistants were resolved by a coding of the third research assistant. The inter-rater reliability is high. We find average agreement

[9] Note that our incentive scheme technically incentivizes respondents to state the mode of their belief distribution, contrary to often-used scoring rules which incentivize the report of the distribution mean (Hossain and Okui, 2013; Selten, 1998). We chose this incentive scheme because it is easy to explain and understand and hence helps safe precious survey time with our expert sample. Of course, for symmetric and single-peaked distributions (e.g. normal distributions), mode and mean coincide.

[10] Thus, the fractions of subcategories selected do not need add up to 100% for each category.

across the different classification categories in 96.26% of the cases. Appendix D reports agreement among coders for each classification category separately.

Furthermore, Tables XIII and XIV in Appendix D demonstrate that all our results are robust to using individual coding decisions instead of the joint coding result.

D. Procedures

The survey was implemented via Qualtrics and advertised among CFA Institute members by the CFA Institute by email. 1,989 financial professionals completed the survey and constitute our main sample. This implies a response rate of 3.6%.[11] They were randomized into the two information treatments as well as the control (no information) condition. We oversampled the two information treatments for power reasons (treatment UP: $N = 801$; treatment DOWN: $N = 792$; treatment CONTROL: $N = 396$).[12]

We randomized the positioning of the incentivized elicitation of second-order beliefs. Some respondents faced these questions right after the elicitation of their own first-order beliefs, some later in the survey (before the information intervention). Additional measures include general market return expectations, general knowledge about climate change, political orientation, optimism, and views on successful investment strategies. CFA Institute provided us with some basic sociodemographic information about respondents. At the end of the survey, we included some questions tailored to the respective professional role of the respondents.[13] We pre-registered the survey on AsPredicted (#126275). The pre-registration includes the main research questions, survey measures, incentives, the information intervention and the CFA Institute sample.[14]

[11] This is comparable to the response rates of 2.5%-4% for individuals contacted for the first time in the surveys by Giglio et al. (2021b).

[12] We ran a small pilot sample that we used as benchmark sample for the second-order belief elicitation and for the information treatments, as well as to inform the development of the classification manual. The survey was virtually identical to the actual survey, except that it did not contain an information intervention. Observations from this pilot are not included in our analyses.

[13] For that purpose we implemented different survey versions depending on the professional role the respondents stated at the beginning of the survey.

[14] A key issue with using professional samples is typically limited sample size. We hence did not preregister a desired sample size, but instead registered that we would send the survey to all CFA members that would fulfil some basic criteria (e.g., being reachable via email).

III. Results

A. *Experts' Return Expectations*

In this section we provide descriptive evidence on our key outcome measure, respondents' incentivized excess return expectation of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months. Due to our incentivized two-step elicitation procedure, we have a qualitative measure of whether respondents expected the excess return to be lower, about the same, or higher than the return of the parent index, as well as a quantitative measure.[15]

Result 1. *We observe substantial heterogeneity in experts' return expectations.*

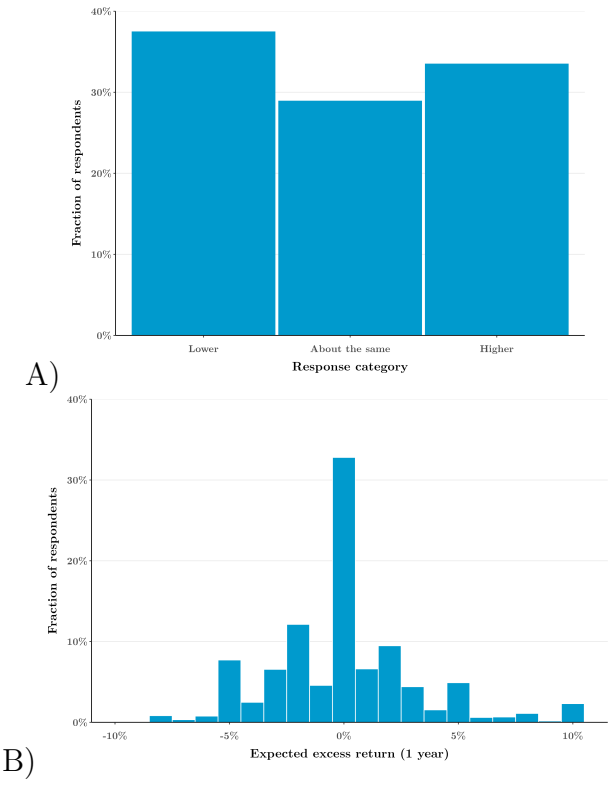


Figure 1. Experts' return expectations.

Notes: This figure displays histograms of survey respondents' incentivized excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months. Panel A shows how many survey participants reported each ordinal category and Panel B shows the frequency of indicated quantitative expected excess returns in percentage points. The variable is winsorized at the levels 5% and 95% as pre-registered.

[15]Throughout the paper, as pre-registered, we winsorize the quantitative measure at 5% and 95%.

Table I. Classification categories for open-text responses.

Category	Subcategory	Description	Examples
1. Information/data challenges		All kinds of challenges with information input and data.	This includes challenges arising from climate risk uncertainty.
	1.1. Data quality and availability	If the survey participant mentions any kind of informational challenges that are related to data quality and/or availability as a factor driving mispricing.	This includes data availability/disclosure (or lack thereof), data quality (or lack thereof), spread of data/information (e.g., on social media, lobbyism), expertise/understanding/ research of climate risk (or lack thereof).
	1.2. Data processing and methodology	If the survey participant mentions any kind of informational challenges that are related to data processing or methodology as a factor driving mispricing.	This includes tools or models (or lack thereof) as well as methodological consensus (or lack thereof).
2. Respondent talks about other market participants		The respondent explicitly or implicitly mentions other market participants in the text.	
	2.1. Beliefs: Others think/believe that climate risks are too important for pricing (others put too much weight on climate risks)	If the survey participant mentions that other market participants believe that climate risks are too important for pricing or that they put too much weight on climate risks in pricing.	This includes perceptions/beliefs/assessments/expectations/opinion of climate risks, that participants tend to overestimate the impact of climate risks, overreaction, hype, too much focus.
	2.2. Beliefs: Others think/believe that climate risks are too unimportant for pricing (others put too little weight on climate risks)	If the survey participant mentions that other market participants believe that climate risks are too unimportant for pricing or that they put too little weight on climate risks in pricing.	This includes perceptions/beliefs/assessments/expectations/opinion of climate risks, ignorance/lack of awareness of climate risks, climate change denial, underestimation of climate risks (or tail events), underestimation of the impact of climate risks, underreaction.
	2.3. Preferences: Others have non-standard preferences	If the survey participant mentions any kind of non-standard preference as a factor driving mispricing.	This includes political orientation, short-term focus – mentioning of long-term focus of climate change / climate risks and short-term focus of markets. Also includes mentioning of different time horizons, mismatch with long time horizon for climate risk, and sustainability preferences.
	2.4. Respondent explicitly mentions words of psychology/bounded rationality	If the survey participant explicitly mentions any kind of behavioral (boundedly rational) aspect or investor psychology.	This includes hype, trend, bubble, herding, emotions (example: excitement, ...), cognitive biases, irrational behavior, psychology, anomalies, affect, sentiment.
3. Transaction costs		If the survey participant mentions any kind of transaction costs as a factor driving mispricing.	This includes any monetary costs (examples: broker fees, bank charges, commissions) and non-monetary costs (effort, time, inconvenience, difficulties in implementation).
4. Liquidity constraints		If the survey participant mentions liquidity or illiquidity, directly or indirectly, as a factor driving mispricing.	This includes descriptions of not being able to sell / being able to sell as well as descriptions of high/low demand or high/low supply.
5. Asymmetric information		If the survey participant mentions any kind of information asymmetries as a factor driving mispricing.	This includes managers biasing information (most popular example in this setting: greenwashing), managers withholding information, misinformation, insider information, corruption.
6. Policy measures		If the survey participant mentions any kind of political/government/state intervention formally (laws, policies, ...) or informally ("political pressure") as a factor driving mispricing.	This includes any legislation, regulation, subsidies, taxes. It also includes measures by related bodies, such as central banks, national banks.
	6.1. Anticipated bailout	If the survey participant mentions the specific anticipation of a bailout.	This includes any type of bailouts (companies, banks)
7. Limits to arbitrage		If the survey participant mentions any kind of limits to arbitrage, i.e., reasons why mispricing does not disappear/keeps existing.	This includes reasons for limits to arbitrage, such as costs that arise when engaging in arbitrage and risks that are associated with arbitrage.

Notes: This table contains the categories used for classification of experts' open-text responses about climate risk pricing factors. Coders could also select the categories "unsure" or "no category fits." Selecting multiple categories or subcategories was allowed and no category or subcategory was forced. Appendix A provides the full coding manual.

Figure 1 displays respondents' one-year expected excess return qualitatively based on their reported ordinal categories (Panel A) and quantitatively in percentage points (Panel B). The figure documents large disagreement among the surveyed experts. 37.5% expect the one-year return of the MSCI World Climate Action Index to be lower, 29.0% expect it to be about the same, and 33.5% expect it to be higher than the return of the MSCI World Index. Experts' expected excess returns range from -8.79 percentage points to +10 percentage points, with a mean of -0.16 percentage points and a standard deviation of 4.14 percentage points. Figure 6 in the Appendix depicts respondents' 10-year expected excess return documenting disagreement, yet with more positive excess return expectations – 60.1% of the respondents expect the ten-year return of the MSCI World Climate Action Index to be higher than the return of the MSCI World Index. Experts' expected excess return ranges from -5 percentage points to +15 percentage points, with a mean of +3.23 percentage points and a standard deviation of 4.83 percentage points.

B. Experts' Climate Risk Beliefs

B.1. Beliefs about the Reflection of Climate Risks in Prices

Result 2. *While there is marked heterogeneity, the majority of experts believe that climate risks are not sufficiently reflected in stock prices.*

We document two fundamental beliefs experts hold about the pricing of climate risks in the stock market and how these are related to experts' return expectations. Figure 2 displays experts' beliefs about the current reflection of climate risks in stock prices (Panel A) and their views on the importance of climate risks for the pricing of stocks (Panel B). While there is heterogeneity, the majority of experts (68.0%) believe that climate risks are currently not sufficiently reflected in stock prices. In addition, we find strong heterogeneity among experts in regard to their assessment of how important climate risks are for the pricing of stocks. 32.6% of the experts believe that climate risks are "not at all important" or "not very important" for the pricing of stocks, yet about a quarter of the experts (25.6%) believe that climate risks are "very important" or "extremely important"

for pricing.

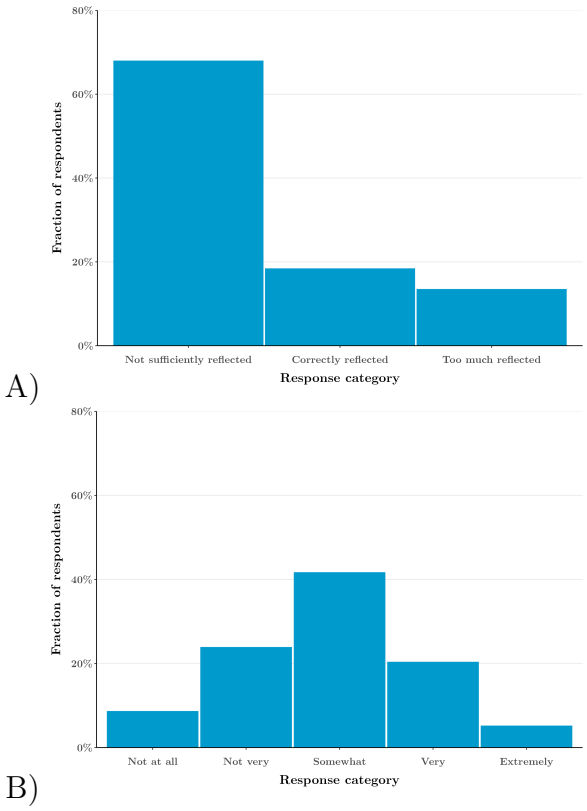


Figure 2. Experts' beliefs about climate risk pricing.

Notes: This figure displays histograms of survey respondents' self-reported beliefs indicated in ordinal categories. Panel A shows respondents' beliefs about the current reflection of climate risks in prices. Panel B reports respondents' beliefs about the importance of climate risks for the pricing of stocks.

Result 3. *Experts' beliefs about the importance of climate risks for prices and the current level of pricing of climate risks are correlated with their return expectations.*

Table II provides odds ratios from ordered logit regressions. Dependent variables are participants' reported qualitative excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months (incentivized) and the next 10 years (unincentivized). As displayed in Column 1, we find that one unit change in experts' perceived importance of climate risks for pricing (from low to high) increases the probability of reporting an expected positive one-year excess return significantly. In addition, one unit change in the experts' perception of the current reflection of climate risks in prices (from too little to too much) decreases the probability of reporting a positive one-year excess return significantly. These findings persist when we control for participants' general market return expectations in percentage points (Column

2). The results are similar for respondents' excess return expectations over the next 10 years (Column 3 and 4).

We find similar results for experts' expected excess return in quantitative terms. Table XI in the Appendix shows that the higher experts perceive the importance of climate risks for the pricing of stocks, the higher they expect the excess return to be in quantitative terms (reported in percentage points). Also, the more experts believe that climate risks are reflected in prices, the lower they expect the excess return to be in quantitative terms (reported in percentage points).

Table II. Experts' climate risk beliefs and expected excess return expectations.

	(1) Exc. return (1Y)	(2) Exc. return (1Y)	(3) Exc. return (10Y)	(4) Exc. return (10Y)
Importance for pricing	1.466***	1.456***	1.672***	1.676***
	(0.07)	(0.07)	(0.12)	(0.12)
Reflection in prices	0.659***	0.659***	0.425***	0.424***
	(0.04)	(0.04)	(0.04)	(0.04)
Market expectations		1.014***		0.994
		(0.00)		(0.01)
Estimated cut points:				
cut1	0.946	0.950	0.373***	0.369***
	(0.19)	(0.19)	(0.10)	(0.10)
cut2	3.420***	3.458***	0.941	0.931
	(0.70)	(0.71)	(0.26)	(0.26)
N	1,989	1,989	1,460	1,460
Pseudo R^2	0.04	0.04	0.10	0.10

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The dependent variables are respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 12 months (*Exc. return (1Y)*) and over the next 10 years (*Exc. return (10Y)*) in ordinal categories (with 0="lower", 1="about the same", 2="higher"). Note that 1,460 survey respondents in our sample indicated a 10-year excess return expectation. *Importance for pricing* is respondents' answer to the question "In your opinion, how important are climate risks for the pricing of company stocks?" on a 5-point Likert scale, ranging from "Not at all important" to "Extremely important". *Reflection in prices* is respondents' answer to the question "In the stock market, do prices currently reflect climate-related risks correctly?" (with response categories: reflected too little, fully reflected in prices, reflected too much). *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

B.2. Experts' Mental Models about the Pricing of Climate Risk Beliefs

We describe mental models of how finance experts reason about climate risk pricing in financial markets. We then show that experts' different ways of reasoning about climate

risk pricing explain variation in their return expectations.

Result 4. *We document distinct mental models on climate risk pricing among experts which reflect (i) market frictions, most notably data challenges, and (ii) behavioral frictions, in particular second-order belief patterns.*

We performed textual analysis of experts' responses to an open-ended question to measure experts' reasoning about climate risk pricing. The survey participants were asked the following question: *Which factors do you think cause a deviation from correct pricing of climate risks? Please respond in full sentences.* Figure 3 depicts the frequency of classified factors mentioned in text responses by experts according to our classification scheme. The figure illustrates that several explanatory factors for mispricing were mentioned by our expert sample. The variation in experts' reasoning largely reflects differences in to what extent market frictions versus behavioral frictions are viewed to generate the mispricing. The most frequently mentioned factors are data challenges, which are market frictions (mentioned by 47.0% of experts) and beliefs about other market participants, which are behavioral frictions (mentioned by 48.3% of experts). In particular, beliefs about other market participants are (i) beliefs about other market participants' non-standard beliefs, i.e., second-order beliefs (mentioned by 32.8% of experts), (ii) beliefs about other market participants' non-standard preferences (mentioned by 13.6% of experts), and (iii) bounded rationality of other market participants (mentioned by 8.7% of experts). Another frequently mentioned factor is policy measures (mentioned by 11.1% of experts) which includes legislation and regulation (such as taxes and subsidies or the inclusion of sustainability/climate aspects to disclosure standards) that can cause mispricing.

The three key explanatory factors we identify – data challenges, beliefs about other market participants (particularly beliefs about other' non-standard beliefs, i.e., second-order beliefs), and policy measures – seem to reflect distinct ways to think about the pricing of climate risks. Pair-wise correlation coefficients between experts' mentioning of data challenges, of other market participants' non-standard beliefs, and of policy measures are very low, ranging from -0.0641 to -0.0025. In general the factors overlap little in experts' reasoning. Only 13.2% of experts mention data challenges and other market

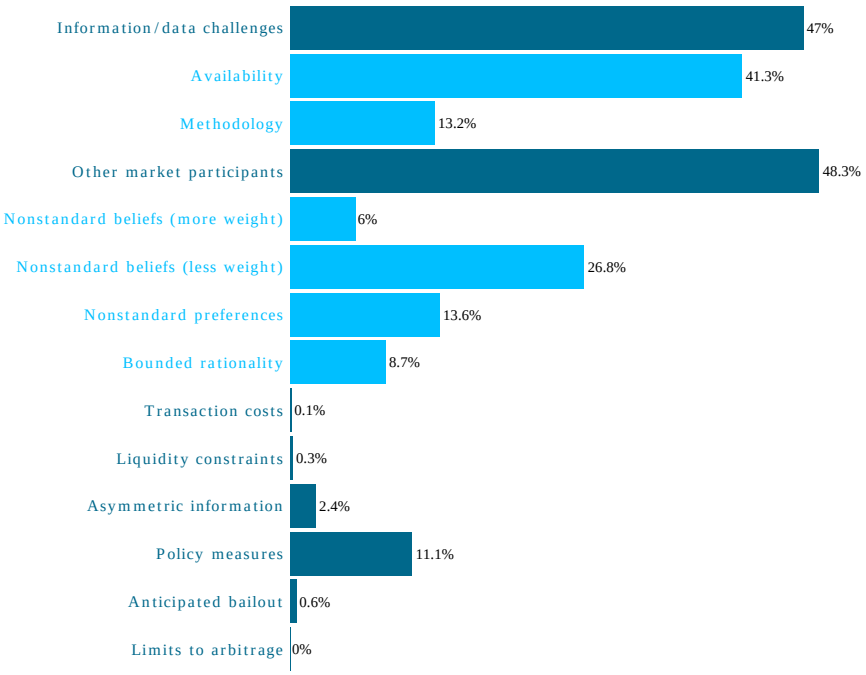


Figure 3. Climate risk pricing factors mentioned in text responses.

Notes: This figure displays the frequency of factors mentioned in text responses by expert survey participants. Categories are shown in dark blue, sub-categories are shown in light blue. Note that texts can be classified as mentioning multiple categories and sub-categories. In addition, categories as well as sub-categories were not forced to be classified by the coders (i.e., sub-categories do not necessarily add up to 100%).

participants' non-standard beliefs jointly, 5.2% of experts mention data challenges and policy measures jointly, and 3.1% of experts mention other market participants' non-standard beliefs and policy measures jointly.

Note that the key explanatory factors we identify also correlate with our structured elicitation measures in a meaningful way (see Table XX, Appendix E).

Result 5. *Experts' mental models on climate risk pricing explain variation in return expectations.*

We document that heterogeneity in reasoning about climate risk pricing can explain variation in return expectations. For this purpose, we test distinct predictions which link the key factors mentioned by the experts to their excess return expectations. We exploit the fact that experts' reasoning is directly linked to whether they believe climate risks are currently not sufficiently reflected or too much reflected in prices. If experts think that (i) climate risks are to some extent material for pricing and (ii) mispricing will resolve at some point in time, then their mental model has direct implications for

return expectations. Notice that most experts indeed think that climate risks are at least "somewhat important" for the pricing of stocks and that the mispricing of climate risks is temporary and will resolve at some point.

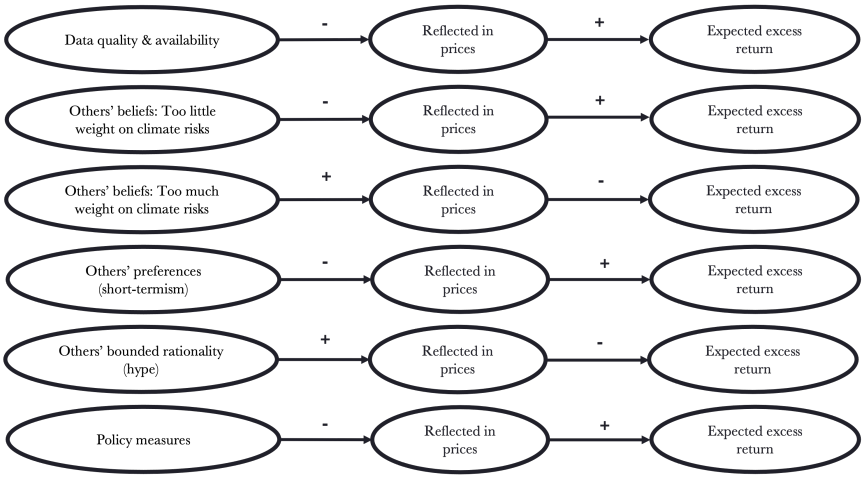


Figure 4. Experts' mentioned climate risk pricing factors and their predicted relation to return expectations.

Notes: This figure displays factors mentioned in text responses by expert survey participants and their predicted relation to return expectations. The associations are visualized in directed acyclic graphs. Vertices represent experts' mentioned climate risk pricing factors (left-hand side), their beliefs about the level of current climate risk pricing (center), and their expected excess return (right-hand side). Signs on top of the edges indicate whether the predicted association is positive or negative.

Figure 4 illustrates our predictions visualized in simple directed acyclic graphs (DAGs) for each of the mentioned climate risk pricing factors. Each DAG represents a distinct mental model which relates a climate risk pricing factor (vertices on the left-hand side) to experts' expected excess return through their belief about the current reflection in prices. Whenever an expert believes that a climate risk pricing factor hinders (-) that climate risks are sufficiently reflected in prices, this expert expects the future excess return to be higher (+). Whenever an expert believes that a climate risk pricing factor leads to the fact that climate risks are too much reflected in prices (+), this expert expects the future excess return to be lower (-). For instance, second-order beliefs that other market participants put too much weight on climate risks when assessing prices are directly associated with beliefs that climate risks are currently too much reflected in prices today. As a consequence, if one thinks that such mispricing will resolve over time, returns of stocks in the MSCI World Climate Action Index (which includes relatively more green firms) will see negative adjustments in prices in the future relative to stocks in its parent

index (which includes relatively more brown firms).

Table III. Respondents' excess return expectations and confidence levels across mental models.

	Exc. return (1y)		Exc. return (10y)		Confidence in prediction of exc. return (1y)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Full sample	-0.05	4.14	2.23	4.84	2.80	0.89
Respondents who mention:						
Data Challenges	0.40	4.17	2.79	4.86	2.82	0.84
Others' Beliefs (+)	-1.63	3.11	-0.65	3.69	2.77	0.92
Others' Beliefs (-)	0.61	4.17	3.16	4.44	2.82	0.86
Others' Pref.	-0.09	3.83	2.62	4.32	2.81	0.90
Bounded Rat.	-0.84	4.05	2.32	4.96	2.73	0.90
Policy measures	-0.57	4.63	1.74	4.90	2.83	0.79

Note: This table depicts mean values and standard deviations for respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 12 months (*Exc. return (1Y)*) and over the next 10 years (*Exc. return (10Y)*) in percentage points, winsorized at 5% and 95%. In addition, the table presents mean values and standard deviations for respondents' self-reported confidence in their excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 12 months (*Confidence*) on a 5-point scale (from 1 (not at all confident) to 5 (extremely confident). Descriptive statistics are shown for the full sample (N = 1,989) and across sub-samples of respondents who hold specific mental models.

First, Table III reports mean values and standard deviations of respondents' excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months and the next 10 years across different mental models. It documents large variation across respondents who hold different mental models. For example, experts who mention the belief that other market participants put too much weight on climate risk for pricing, report an average excess return over the next 12 months of -1.63%, whereby experts who mention data challenges report an average excess return over the next 12 months of +0.40%. These differences become more pronounced in experts' excess return expectations over the next 10 years, where mean expected excess returns range from -0.65% to 3.16% across different mental models.

Table IV reports results for testing our predictions displayed in the acyclic graphs of Figure 4. It provides odds ratios from ordered logit regressions of mental models with excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months (Column 1 and 2) and the next 10 years (Column 3 and 4) as dependent variables.

In general, almost all findings are in line with our predictions. Results from column

Table IV. Climate risk pricing factors and expected excess returns.

	(1) Exc. return (1y)	(2) Exc. return (1y)	(3) Exc. return (10y)	(4) Exc. return (10y)
Factor Data				
Challenge	1.275**	1.272**	1.197	1.185
	(0.13)	(0.13)	(0.16)	(0.17)
Factor Others' Beliefs				
(too much weight)	0.450***	0.487***	0.231***	0.242***
	(0.09)	(0.10)	(0.06)	(0.07)
Factor Others' Beliefs				
(too little weight)	1.328***	1.281**	1.736***	1.753***
	(0.14)	(0.14)	(0.23)	(0.24)
Factor Others' Preferences				
(short-termism)	0.916	0.918	1.563**	1.614***
	(0.12)	(0.12)	(0.27)	(0.30)
Factor Bounded				
Rationality (hype)	0.733*	0.717**	1.259	1.268
	(0.12)	(0.12)	(0.30)	(0.31)
Factor Policy Measures	0.806	0.836	0.627***	0.645**
	(0.11)	(0.12)	(0.10)	(0.11)
Market expectations	1.021***	1.021***	0.999	1.000
	(0.00)	(0.00)	(0.01)	(0.01)
Female		1.325**		1.418*
		(0.19)		(0.27)
Political orientation				
(left to right)		0.953*		0.932*
		(0.03)		(0.03)
Age (in years)		0.993*		0.995
		(0.00)		(0.01)
Estimated cut points:				
cut1	0.619***	0.353***	0.293***	0.160***
	(0.06)	(0.09)	(0.04)	(0.06)
cut2	2.034***	1.160	0.669***	0.372***
	(0.21)	(0.30)	(0.09)	(0.14)
N	1,622	1,544	1,260	1,202
Pseudo R^2	0.02	0.03	0.04	0.04

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The dependent variables are *Exc. return (1y)*: respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months in ordinal categories (with 0="lower", 1="about the same", 2="higher") and *Exc. return (10y)*: respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 10 years in ordinal categories (with 0="lower", 1="about the same", 2="higher"). Note that the sample is restricted to survey respondents who indicated that currently climate risks are not correctly priced (1,622 respondents). *Factor* variables are dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *Female* equals 1 if the respondent is female and 0 otherwise. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *Age* is respondents' age in years. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

1 indicate that experts mentioning the very common factors – data challenges and the second-order belief that other market participants put too little weight on climate risks

when assessing prices – are more likely to expect higher excess returns of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months. In contrast, experts mentioning the second-order belief that other market participants put too much weight on climate risks when assessing prices are more likely to expect lower excess returns. Experts who mention the belief that some investors in the market are boundedly rational are marginally more likely to expect lower excess returns, when controlling for expert characteristics, but this effect fades when looking at a 10-year horizon. Interestingly, experts mentioning the belief about other market participants' non-standard preferences (short-termism) are more likely to expect higher excess returns of the MSCI World Climate Action Index over its parent index, the MSCI World Index, only over the next 10 years (Column 5). Mentioning political measures is not significantly correlated with any of the dependent variables.

Our results are robust when we control for participants' general market return expectations in percentage points, gender, political views, and age (Columns 2 and 4). Furthermore, results are similar for respondents' excess return expectations over the next 10 years (Column 3 and 4). Further, Tables XIII and XIV in Appendix D demonstrate that our results are robust to using individual coding decisions instead of the joint coding result.

B.3. Determinants of Experts' Beliefs

Next, we study determinants of experts' mental models. We examine how a rich set of experts' characteristics relate to the type of mental model held.

Result 6. *Political preferences and regional factors are key determinants of experts' beliefs.*

Table V provides odds ratios from logit regressions with participants' mental models, i.e., mentioned climate risk pricing factors as dependent variables. Political preferences and regional factors are key determinants of experts' mental models. Experts from the political right are more likely to believe that other market participants overly attend to climate risks and less likely to believe that other market participants ignore climate risks

Table V. Correlates of climate risk pricing beliefs: expert characteristics.

	(1) Data Challenge	(2) Others' Beliefs (+)	(3) Others' Beliefs (-)	(4) Others' Pref.	(5) Bounded Rat.	(6) Policy
Political orientation						
(left to right)	0.978	1.310***	0.915***	0.978	1.039	1.018
	(0.03)	(0.08)	(0.03)	(0.04)	(0.05)	(0.04)
Europe	0.720	2.835	0.816	0.882	1.478	4.102*
	(0.22)	(2.12)	(0.25)	(0.35)	(0.83)	(3.02)
North America	0.498**	5.605**	0.670	1.043	2.366	4.667**
	(0.15)	(4.10)	(0.20)	(0.40)	(1.31)	(3.43)
Asia	0.735	0.631	0.978	0.777	0.664	3.555*
	(0.23)	(0.55)	(0.30)	(0.31)	(0.41)	(2.63)
Age (in years)	0.997	1.014	0.996	1.018*	1.004	1.017
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Female	1.392**	0.492*	1.122	0.871	0.529*	0.794
	(0.23)	(0.21)	(0.19)	(0.19)	(0.18)	(0.21)
Analyst job	0.961	0.488**	1.227	1.287	0.839	1.312
	(0.14)	(0.18)	(0.18)	(0.24)	(0.23)	(0.28)
Investment job	0.796	1.323	1.006	0.935	1.273	1.367
	(0.11)	(0.34)	(0.15)	(0.17)	(0.29)	(0.28)
Corporate job	0.851	1.395	1.285	0.925	1.696**	1.247
	(0.16)	(0.44)	(0.25)	(0.23)	(0.45)	(0.34)
Expertise:						
encounter pricing	0.952	1.004	1.016	1.084	1.091	1.044
	(0.04)	(0.09)	(0.05)	(0.06)	(0.09)	(0.07)
Expertise:						
years with CFA	1.021	0.927	0.938	0.955	1.057	0.954
	(0.05)	(0.10)	(0.05)	(0.07)	(0.08)	(0.07)
N	1,461	1,461	1,461	1,461	1,461	1,461
R^2	0.01	0.11	0.02	0.01	0.05	0.02

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of logit regressions. The dependent variables are *Factor* dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. Note that the sample is restricted to survey respondents who indicated that currently climate risks are not correctly priced. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *Europe* equals 1 if the respondent's workplace is in Europe and 0 otherwise. *North America* equals 1 if the respondent's workplace is in North America and 0 otherwise. *Asia* equals 1 if the respondent's workplace is in Asia and 0 otherwise. *Age* is respondents' age in years. *Female* equals 1 if the respondent is female and 0 otherwise. *Analyst job* equals 1 if the respondent works as an analyst and 0 otherwise. *Corporate job* equals 1 if the respondent works in a corporate finance (e.g., CFO, CIO) position and 0 otherwise. *Investment job* equals 1 if the respondent works as an investor and 0 otherwise. *Expertise: encounter pricing* is respondents' answer to the question "In your daily job, how often do you encounter the topic of stock pricing or pricing in financial markets in general?" on a scale from 1 (never) to 6 (every day). *Expertise: years with CFA* is the number of years the respondent is member of the CFA Institute. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

(columns 2 and 3) compared to experts from the political left. Further analyses show that the link between experts' political orientation and mental model is only present in North America and not in Europe and Asia (see Table XV- XVII in Appendix). This aligns with evidence from political economy that suggests that various markers of political

polarization are most pronounced in the US (Draca and Schwarz, 2021; Boxell, Gentzkow, and Shapiro, forthcoming).

In addition, financial professionals in North America are less likely to believe that data challenges are a key reason for the mispricing (column 1) and much more likely to believe that policy measures drive the mispricing (column 6). Female experts are more likely to believe that data challenges are a key reason for the mispricing. Further, experts who hold a corporate job focus more on reasons related to other market participants' bounded rationality (hype) and experts who work as an analyst are much less likely to reason about other market participants' beliefs (column 2) when explaining climate risk mispricing.

B.4. Persistence of Mispricing

We now return to expert's views on whether climate risks are correctly priced. Recall that a key result from our paper is that financial experts tend to think that climate risks are not correctly priced. In this section we focus on experts' expectations about the persistence of mispricing and factors that can explain this expected persistence, i.e., that hinder trading against this mispricing by sophisticated investors.

Result 7. *Most experts expect the mispricing of climate risks to persist over several years.*

Figure 5 shows respondents' views on the persistence of the perceived mispricing of climate risks in the stock market. While the majority of experts expect the perceived mispricing of climate risks to resolve at some point (70.0%), almost all expect the correction to take years rather than months. Importantly, there is substantial disagreement on the exact time horizon. For example, 20.2% of the experts believe it will take five years and 33.8% of the experts believe it will take ten years or more. A substantial fraction even believes that mispricing will never be resolved.[16]

[16]In Table XII we relate experts' beliefs about the time horizon of climate risk mispricing to the type of mispricing they believe exists. The table provides odds ratios from logit regressions of models with participants' beliefs about the current level of climate risk pricing as dependent variables, the belief that climate risk are not sufficiently reflected in prices, and the belief that climate risk are too much reflected in prices, separately. The table show that experts who believe that mispricing is only temporary and will resolve over a period less than one year, have a significantly higher likelihood of believing that climate

The mental models we identify can speak to why experts expect such persistence in mispricing and why they do not engage in trading against this mispricing. First, our results in Section III.B.2 show that experts view information challenges as a key reason for mispricing. Limited data quality or availability implies a substantial amount of pricing uncertainty, making trading against mispricing very risky in a standard sense. Furthermore, lack of information implies that arbitrageurs cannot convey verifiable information that explains their arbitrage strategy to their principals, such as investors and financing banks. As a consequence, they will not be able to gather the necessary funds to pursue their arbitrage strategy (Shleifer and Vishny, 1997).

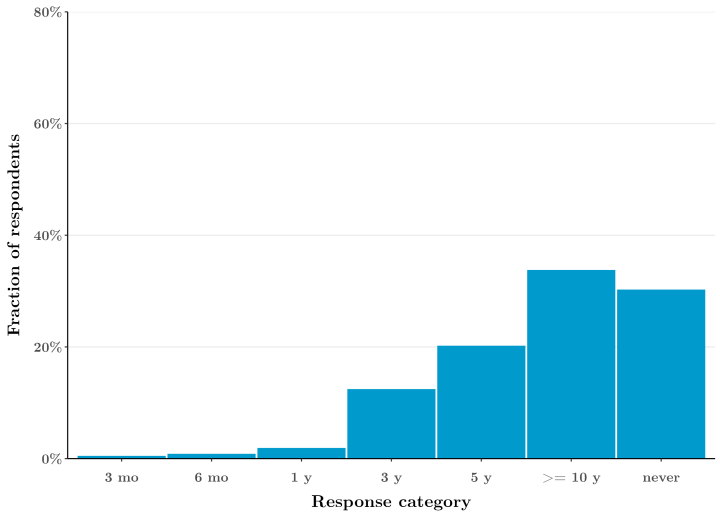


Figure 5. Experts' beliefs about the persistence of mispricing.

Notes: This figure displays a histogram of respondents' beliefs about the persistence of mispricing, i.e., their believed time horizon in which mispricing of climate risks in the stock market will be resolved, if ever.

Second, our results in Section III.B.2 point towards second-order beliefs as a key reason for mispricing. The fact that some experts point towards the irrationality of other market participants directly relates to noise trader risk in the market De Long, Shleifer, Summers, and Waldmann (1989, 1990). Furthermore, our results indicate that many experts tend to think that other market participants do not share their own views on the pricing of climate risks and either under- (or over-) estimate these risks. This directly relates to synchronization risk Abreu and Brunnermeier (2002). Abreu and Brunnermeier (2002) directly formalize a key role of second-order beliefs. Synchronization risk posits

risks are reflected too much in prices. Among experts who believe that climate risk mispricing will persist for 10 or more years, both beliefs are present.

that, if trading against mispricing requires a certain number of sophisticated investors, then a substantial risk for arbitrageurs stems from uncertainty about whether enough other market participants share their views and will also trade against the mispricing (second-order beliefs).

Table VI demonstrates that some of the identified mental models discussed above directly relate to experts' beliefs about the persistence of climate risk mispricing. The table provides odds ratios from logit regressions with the dependent variable being a binary variable reflecting participants' views on whether mispricing will be rather long-term or short-term.[17] The explanatory variables are the climate risk pricing factors we identified. Experts' mental models are predictive of their beliefs in long-term mispricing. In particular, beliefs about others' irrationality as well as beliefs about others' pricing views are associated with the view that mispricing will persist for a very long time.

Table VI. Climate risk pricing factors and experts' beliefs in long-term mispricing.

	(1) Resolve in >= 10y
Factor Data Challenge	0.919
	(0.11)
Factor Others' Beliefs (too much weight)	0.715
	(0.17)
Factor Others' Beliefs (too little weight)	1.262**
	(0.15)
Factor Others' Preferences (short-termism)	1.759***
	(0.25)
Factor Bounded Rationality (hype)	1.173
	(0.21)
Factor Policy Measures	1.156
	(0.18)
N	1,622
R^2	0.01

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of logit regressions. Note that the sample is restricted to survey respondents who indicated that currently climate risks are not correctly priced. The dependent variables are *Factor* dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Resolve in >= 10Y* is a dummy variable that equals 1 if the respondent indicated the belief that climate risks will be reflected correctly in prices in 10 years or longer (answer options: "in 10 years from now", "in more than 10 years from now") and 0 otherwise. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

[17] We use the 10 years or more category as the cutoff, which is both the modal and median answer in our sample.

C. *Causal Role of Second-order Beliefs*

In this section we show that a key aspect of one widely held mental model, namely beliefs about the beliefs of others (second-order beliefs), causally affects experts' return expectations using an information provision experiment. We document that shifting experts' second-order beliefs about other CFA Institute members' beliefs about climate risks and the pricing of those risks causally impacts return expectations. Notice that we focus on incentivized beliefs about how other experts who answered our survey think about the importance and pricing of climate risks. Hence, in contrast to second-order beliefs about other market participants in general that arose from our open text elicitation, these second-order beliefs focus on a very specific group, other sophisticated market participants. The advantage of this approach is that these are beliefs we can incentivize and which we can plausibly shift with credible information.

Result 8. *Shifting experts' second-order beliefs through information provision causally affects their return expectations.*

Table VII presents our treatment effect from the information provision intervention, comparing treatments UP and DOWN. The table provides odds ratios from ordered logit regressions of models with participants' incentivized report of excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 12 months and over the next 10 years as dependent variable. The treatment dummy indicates whether the respondents were in the UP treatment, compared to being in the DOWN treatment. After the treatment, respondents in the UP treatment were more likely to report higher expected excess returns for the next 12 months compared to respondents in the DOWN treatment (Column 1). This finding holds if we control for respondents' general market return expectations (Column 2). We find similar results for experts' expected excess return in quantitative terms. Table XIX in the Appendix shows that respondents in the UP treatment expect a 3.8 percentage points higher excess return of the MSCI World Climate Action Index over its parent index over the next 12 months compared to those in the DOWN treatment, controlling for respondents' general market return expectations. Over the 10 year horizon, no treatment effect is detectable.

Table VII. Treatment effect of information provision intervention on excess return expectations.

	(1) Exc. return (1y)	(2) Exc. return (1y)	(3) Exc. return (10y)	(4) Exc. return (10y)
Treatment	1.252**	1.273***	1.012	1.012
	(0.12)	(0.12)	(0.12)	(0.12)
Market expectations		1.020***		1.001
		(0.00)		(0.01)
Estimated cut points:				
cut1	0.663***	0.693***	0.288***	0.289***
	(0.05)	(0.05)	(0.03)	(0.03)
cut2	2.301***	2.437***	0.623***	0.624***
	(0.16)	(0.18)	(0.05)	(0.05)
N	1,593	1,593	1,172	1,172
Pseudo R^2	0.00	0.01	0.00	0.00

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The dependent variable is respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 12 months (*Exc. return (1y)*) and 10 years (*Exc. return (10y)*). *Treatment* is a dummy variable that equals 1 if the respondent was assigned to the UP treatment and 0 if the respondent was assigned to the DOWN treatment. *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

We have shown that our information intervention successfully influenced excess return expectations. While it is notoriously difficult to pin down directly that these effects operate via a shift in second-order beliefs, the following arguments speak in favor of this interpretation. First, in Appendix G we document that we indeed successfully shifted respondents' second-order beliefs. Second, an alternative interpretation of our results would be that the intervention affected experts' first-order beliefs instead of their second-order beliefs. Yet, if the information treatment affected experts' first-order beliefs instead of their second-order beliefs, then we should not find a significant treatment effect for survey respondents whose first-order beliefs are already in line with the information provided in the intervention on second-order beliefs. Contrary to this prediction, we find a significant treatment effect on second-order beliefs also for this sub-sample of experts, with an even higher R^2 (see Columns 1 and 3 of Table XXI in the Appendix). Further, Table XXII provides the odds ratios from ordered logit regressions including experts' first-order beliefs as controls (Columns 3 and 4) and clarifies that the treatment effect on second-order

beliefs is robust.

IV. Conclusion

In this paper we make use of a global sample of CFA-certified financial experts to study their beliefs about climate risk pricing and how these beliefs influence their stock return expectations. We designed a tailored and comprehensive survey containing open-ended and structured questions and conducted an information provision experiment among these experts. In addition, we delineate distinct lines of reasoning (mental models) used by financial professionals to interpret and predict the asset pricing implications of climate risks.

Our key results can be summarized as follows. We establish that financial experts hold heterogeneous beliefs on how climate risks are priced. Moreover, we find that these beliefs significantly relate to experts' short-term (1-year) as well as long-term (10-year) return expectations. While there is heterogeneity in beliefs, most survey participants (68%) believe that climate risks are not yet sufficiently reflected in stock prices. There is also substantial disagreement about the persistence of climate risk mispricing. The majority of experts expect the mispricing of climate risks to persist for ten years or more.

Based on the analysis of experts' text responses, we identify distinct lines of reasoning used by financial professionals to interpret and predict the asset pricing implications of climate risks. Broadly, these mental models distinguish between factors related to i) perceived informational constraints, ii) experts' views about other market participants' beliefs (second-order beliefs), and iii) experts' views on the impact of policy measures by governing bodies (e.g., regulation and taxation). We document that the heterogeneity in reasoning about climate change can explain variation in experts' return expectations. Further analysis shows that political ideologies and regional factors are key determinants shaping experts' mental models. However, we find that political preferences only play a major role in North America.

A key insight of our survey and open-text elicitations is that second-order beliefs play

a crucial role in experts' reasoning about climate risks. By means of an online experiment, we provide causal evidence that giving information on the beliefs of other survey participants impacts experts' excess return expectations of the MSCI World Climate Action Index over its parent benchmark index, the MSCI World Index.

Our findings offer rare empirical evidence on the beliefs of financial experts about the current and future ability of financial markets to correctly price climate risks, on the challenges to correct climate risk pricing, as well as on experts' excess return expectations in the short- and long-term. These ingredients can further inform and provide guidance to future theoretical work on climate risk pricing. Moreover, we introduce mental models as microfoundations of finance professionals' heterogeneous expectation formation in the domain of climate finance and establish the important role of second-order beliefs.

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Appendices

A. Coding Manual

A. What is Mispricing?

Mispricing is a divergence between the market price of a stock and the fundamental value of that stock. In theory, the fundamental value of a stock reflects the expected future cashflows of the respective company. In reality, it is very difficult to determine the true fundamental value of a stock.

B. Application: Climate Risks

Climate risks are the potential risks that may arise from climate change or from efforts to mitigate climate change, their related impacts, and their economic and financial consequences. Broadly speaking, climate risks can be physical or regulatory.

Physical climate risks are the damages and losses to property that occur due to the physical consequences of climate change. These physical risks result from acute climatic events, such as flooding, wildfires, and extreme heat, and chronic climatic events like droughts and coastal inundation. All of these can have an impact on the investor, such as a change in earnings or an increase in default risk.

Regulatory risks arise from efforts to mitigate climate change, i.e., from regulatory measures that aim at mitigating climate change. For example, companies extracting fossil fuels (fossil oil, coal) face the threat that, due to their contribution towards global warming, governments might limit or prohibit the extraction in the future (this debate often refers to the concept of "stranded assets").

C. Overview of Categories

1. Political measures and laws (incl. taxes)
2. Transaction costs

3. Liquidity
4. Asymmetric information (e.g., greenwashing)
5. Information/data challenges
   (a) Data quality and availability
   (b) Data processing and methodology
6. Respondent talks about other market participants
   (a) Others think/believe that climate risks are too important for pricing (others put too much weight on climate risks)
   (b) Others think/believe that climate risks are too unimportant for pricing (others put too little weight on climate risks)
   (c) Others have non-standard preferences
   (d) Respondent explicitly mentions words of psychology/behavioral aspects
   (e) Anticipated bail-out
7. Limits to arbitrage
8. Unsure
9. I think no category fits

D. Rules

1. Go through all broad categories and please always select all categories that apply.
2. There is the possibility to mark your classification as "unsure" (last category).
3. As a general rule: if a text mentions the term of the category (even if not explained further), the category should be selected.
4. If you don't think a statement fits any of the categories, read it again. If your view is unchanged, put it in "no category". We don't want to overthink what the participants might have meant...

E. Categories

1 Political measures and laws (incl. taxes)

Definition: All kinds of political interventions/measures (policies, legislation,...).

Mechanisms: Policies or legislation can set incentives for specific behavior (either on the demand or supply side), which makes valuation of stocks differ from a situation without this intervention.

Description: If the survey participant mentions any kind of political/government/state intervention formally (laws, policies, ...) or informally ("political pressure") as a factor driving mispricing.

- Includes any legislation, regulation (examples: EU taxonomy (represents an important step of the EU towards managing sustainable investments and reducing the CO2 emissions), EU regulation that financial providers now must elicit their clients' preferences for sustainable investments, inclusion of sustainability/climate aspects to disclosure standards).
- Includes subsidies.
- Includes taxes.
- Includes measures by related bodies, such as central banks, national banks, ... (examples: the FED, ECB, ...).
- The intervention can be on the country level (US, Germany, ...) or broader level (EU, ...).
- Includes also reasoning about the absence of political intervention (example: "politics is not doing enough", "Republicans do not want to intervene").
- Includes policy risk (example: future legislation is uncertain).

2 Transaction costs

Definition: A transaction cost is any expense incurred when conducting an economic transaction.

Mechanism: Investors often incur high transaction costs while trading stocks. This creates a difference between the cash flow of the stock and the amount of money the investor actually receives. The disparity can affect the market prices of stocks.

Description: If the survey participant mentions any kind of transaction costs as a factor driving mispricing.

- Includes any monetary costs (examples: broker fees, bank charges, commissions, ...).
- Includes any non-monetary costs (effort, time, inconvenience, difficulties in implementation, ...).

3 Liquidity

Definition: The liquidity of a stock is the characteristic describing how easy and fast an investor can sell this stock.

Mechanism: Liquidity risk is the risk that investors won't find a market for their stocks, which may prevent them from buying or selling when they want. This can affect prices. Lower liquidity tends to mean that investors will get worse prices for their investment. Higher liquidity tends to mean that investors will get better prices for their investment.

Description: If the survey participant mentions liquidity or illiquidity, directly or indirectly, as a factor driving mispricing.

- Includes descriptions of not being able to sell / being able to sell.
- Includes descriptions of high/low demand or high/low supply.

4 Asymmetric information (e.g., greenwashing)

Definition: Asymmetric information arises when one party to an economic transaction has more or better information than another and uses that to their advantage. Please also select this category if the term "asymmetric information" is mentioned in the text.

Mechanism: In this setting, asymmetric information may occur between the management of the company and the shareholders. Withholding information or spreading misinformation can make valuation of stocks differ from the fundamental value.

Description: If the survey participant mentions any kind of information asymmetries as a factor driving mispricing.

- Includes managers biasing information (most popular example in this setting: greenwashing).
- Includes managers withholding information.
- Includes misinformation.

- Includes insider information, corruption.

5 Information/data challenges

Broad category: All kinds of challenges with information input and data. This includes challenges arising from climate risk uncertainty.

5.1 Data quality and availability

Definition: Any aspect of data quality or availability about factors that should be priced in.

Mechanism: If data to estimate the impact of a respective factor on future cashflows of the company is poor or not available at all, this factor cannot be valued and priced accurately. This can lead to noise in prices, but in some situations also to systematic under- or overpricing.

Description: If the survey participant mentions any kind of informational challenges that are related to data quality and/or availability as a factor driving mispricing.

- Includes data availability/disclosure (or lack thereof).
- Includes data quality (or lack thereof).
- Includes spread of data/information (e.g., on social media, lobbyism).
- Includes expertise/understanding/research of climate risk (or lack thereof).

5.2 Data processing and methodology

Definition: Any aspect of data processing or methodology.

Mechanism: If market participants do not know how to use information or tools to estimate the impact of a respective factor on future cashflows of the company, this factor cannot be valued and priced accurately. This can lead to noise in prices, but in some situations also to systematic under- or overpricing.

Description: If the survey participant mentions any kind of informational challenges that are related to data processing or methodology as a factor driving mispricing.

- Includes tools or models (or lack thereof).
- Includes methodological consensus (or lack thereof).

6 Respondent talks about other market participants

Broad category: The respondent explicitly or implicitly mentions other market participants in the text.

6.1 Respondent expresses that other market participants think/believe that climate risks are too important for pricing (others put too much weight on climate risks in pricing)

Definition: With "putting too much weight" we mean incorporating climate risks too much in prices.

Mechanism: Too much weight on climate risks can either lead to over- or underpricing – depending on the evaluators' focus and the company's status (examples: evaluating a high carbon intense company, putting too much weight on climate risks likely leads to underpricing; evaluating a company with outstanding climate risk management relative to others, putting too much weight on climate risks likely leads to overpricing).

Description: If the survey participant mentions that other market participants believe that climate risks are too important for pricing or that they put too much weight on climate risks in pricing.

- Example: people focus on climate risks too much.
- Includes perceptions/beliefs/assessments/expectations/opinion of climate risks.
- Includes: they tend to overestimate the impact of climate risks.
- Includes overreaction.
- Includes that there is a hype and hence too much focus on this.

6.2 Respondent expresses that other market participants think/believe that climate risks are too unimportant for pricing (others put too little weight on climate risks in pricing)

Definition: With "putting too little weight" we mean incorporating climate risks too little (or not at all) in prices.

Mechanism: Too little weight on climate risks can either lead to over- or underpricing – depending on the evaluators' focus and the company's status (examples: evaluating a high carbon intense company putting too little weight on climate risks likely leads to overpricing; evaluating a company with outstanding climate risk management relative to

others putting too little weight on climate risks likely leads to underpricing).

Description: If the survey participant mentions that other market participants believe that climate risks are too unimportant for pricing or that they put too little weight on climate risks in pricing.

- Includes perceptions/beliefs/assessments/expectations/opinion of climate risks.
- Includes ignorance/lack of awareness of climate risks.
- Includes climate change denial.
- Includes underestimation of climate risks (or tail events).
- Includes: they tend to underestimate the impact of climate risks.
- Includes underreaction.

6.3 Respondent expresses that other market participants have non-standard preferences

Definition: With "non-standard preference" we mean a preference that is making investors buy or sell a stock based on other than mean-variance characteristics (i.e., classical risk-return trade-off).

Mechanism: Market participants' preferences for a stock (or stock class) can drive demand up or down (e.g., liking green stocks). This demand impacts stock prices.

Description: If the survey participant mentions any kind of non-standard preference as a factor driving mispricing.

- Includes political orientation.
- Includes short-term focus – mentioning of long-term focus of climate change / climate risks and short-term focus of markets. Also includes mentioning of different time horizons.
- Includes mismatch with long time horizon for climate risk.
- Includes sustainability preferences.

6.4 Respondent explicitly mentions words of psychology/behavioral aspects

Definition: Cognitive and/or emotional factors that influence the decision-making process of investors.

Mechanism: Trends and systematic behavior among groups of investors can drive demand up or down (e.g., an investment style gets popular, and everyone wants to invest in it). This demand impacts stock prices.

Description: If the survey participant explicitly mentions any kind of behavioral aspect or investor psychology.

- Includes hype, trend, bubble, herding.
- Includes emotions (example: excitement, ...).
- Includes cognitive biases, irrational behavior, psychology.
- Includes anomalies.
- Includes affect.
- Includes sentiment.

7 Limits to arbitrage

Definition: Arbitrage is the practice of taking advantage of a difference in prices in two or more markets (i.e., buying and selling the same asset on different markets).

Mechanism: Arbitrage gives investors, theoretically, a risk-free profit (profit = difference in price between the different markets). In this context, arbitrage is important, because in a perfect world, arbitrage would always make prices fair, i.e., mispricing disappear: Whenever there is a mispricing in one market, some investors would see it and engage in arbitrage until the price converged to the true price. Limits to arbitrage are factors that slow down arbitrage or even make it impossible. This, in turn, lets mispricing survive over (some) time.

Description: If the survey participant mentions any kind of limits to arbitrage, i.e., reasons why mispricing does not disappear/keeps existing.

- Includes reasons for limits to arbitrage, such as costs that arise when engaging in arbitrage.
- Includes reasons for limits to arbitrage, such as risks that are associated with arbitrage.

8 Unsure Please select this category in case you are very unsure how to classify the text or parts of the text. You can still suggest categories if you want.

9 I think no category fits Please select this category in case you think that no category fits.

8 Unsure Please select this category in case you are very unsure how to classify the text or parts of the text. You can still suggest categories if you want.

9 I think no category fits Please select this category in case you think that no category fits.

B. Experimental Instructions

In the following we provide the full survey as it was implemented in Qualtrics. This is the version for the treatment group UP for analysts, in the randomization where second-order beliefs were elicited early.

Welcome Page



Thank you for participating in this study!

This survey is about your general viewpoints on market pricing and risks, including climate-related risks. If you feel not familiar with a topic, that's fine. Please just give us your best prediction.

This study investigates financial professionals' views on pricing in financial markets and is conducted by Bocconi University, CFA Institute, Maastricht University, University of Amsterdam, and University of Bonn.

Completing the survey will take you about 10 minutes.

Your participation is voluntary and you can withdraw at any time without any reason.

Informed Consent

Informed consent
Please read and consent to the following information. This is information you need in order to provide your informed consent for your participation in this research project:

▼ *Reveal information*

INFORMED CONSENT

The purpose of this document is to supply you with the information you need in order for you to provide your informed consent for your participation in this research project.

Statement of the research being undertaken
The study investigates financial professionals' views on pricing in financial markets.

Procedures and duration
Completing the survey will take you about 10 minutes.

Expected benefits and foreseeable risks
This study does not involve any known physical or emotional risk. The study benefits the advancement of scientific knowledge.

Voluntary participation
Your participation is voluntary and you can withdraw at any time without any reason. You do not have to answer questions you don't want to answer, and withdrawal involves no penalty or loss of benefits.

Compensation

In appreciation of your time and input, those who complete the survey will receive **early access to our results of the study** (approximately 2 weeks after completion). In addition, you have the chance to earn one of 5 vouchers for **your favorite restaurant, worth 250 dollars**, by answering the bonus questions. Those answering the bonus questions and providing a valid email address at the end of this survey will be eligible to be drawn at random to earn one of the five vouchers. In case you earn the voucher, you will be contacted by the research team led by Bocconi University, at which point you can indicate your preferred restaurant.

Deception

This study **does not involve** any kind of deception.

ADDITIONAL INFORMATION: DATA PRIVACY AND MANAGEMENT

We are required to provide participants with certain information to communicate our compliance with General Data Protection Regulation n. 679/2016. UNIVERSITA' COMMERCIALE "LUIGI BOCCONI" (hereinafter referred to as "Bocconi University"), having its registered office in Milano at via Sarfatti 25, hereby declares that it falls within the field of application General Data Protection Regulation n. 679/2016 dealing with the protection of personal data with reference to the use of the data subject's personal data that is being collected as part of this research project.

Researchers' and Ethical Review Board Contact Information

This research is being undertaken by Katrin Gödker (katrin.goedker@unibocconi.it) at Bocconi University, in partnership with CFA Institute, Maastricht University, University of Amsterdam, and University of Bonn.

If participants have any questions about how the research was undertaken, who will have access to and control of the data, and in case participants want to provide feedback, ask questions, or inquire about the results of the study, they should contact the researcher and/or the Data Protection Officer of Bocconi University at DPO@unibocconi.it.

Confidentiality and Security Measures

The scientific data from this research will be collected in this online survey and stored for research purposes only for a period of 10 years on password protected files. In the survey, we will ask some personal questions. Please note, that we will pseudonymize the data after collection by means of unique survey IDs. The data are then completely deidentified and will not reveal your identity.

In the event of publication or presentation, no identifying information will be disclosed. The results will be only published in aggregate form.

Data Sharing
The fully deidentified data from this study may be shared with other researchers for scientific purposes with permission of CFA Institute.

Data about you collected for the purposes of this project and similar future projects may be transferred to and stored at a destination outside the European Economic Area ("EEA"), for example where it is processed by an organisation operating outside the EEA who works for us or for one of our suppliers, or where personal data is processed by one of our suppliers who is based outside the EEA or who uses storage facilities outside the EEA. This process will be subject to appropriate safeguards to protect the security and confidentiality of your Data.

Data Subject's Rights
Data subjects shall have the rights described in the articles 15, 16, 17 and 18 of General Data Protection Regulation n. 679/2016. In particular, for example, data subjects can require accessing to, correcting, erasing the personal data and restricting our data processing activities.

Please note that when data are processed for research purposes the above rights are not absolute, and we may be entitled to refuse requests where exceptions apply. Consider the following, stated in art. 17(3) GDPR, in particular:

- the right to erasure shall not apply when is likely to render impossible or seriously impair the achievement of the objectives of the processing carried out in accordance with art. 89(1) GDPR;
- the right to erasure and to object may not apply when research is carried out for reasons of public interest in the area of public health.

If you have given your consent and you wish to withdraw it, please contact the responsible of the relevant department using the contact details set out below. Please note that where our processing of your personal data relies on your consent and where you then withdraw that consent, its withdrawal shall not cause any effect in the lawfulness of the previously processed Data.

Copyright Statement
Within the context of the research project, you consent that Bocconi University and the researcher edits, copies, archives, disseminates and publishes your contribution to the project. Moreover, in accepting to participate in the project you expressly waive potential copyrights that could emerge from the result of the project, granting Bocconi University and the researchers involved a non-exclusive, free, irrevocable and worldwide license to use your contribution for the purposes indicated above.

If you wish to be aware of the results of the projects, the researcher will make all reasonable steps to inform you, when privacy or other legal concerns do not impede to do so.

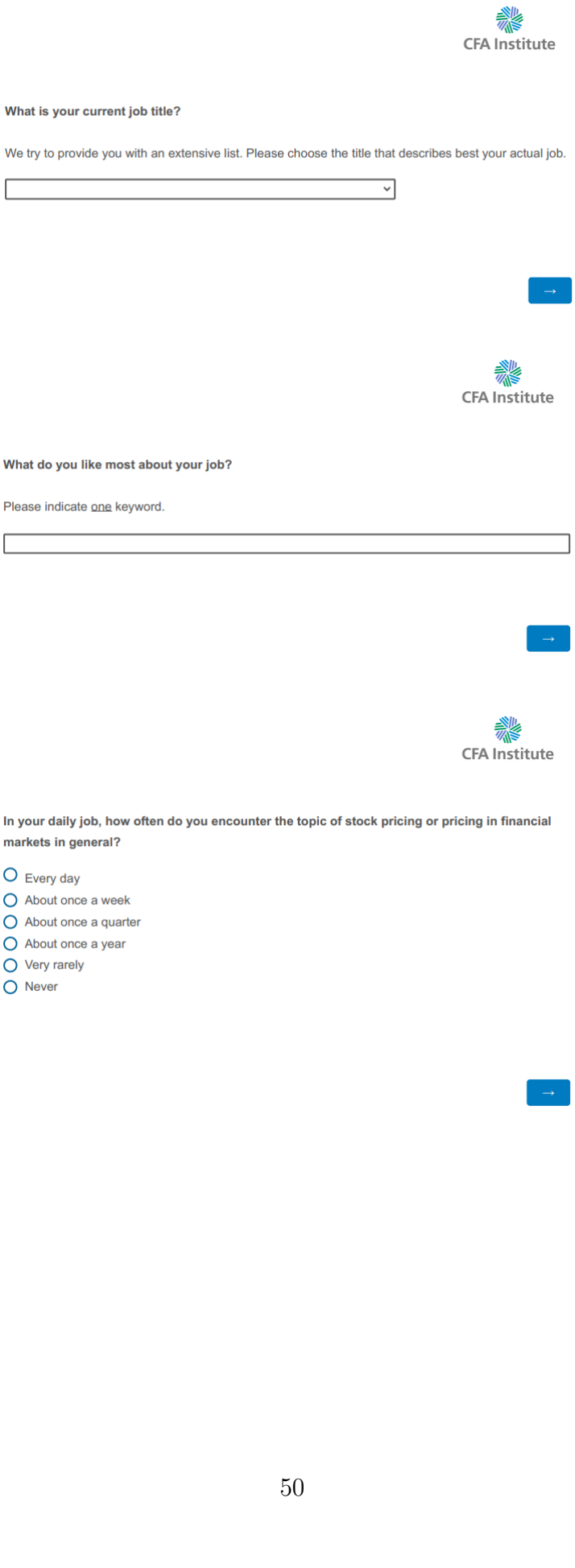
If you have given your consent and you wish to withdraw it, please contact the researcher using the contact details set out above. Please note that where our processing of your personal data relies on your consent and where you then withdraw that consent, its withdrawal shall not cause any effect in the lawfulness of the previously processed Data.

Research Participant Declaration
I confirm that I received the information that precedes (via the *Reveal information* button), and I declare having read and understood its content. I confirm that I am 18 years of age or older, and volunteer to take part in this research. Taking note that my Data are processed in full compliance with the Law, I freely consent to my Data to be used in the manner and uses described. I also declare having understood my rights and limitations, as well as how to exercise them

- ○ I CONSENT to take part in this study.
- ○ I DO NOT CONSENT to take part in this study.

→

Initial Questions



CFA Institute

On the next page, you will encounter an open question in which we will ask you to describe your thoughts and views, using your own words.

From our experience, it can take about **2 minutes** to complete this question. Your responses are very valuable for this research project. Therefore, **please take your time to respond carefully.**

We are interested in what you think, so please describe your views and opinions.

→

CFA Institute

Which factors do you think cause mispricing in financial markets? Please respond in full sentences.

By mispricing we mean prices diverging from the asset's fundamental value (i.e. the present value of future cash flows).

→

CFA Institute

Let's continue with questions about stock pricing. In particular, we are interested in your opinion on the pricing of climate risks.

In your opinion, how important are climate risks for the pricing of company stocks?

- ○ Extremely important
- ○ Very important
- ○ Somewhat important
- ○ Not very important
- ○ Not at all important

→



In the stock market, do prices currently reflect climate-related risks correctly?

Note: Please answer to this question by taking all stocks listed in the US stock market into account.

- ○ Yes, climate-related risks are **fully reflected** in prices
- ○ No, climate-related risks are **reflected too much** in prices
- ○ No, climate-related risks are **not sufficiently reflected** in prices

→



Important: On the next page, you will encounter an open question in which we will ask you to describe your thoughts and views, using your own words.

From our experience, it can take about **2 minutes** to complete this question. Your responses are very valuable for this research project. Therefore, **please take your time to respond carefully**.

We are interested in what you think, so please describe your views and opinions.

→



Which factors do you think cause the deviation from correct pricing of climate risks? Please respond in full sentences.

→

CFA Institute

Do you think that the deviation from correct pricing of climate risks will resolve at some point?

- ○ Yes, in 3 months from now climate risks will be reflected correctly in prices.
- ○ Yes, in 6 months from now climate risks will be reflected correctly in prices.
- ○ Yes, in 1 year from now climate risks will be reflected correctly in prices.
- ○ Yes, in 3 years from now climate risks will be reflected correctly in prices.
- ○ Yes, in 5 years from now climate risks will be reflected correctly in prices.
- ○ Yes, in 10 years from now climate risks will be reflected correctly in prices.
- ○ Yes, in more than 10 years from now climate risks will be reflected correctly in prices.
- ○ No, climate risks will never be fully reflected in prices.

→

Bonus Questions

CFA Institute

Now we start the **bonus questions!** This means that you have a chance to earn one of five vouchers for your favorite restaurant, worth 250 dollars. These questions are flagged with the sign:



The bonus: We ask three bonus questions. After all surveys are completed, the computer will randomly select one of the three questions and the five most accurate respondents to that question, i.e., whose predictions are closest to the truth, will be eligible for a voucher.

→

CFA Institute

We recently surveyed 100 CFA Institute members (e.g., financial analysts, professional asset managers, and CFOs) and asked them the same questions we asked you about pricing. In particular, we asked them whether they think that climate risks are important for the pricing of stocks. Now, we ask you to predict how the CFA members responded to these questions.

→

CFA Institute

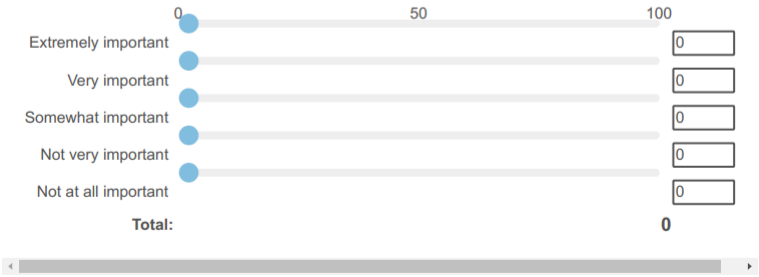


Question 1

The first question we asked was the following:

"Do you think that climate risks are important for the pricing of stocks?"

For each possible option, please estimate how many out of the 100 CFA Institute members we asked gave that answer. Your answers need to sum up to 100.





CFA Institute

BONUS

Question 2

The second question we asked was the following:

"In the stock market, do prices currently reflect climate-related risks correctly?
Note: Please answer to this question by taking all stocks listed in the S&P 500 into account."

For each possible option, please estimate how many out of the 100 CFA Institute members we asked gave that answer. Your answers need to sum up to 100.



→

Investment Approaches

CFA Institute

Investors follow different investment approaches. Below, we show you a list of several investment strategies.

To what extent, do you personally think, are these strategies successful in maximizing an equity investment's rate of return over a specific period of time?

Factor investing, stock selection:

	Investment period of the next 6 months					Investment period of the next 5 years				
	Very successful	Rather successful	Neutral	Not very successful	Not at all successful	Very successful	Rather successful	Neutral	Not very successful	Not at all successful
Value investing	○	○	○	○	○	○	○	○	○	○
Growth investing	○	○	○	○	○	○	○	○	○	○
Investing in small cap	○	○	○	○	○	○	○	○	○	○
Investing in large cap	○	○	○	○	○	○	○	○	○	○
Investing in low beta	○	○	○	○	○	○	○	○	○	○
Fundamental research	○	○	○	○	○	○	○	○	○	○
Other:	○	○	○	○	○	○	○	○	○	○

Timing:

	Investment period of the next 6 months					Investment period of the next 5 years				
	Very successful	Rather successful	Neutral	Not very successful	Not at all successful	Very successful	Rather successful	Neutral	Not very successful	Not at all successful
Momentum investing	○	○	○	○	○	○	○	○	○	○
Mean reversion investing	○	○	○	○	○	○	○	○	○	○
Technical analysis, using charts	○	○	○	○	○	○	○	○	○	○
Other:	○	○	○	○	○	○	○	○	○	○

Passive investing:

	Investment period of the next 6 months					Investment period of the next 5 years				
	Very successful	Rather successful	Neutral	Not very successful	Not at all successful	Very successful	Rather successful	Neutral	Not very successful	Not at all successful
Indexing	○	○	○	○	○	○	○	○	○	○
Smart beta	○	○	○	○	○	○	○	○	○	○
Other:	○	○	○	○	○	○	○	○	○	○

Thematic investing, asset classes:

	Investment period of the next 6 months					Investment period of the next 5 years				
	Very successful	Rather successful	Neutral	Not very successful	Not at all successful	Very successful	Rather successful	Neutral	Not very successful	Not at all successful
Sustainability / ESG integration	○	○	○	○	○	○	○	○	○	○
Emerging markets	○	○	○	○	○	○	○	○	○	○
Crypto currencies	○	○	○	○	○	○	○	○	○	○
Commodities	○	○	○	○	○	○	○	○	○	○
Specific industries (e.g., Tech)	○	○	○	○	○	○	○	○	○	○
Bonds	○	○	○	○	○	○	○	○	○	○

	Investment period of the next 6 months					Investment period of the next 5 years				
	Very successful	Rather successful	Neutral	Not very successful	Not at all successful	Very successful	Rather successful	Neutral	Not very successful	Not at all successful
Other:	○	○	○	○	○	○	○	○	○	○

Other approaches:

	Investment period of the next 6 months					Investment period of the next 5 years				
	Very successful	Rather successful	Neutral	Not very successful	Not at all successful	Very successful	Rather successful	Neutral	Not very successful	Not at all successful
Other:	○	○	○	○	○	○	○	○	○	○

→

Prior Beliefs

CFA Institute

Next, we would like to ask you a few questions about the climate and the environment.

→

CFA Institute

Climate scientists have previously warned that severe effects could occur if the Earth warms more than 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial levels. The Intergovernmental Panel on Climate Change (IPCC) made projections for the development of global warming.

Without strengthening climate policies, what do you think is the current prediction of the Intergovernmental Panel on Climate Change (IPCC) for the rise in global temperatures by 2100 compared to pre-industrial levels?

Please answer in either degrees Celsius or Fahrenheit and specify which unit you mean.

- ○ Degrees Celsius
- ○ Degrees Fahrenheit

→

CFA Institute

Take a guess! According to the National Centers for Environmental Information (NCEI) how much costs in the US were caused by weather and climate disasters in 2021?

As a benchmark: In 2021, the US government spent in total **6.82 trillion USD**. Some examples of spending categories are listed below.

- 796.8 billion USD were spent on health (12%)
- 754.8 billion USD were spent on national defense (11%)
- 696.5 billion USD were spent on Medicare (10%)
- 296.6 billion USD were spent on education, training, and employment (4%)
- 46.9 billion USD were spent on international affairs (1%)

How much do you estimate weather and climate disasters cost the United States in 2021?

Please answer either in million USD or billion USD and specify which unit you mean.

- ○ Million USD
- ○ Billion USD

→

CFA Institute

Next, we are interested in your personal stock market expectations.

What would you expect the return of the S&P 500 to be over the next 12 months? (Please answer in %)

Note: This expected return is the change in value, in percent, that you would expect to **receive over the next 12 months** from investing in a portfolio that holds all stocks listed in the S&P 500. It includes both dividends and capital gains/losses.

Please enter your guess (in percent) and specify whether you mean a percent increase or decrease.

- ○ Percent increase
- ○ Percent decrease

→

CFA Institute

How confident are you with your answer on the previous page?

- ○ Extremely confident
- ○ Very confident
- ○ Somewhat confident
- ○ Not very confident
- ○ Not at all confident

→

CFA Institute

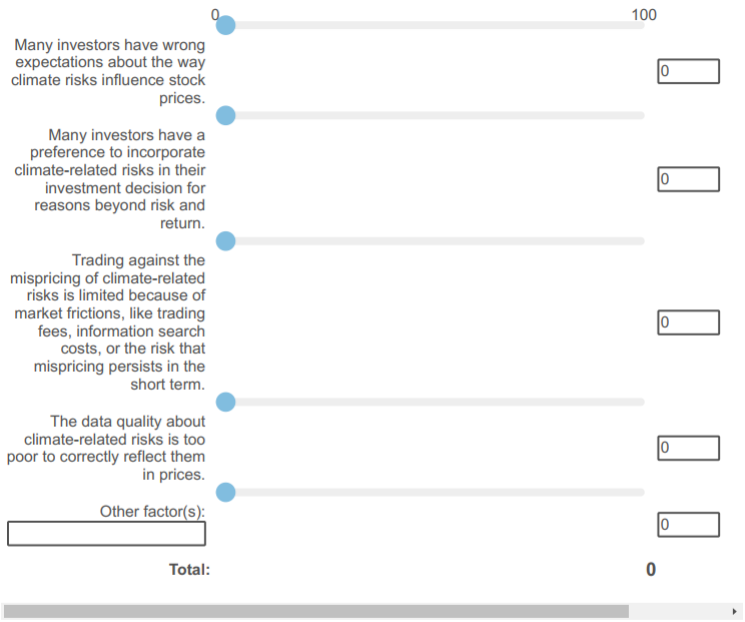
Okay, let's go back to the pricing of climate-related risks. We are interested in learning more about your opinion.

What explains the current pricing of climate-related risks?

Several factors could explain why climate-related risks are currently not correctly reflected in asset prices. We show you a list of four of such factors. In your view, how much did each of these factors contribute to the mispricing of climate risks? Please allocate 100 points based on the importance of each factor. More points means that you consider the factor to be more important.

If you think that none of the mentioned factors are important, please choose "None of these factors."

What explains the current pricing of climate-related risks?



→

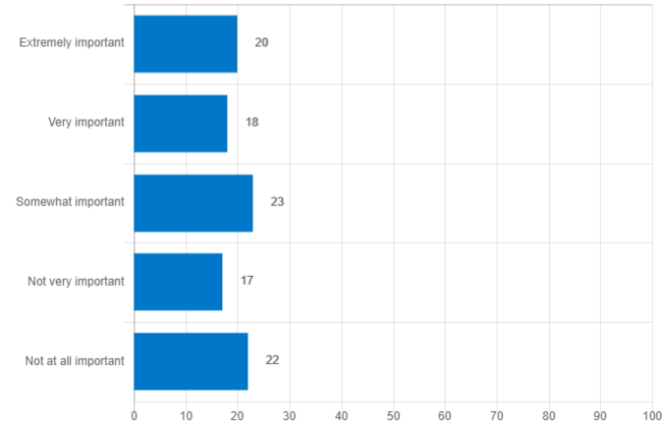
Reminder

CFA Institute

To remind you, we asked you to predict how other CFA Institute members answered to the following two questions.

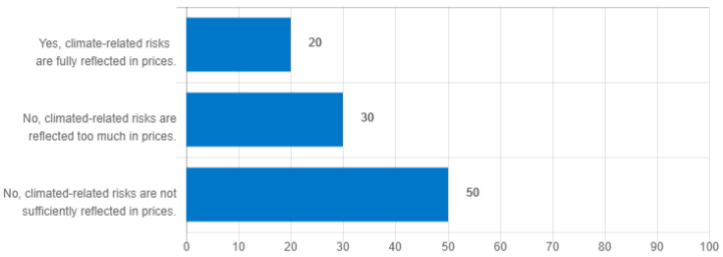
Question 1: *Do you think that climate risks are important for the pricing of stocks?*

Your prediction:



Question 2: *In the stock market, do prices currently reflect climate-related risks correctly?*
Note: Please answer to this question by taking all stocks listed in the S&P 500 into account.

Your prediction:



→

Information Treatment

CFA Institute

Are you interested in how other CFA members think about the pricing of climate risks?

We recently surveyed CFA financial experts. All respondents are international members of the CFA Institute. On the next page, we will provide you with information on their views.

The information: You will not see how all members of the CFA Institute responded to our questions. Instead, you will see how a random subset of 10 respondents answered to the questions.

→

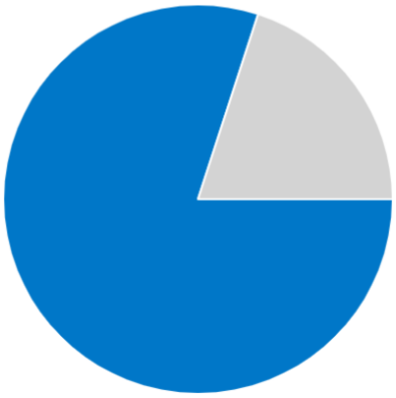
CFA Institute

1) We asked CFA financial experts: How important are climate risks for the pricing of company stocks?

This is what the 10 experts responded:

8 out of 10

CFA members think that climate risks are **important for the pricing** of stocks (somewhat, very, or extremely important).



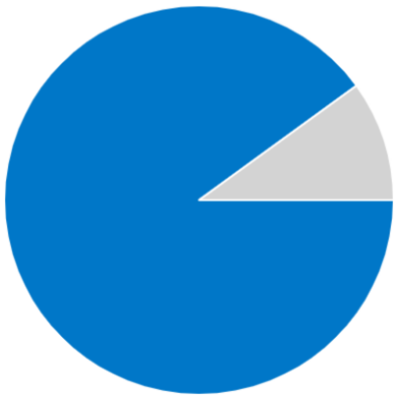
You can continue to the next page in 5 seconds.

CFA Institute

2) We asked CFA financial experts: In the stock market, do prices currently reflect climate-related risks correctly?

This is what the 10 experts responded:

9 out of 10
CFA members think that climate risks are
not sufficiently reflected in prices.



You can continue to the next page in 5 seconds.

→

CFA Institute

In this section, we ask you about your return expectations for a climate-related index.



This is again a **bonus question**! This means that if this task is selected by the computer, you have a chance to earn one of five vouchers for your favorite restaurant, worth 250 dollars.

The bonus: We ask you about your 1-year return expectations for a climate-related index. After exactly 1 year, we will compare your prediction to the true realization and the five most accurate respondents to that question, i.e., whose predictions are closest to the true realization, will receive the voucher.

The **MSCI World Climate Action Index** is designed to represent the performance of MSCI World companies that have been assessed to lead their sector peers in terms of their positioning and actions relative to a climate transition.

Do you expect the return of the MSCI World Climate Action Index to be higher, lower, or about the same compared to the parent index, MSCI World Index, over the next 12 months?

- (●) **Higher**
- ( ) Lower
- ( ) About the same

How many percentage points higher?

As a benchmark, note that the average annual return for MSCI World over the last 45 years was 10.79% (as of end of January 2023).

[ ]

→

CFA Institute

How confident are you with your answer?

- ( ) Extremely confident
- ( ) Very confident
- ( ) Somewhat confident
- ( ) Not very confident
- ( ) Not at all confident

→



This is not a bonus question. But we are also interested in your expectations for the next 10 years.

Do you expect this gap between the MSCI World Climate Action Index' return and the MSCI World Index' return to be different for the average annual returns over the next 10 years?

- ○ Yes, this will change.
- ○ No, this will be the same.

→



Do you expect the return of the MSCI World Climate Action Index to be higher, lower, or about the same compared to the parent index, MSCI World Index, over the next 10 years?

- ● **Higher**
- ○ Lower
- ○ About the same

How many percentage points higher?

As a benchmark, note that the average annual return for MSCI World over the last 45 years was 10.79% (as of end of January 2023).

→

Multiple Price List



Finally, we would like to ask you to respond to a few questions about your job and yourself. Note, these answers are crucial for our study, please answer them carefully. We guarantee the privacy of all the shared information.

→

CFA Institute

Now you have the opportunity to acquire information. We offer you the possibility to **receive an individualized report of our survey results within 2 weeks**. This individualized report contains more information than the other survey respondents receive, and you receive it already in 2 weeks instead of 2 months.

The data report includes:

1. Summary of our **survey results**.
2. How ***your*** **responses compare** to the distribution of responses of a representative sample of CFA Institute members.
3. Related **climate scientific input**: A summary of the recent scientific results on climate risks and possible economic consequences.
4. **Exclusive access to a webinar with an expert panel** discussing the survey results considering recent scientific results on climate risks and possible economic consequences.

We will make you 11 offers. Each time, you can choose to either receive the piece of information or receive a certain amount of money. One of these offers will count and you don't know in advance which of them. Thus, each time you should choose the option you prefer most - information or money.

We will make you 11 offers. Each time, you can choose to either receive the piece of information or receive a certain amount of money. One of these offers will count and you don't know in advance which of them. Thus, each time you should choose the option you prefer most - information or money.

How do your choices matter?
Among all participants of this study, the computer will randomly select 5 additional participants. For these 5 participants **one of the eleven scenarios** will be randomly selected to count. That is, if you get drawn and you decided to receive the piece of information in that specific scenario, you will receive the information. If you decided to receive a certain amount of money in that specific scenario, you will receive the money in form of an amazon gift voucher.

→



Your choices:

Option A			or		Option B
I prefer to receive the information	○	○			I prefer to receive **0.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **20.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **40.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **60.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **80.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **100.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **120.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **140.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **160.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **180.00 EUR**
I prefer to receive the information	○	○			I prefer to receive **200.00 EUR**

→

Subject Identifiers



Could you please provide us with the following information?

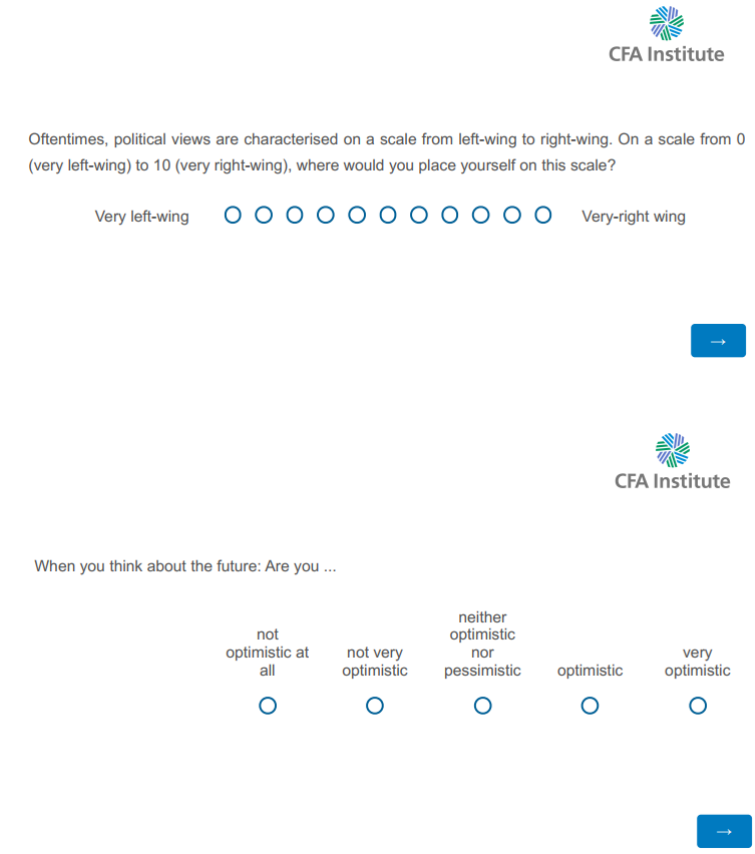
Note, these answers are crucial for our study, please answer them carefully. We guarantee the privacy of all the shared information.

Your IBES analyst code, if available:

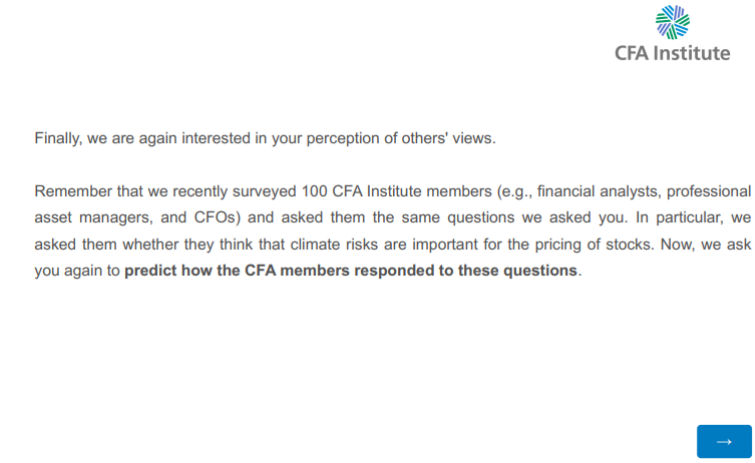
Your Name:

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Covariates



Second-Order Beliefs



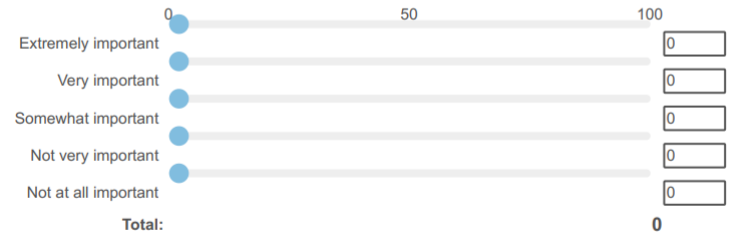
CFA Institute

Question 1

The first question we asked was the following:

"Do you think that climate risks are important for the pricing of stocks?"

For each possible option, please estimate how many out of the 100 CFA Institute members we asked gave that answer. Your answers need to sum up to 100.



→

CFA Institute

Question 2

The second question we asked was the following:

"In the stock market, do prices currently reflect climate-related risks correctly?
Note: Please answer to this question by taking all stocks listed in the S&P 500 into account."

For each possible option, please estimate how many out of the 100 CFA Institute members we asked gave that answer. Your answers need to sum up to 100.



→

End Page



Thank you for participating in our study!

You will receive **early access to our results** for completing the survey.

In addition, for completing the bonus questions, you have the chance to earn one of five vouchers for your favorite restaurant, worth 250 dollars, by providing your email address below.

Separately, if you get drawn for the additional information or money (depending on your choice in the task), we will send you an email within 2 weeks.

If you would like to receive the report of the results and potentially the voucher from Bocconi University, please provide your email address below.

In case you have any questions, please contact us: katrin.goedker@unibocconi.it.

Can Bocconi University contact you again for a follow-up study?

- ○ Yes
- ○ No

→

C. Descriptives

Table VIII. Descriptive statistics for the survey respondents. This table depicts mean values and standard deviations for respondents' socio-demographics and job roles.

N = 1,989	**Mean**	**St. Dev.**
North America	0.51	0.50
Europe	0.25	0.44
Asia	0.19	0.40
Female	0.12	0.32
Age (in years)	44.20	12.50
Analyst job	0.22	0.41
Corporate job	0.12	0.32
Investment job	0.28	0.45
Expertise: encounter pricing (1-6 scale)	5.22	1.26
Expertise: years with CFA (1-6 scale)	3.31	1.79
Political orientation (left to right)	6.15	1.84

Table IX. Job titles of survey respondents.

Job Title	Number of survey respondents	Share of survey respondents
Portfolio Manager	352	17.70%
Research Analyst, Investment Analyst or Quantitative Analyst	235	11.81%
Consultant	125	6.28%
Risk Analyst / Manager	114	5.73%
Chief Investment Officer (CIO)	103	5.18%
Investment Strategist	92	4.63%
Corporate Financial Analyst	82	4.12%
Personal Financial Advisor or Planner	78	3.92%
Chief Executive Officer (CEO)	76	3.82%
Investment Consultant	75	3.77%
Chief Financial Officer (CFO)	69	3.47%
Credit Analyst	66	3.32%
Relationship Manager / Account Manager	65	3.27%
Trader	64	3.22%
Information Technology (e.g. Business Analyst, Quality Assurance)	49	2.46%
Academic	38	1.91%
Accountant or Auditor	32	1.61%
Economist	25	1.26%
Compliance Analyst / Officer	24	1.21%
Sales Agent (Securities, Commodities, Financial Services)	24	1.21%
Performance Analyst	23	1.16%
Business development	14	0.70%
Corporate finance	14	0.70%
Treasury	13	0.65%
Other C-level	12	0.60%
Investment banking	7	0.35%
Regulator	7	0.35%
Board member	5	0.25%
Banker	4	0.20%
Fund director or team	4	0.20%
ESG specialist	3	0.15%
Private equity	3	0.15%
Central banker	2	0.10%
Legal, attorney	2	0.10%
Angel investor, VC	1	0.05%
Investor relations	1	0.05%
Insurance	0	0.00%
Journalist	0	0.00%
Others	86	4.32%
Total	1,989	100%

D. Inter-rater reliability

Table X. Inter-rater reliability across classification categories.

	Agreement in %
Classification category: Political measures and laws	96.98
Classification category: Transaction costs	99.91
Classification category: Liquidity	99.94
Classification category: Asymmetric information (e.g., greenwashing)	99.54
Classification category: Information/data challenges	92.75
Classification category: Information/data challenges - Data quality and availability	90.06
Classification category: Information/data challenges - data processing and methodology	94.52
Classification category: Respondent talks about other market participants	90.84
Classification category: Respondent talks about other market participants (others' beliefs (+))	98.49
Classification category: Respondent talks about other market participants (others' beliefs (-))	92.26
Classification category: Respondent talks about other market participants (others' preferences)	95.74
Classification category: Respondent talks about other market participants (others' bounded rationality)	97.36
Classification category: Respondent talks about other market participants (anticipation of bail-out)	99.91
Classification category: Limits to arbitrage	99.97
Classification category: Unsure	95.33
Classification category: No category fits	96.58

E. Robustness and Additional Analyses

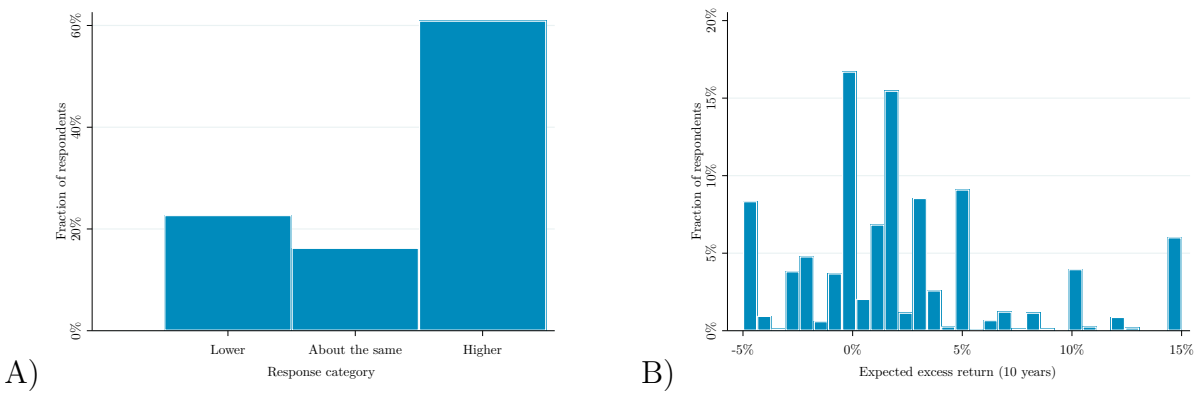


Figure 6. Experts' return expectations (10-year horizon).

Notes: This figure displays histograms of survey respondents' incentivized excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 10 years. Panel A shows how many survey participants reported each ordinal category and Panel B shows the frequency of indicated quantitative expected excess returns in percentage points. The variable is winsorized at the levels 5% and 95% as pre-registered.

Table XI. Experts' climate risk beliefs and quantitative excess return expectations. This table contains the coefficients and robust standard errors (in parentheses) of OLS regressions. The dependent variable is respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months in percentage points. The dependent variable is winsorized at the levels 5% and 95% as pre-registered. *Importance for pricing* is respondents' answer to the question "In your opinion, how important are climate risks for the pricing of company stocks?" on a 5-point Likert scale, ranging from "Not at all important" to "Extremely important. *Reflection in prices* is respondents' answer to the question "In the stock market, do prices currently reflect climate-related risks correctly?" (with response categories: fully reflected in prices, reflected too much, reflected too little). *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1)	(2)	(3)	(4)
	Exc. return (1Y)	Exc. return (1Y)	Exc. return (10Y)	Exc. return (10Y)
Importance for pricing	0.749***	0.719***	1.036***	1.039***
	(0.10)	(0.10)	(0.15)	(0.15)
Reflection in prices	-0.681***	-0.674***	-1.415***	-1.416***
	(0.13)	(0.13)	(0.19)	(0.19)
Market expectations		0.043***		-0.007
		(0.01)		(0.01)
Constant	-1.229***	-1.246***	0.981	0.990
	(0.43)	(0.43)	(0.63)	(0.63)
N	1,989	1,989	1,460	1,460
R^2	0.07	0.08	0.11	0.11

Table XII. Experts' belief about the current level of climate risk pricing.

	(1) Not sufficiently reflected	(2) Too much reflected
Resolve in < 1Y	2.478*	3.975***
	(1.20)	(1.96)
Resolve in >= 10Y	6.047***	1.629***
	(0.86)	(0.28)
Never Resolve Mispricing	3.219***	3.060***
	(0.41)	(0.49)
N	1,989	1,989
R^2	0.09	0.03

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of logit regressions. The dependent variables are *Not sufficiently reflected* which is a dummy variable that equals 1 if the respondent indicated the belief that climate-related risks are not sufficiently reflected in prices and 0 otherwise and *Too much reflected* which is a dummy variable that equals 1 if the respondent indicated the belief that climate-related risks are too much reflected in prices and 0 otherwise. *Resolve Mispricing in < 1Y* is a dummy variable that equals 1 if the respondent indicated the belief that climate risks will be reflected correctly in prices in less than a year (answer options: "in 3 months from now" and "in 6 months from now") and 0 otherwise. *Resolve Mispricing in >= 10Y* is a dummy variable that equals 1 if the respondent indicated the belief that climate risks will be reflected correctly in prices in 10 years or more (answer options: "in 10 years from now" and "in more than 10 years from now") and 0 otherwise. *Never Resolve Mispricing* is a dummy variable that equals 1 if the respondent indicated the belief that climate risks will never be reflected correctly in prices and 0 otherwise. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

Table XIII. Climate risk pricing factors and expected excess returns - coder 1.

	(1) Reflected	(2) Reflected	(3) Exc. return (1y)	(4) Exc. return (1y)	(5) Exc. return (10y)	(6) Exc. return (10y)
Factor Data						
Challenge	0.078***	0.087***	1.611***	1.520***	2.114***	1.945***
	(0.01)	(0.02)	(0.14)	(0.14)	(0.24)	(0.23)
Factor Others' Beliefs						
(too much weight)	45.394***	36.435***	0.429***	0.447***	0.487**	0.478**
	(20.97)	(17.06)	(0.10)	(0.11)	(0.15)	(0.15)
Factor Others' Beliefs						
(too little weight)	0.029***	0.034***	1.693***	1.539***	2.910***	2.799***
	(0.01)	(0.01)	(0.18)	(0.17)	(0.42)	(0.43)
Factor Others'						
Preferences						
(short-termism)	0.279***	0.285***	0.983	0.973	2.140***	2.173***
	(0.08)	(0.08)	(0.13)	(0.13)	(0.39)	(0.41)
Factor Bounded						
Rationality (hype)	2.997***	3.442***	0.704*	0.717*	1.457	1.389
	(1.21)	(1.35)	(0.13)	(0.14)	(0.43)	(0.42)
Factor Policy						
Measures	0.526**	0.552**	0.931	0.965	0.855	0.859
	(0.15)	(0.15)	(0.13)	(0.14)	(0.14)	(0.15)
Market expectations	0.986***	0.985***	1.017***	1.016***	1.002	1.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Female		0.888		1.325**		1.499**
		(0.15)		(0.18)		(0.27)
Political orientation						
(left to right)		1.222***		0.932***		0.898***
		(0.04)		(0.02)		(0.03)
Age (in years)		1.010**		0.992**		0.992*
		(0.00)		(0.00)		(0.00)
Estimated cut points:						
cut1	0.570***	3.322***	0.791***	0.358***	0.551***	0.190***
	(0.04)	(1.04)	(0.06)	(0.08)	(0.06)	(0.06)
cut2	3.010***	17.769***	2.746***	1.238	1.275**	0.453**
	(0.20)	(5.57)	(0.20)	(0.29)	(0.13)	(0.14)
N	1,989	1,886	1,989	1,886	1,460	1,391
Pseudo R^2	0.29	0.30	0.02	0.03	0.05	0.06

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The classifications of experts' text responses are restricted to those by coder 1. The dependent variables are *Reflected*: respondents' answer to the question "In the stock market, do prices currently reflect climate-related risks correctly?" (with response categories: reflected too little, fully reflected in prices, reflected too much), *Exc. return (1y)*: respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months in ordinal categories (with 0="lower", 1="about the same", 2="higher") and *Exc. return (10y)*: respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 10 years in ordinal categories (with 0="lower", 1="about the same", 2="higher"). *Factor* variables are dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *Female* equals 1 if the respondent is female and 0 otherwise. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *Age* is respondents' age in years. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

Table XIV. Climate risk pricing factors and expected excess returns - coder 2.

	(1) Reflected	(2) Reflected	(3) Exc. return (1y)	(4) Exc. return (1y)	(5) Exc. return (10y)	(6) Exc. return (10y)
Factor Data						
Challenge	0.076***	0.077***	1.465***	1.420***	1.807***	1.744***
	(0.01)	(0.01)	(0.13)	(0.13)	(0.20)	(0.20)
Factor Others' Beliefs						
(too much weight)	50.848***	43.345***	0.464***	0.509***	0.299***	0.316***
	(23.39)	(18.93)	(0.10)	(0.11)	(0.08)	(0.09)
Factor Others' Beliefs						
(too little weight)	0.049***	0.057***	1.634***	1.541***	2.478***	2.371***
	(0.01)	(0.02)	(0.16)	(0.16)	(0.34)	(0.34)
Factor Others'						
Preferences						
(short-termism)	0.039***	0.036***	1.151	1.167	2.816***	2.835***
	(0.02)	(0.02)	(0.17)	(0.19)	(0.61)	(0.66)
Factor Bounded						
Rationality (hype)	1.028	1.098	0.852	0.837	1.484	1.531*
	(0.39)	(0.41)	(0.14)	(0.14)	(0.36)	(0.39)
Factor Policy						
Measures	0.897	0.985	0.886	0.880	0.728	0.687*
	(0.31)	(0.33)	(0.15)	(0.16)	(0.15)	(0.15)
Market expectations	0.993	0.992	1.016***	1.016***	0.998	0.998
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Female		0.838		1.353**		1.469**
		(0.16)		(0.18)		(0.26)
Political orientation						
(left to right)		1.221***		0.937***		0.896***
		(0.04)		(0.02)		(0.03)
Age (in years)		1.013***		0.992**		0.990**
		(0.00)		(0.00)		(0.00)
Estimated cut points:						
cut1	0.676***	4.350***	0.752***	0.351***	0.463***	0.152***
	(0.05)	(1.31)	(0.05)	(0.08)	(0.04)	(0.05)
cut2	3.725***	24.840***	2.597***	1.211	1.072	0.364***
	(0.28)	(7.79)	(0.18)	(0.28)	(0.10)	(0.11)
N	1,989	1,886	1,989	1,886	1,460	1,391
Pseudo R^2	0.31	0.33	0.02	0.03	0.05	0.06

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The classifications of experts' text responses are restricted to those by coder 2. The dependent variables are *Reflected*: respondents' answer to the question "In the stock market, do prices currently reflect climate-related risks correctly?" (with response categories: reflected too little, fully reflected in prices, reflected too much), *Exc. return (1y)*: respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 12 months in ordinal categories (with 0="lower", 1="about the same", 2"higher") and *Exc. return (10y)*: respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index, over the next 10 years in ordinal categories (with 0="lower", 1="about the same", 2="higher"). *Factor* variables are dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *Female* equals 1 if the respondent is female and 0 otherwise. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *Age* is respondents' age in years. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

Table XV. Political orientation and mental models of experts in North America. Notes: This table contains the odds ratios and robust standard errors (in parentheses) of logit regressions. The sample is limited to respondents who work in North America. The dependent variables are *Factor* dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1) Data Challenge	(2) Others' Beliefs (+)	(3) Others' Beliefs (-)	(4) Others' Pref.	(5) Bounded Rat.	(6) Policy
Political orientation (left to right)	0.843***	1.405***	0.787***	0.871***	1.065	1.052
	(0.03)	(0.09)	(0.03)	(0.05)	(0.07)	(0.05)
N	974	974	974	974	974	974
R^2	0.02	0.05	0.03	0.01	0.00	0.00

Table XVI. Political orientation and mental models of experts in Europe. Notes: This table contains the odds ratios and robust standard errors (in parentheses) of logit regressions. The sample is limited to respondents who work in Europe. The dependent variables are *Factor* dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1) Data Challenge	(2) Others' Beliefs (+)	(3) Others' Beliefs (-)	(4) Others' Pref.	(5) Bounded Rat.	(6) Policy
Political orientation (left to right)	1.001	0.986	0.951	1.058	0.889	0.880
	(0.05)	(0.13)	(0.05)	(0.09)	(0.09)	(0.07)
N	487	487	487	487	487	487
R^2	0.00	0.00	0.00	0.00	0.01	0.01

Table XVII. Political orientation and mental models of experts in Asia. Notes: This table contains the odds ratios and robust standard errors (in parentheses) of logit regressions. The sample is limited to respondents who work in Asia. The dependent variables are *Factor* dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1) Data Challenge	(2) Others' Beliefs (+)	(3) Others' Beliefs (-)	(4) Others' Pref.	(5) Bounded Rat.	(6) Policy
Political orientation (left to right)	1.002	0.708*	0.963	0.966	1.006	0.873
	(0.06)	(0.14)	(0.06)	(0.08)	(0.12)	(0.07)
N	377	377	377	377	377	377
R^2	0.00	0.03	0.00	0.00	0.00	0.01

Table XVIII. Political orientation as a determinant of second-order beliefs. This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The dependent variables are experts' second-order beliefs about how other CFA Institute members view the importance of climate risks for the pricing of stocks (Second-order belief Importance) and to what extent climate risks are currently reflected in prices (Second-order belief Reflected). *Political orientation* is respondents' self-reported political orientation on a scale from 0 (very left-wing) to 10 (very right-wing). *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1) Second-order belief Importance	(2) Second-order belief Reflection
Political orientation (left to right)	1.023	1.086***
	(0.02)	(0.03)
Estimated cut points:		
cut1	0.058***	5.854***
	(0.01)	(1.17)
cut2	0.201***	12.765***
	(0.03)	(2.68)
cut3	1.512***	
	(0.23)	
cut4	5.704***	
	(0.90)	
N	1,905	1,905
Pseudo R^2	0.00	0.00

Table XIX. Treatment effect of information provision intervention on excess return expectations (quantitative). This table contains the coefficients and robust standard errors (in parentheses) of OLS regressions. The dependent variables are respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 12 months (*Exc. return (1y, quant.)*) and respondents' reported excess return expectations of the MSCI World Climate Action Index over its parent index, the MSCI World Index over the next 10 years (*Exc. return (10y, quant.)*) in percentage terms. *Treatment* is a dummy variable that equals 1 if the respondent was assigned to the UP treatment and 0 if the respondent was assigned to the DOWN treatment. *Market expectations* is respondents' return expectations of the market (S&P500) over the next 12 months in percentage points. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1)	(2)
	Exc. return (1y, quant.)	Exc. return (10y, quant.)
Treatment	1.462*	0.756
	(0.30)	(0.21)
Market expectations	1.062***	1.017
	(0.01)	(0.02)
N	1,593	1,172
R^2	0.03	0.00

Table XX. Experts' mental model factors from open-text responses and a structured elicitation method. This table contains the coefficients and robust standard errors (in parentheses) of linear regressions. The dependent variables capture the structured elicitation outcome and are respondents' importance weights allocated to the respective explanatory factor for climate risk mispricing (between 0 and 100). The independent variables are *Factor* dummy variables indicating 1 if the respondents' text responses were classified as mentioning the respective climate risk pricing factor, and 0 otherwise. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively.

	(1) Data (SEL)	(2) Others' Beliefs (SEL)	(3) Others' Beliefs (SEL)
Factor Data Challenge	8.592***		
	(1.16)		
Factor Others' Beliefs (too much weight)		-3.637	
		(2.25)	
Factor Others' Beliefs (too little weight)			5.299***
			(1.18)
Constant	27.657***	30.864***	28.853***
	(0.90)	(0.57)	(0.65)
N	1,622	1,622	1,622
R^2	0.03	0.00	0.01

Table XXI. Manipulation check conditional on first-order beliefs.

	(1) Importance (sec., post) A	(2) Importance (sec., post) NA	(3) Reflection (sec., post) A	(4) Reflection (sec., post) NA
Treatment	4.863***	7.773***	0.261***	0.428***
	(0.94)	(1.54)	(0.04)	(0.13)
Estimated cut points:				
cut1	0.108***	0.389***	1.872***	0.977
	(0.02)	(0.05)	(0.18)	(0.19)
cut2	0.408***	1.778***	6.664***	6.965***
	(0.06)	(0.23)	(0.83)	(1.79)
cut3	1.611***	7.764***		
	(0.25)	(1.29)		
cut4	6.456***	21.443***		
	(1.21)	(4.17)		
N	388	462	979	200
Pseudo R^2	0.06	0.09	0.05	0.02

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The dependent variables are respondents' post-treatment second-order beliefs whether climate risks are important for pricing (*Importance*) and about the level of pricing of climate risks (*Reflected*). Columns 1 and 3 are restricted to respondents who indicate first-order beliefs that are in line with the UP information treatment, i.e., beliefs in high importance of climate risks for pricing (response >3) and not sufficient reflection in current prices. Columns 2 and 4 are restricted to respondents who indicate first-order beliefs that are not in line with the UP information treatment, i.e., beliefs in low importance of climate risks for pricing (response <3) and too much reflection in current prices. *Treatment* is a dummy variable that equals 1 if the respondent was assigned to the UP treatment and 0 if the respondent was assigned to the DOWN treatment. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.

F. Experts' second-order beliefs

Figure 7 depicts experts' first- and second-order beliefs. Although our survey respondents correctly predict colleagues' beliefs that climate risks are not sufficiently reflected in prices (Panel B), they overestimate colleagues' beliefs whether climate risks are important for pricing (Panel A). The mean reported first-order belief about the importance of climate risks for pricing of stocks is 2.92 and the mean reported second-order belief is significantly higher at 3.23 (T-test, $p < 0.001$). In other words, financial experts in our sample believe that other experts report a higher relevance of climate risks for the pricing of stocks than they actually report.

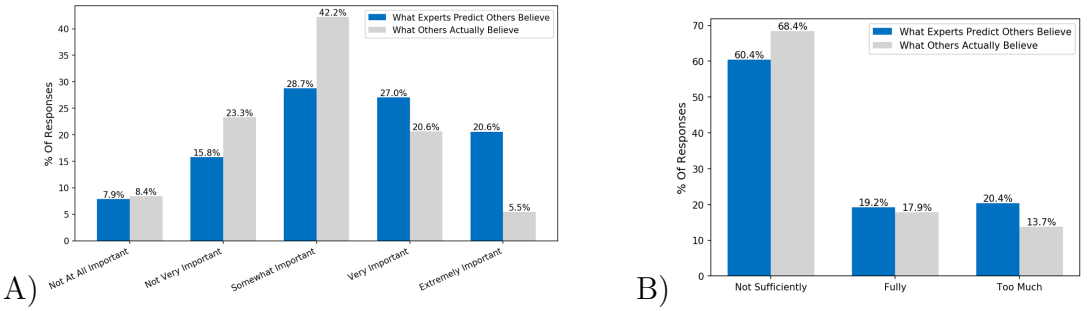


Figure 7. Experts' first- and second-order beliefs about climate risks and pricing.

Notes: This figure displays histograms of survey respondents' first- and second-order climate risk beliefs. Panel A shows how many survey participants reported each ordinal category for the question "In your opinion, how important are climate risks for the pricing of company stocks?" and Panel B shows how many survey participants reported each ordinal category for the question "In the stock market, do prices currently reflect climate-related risks correctly?", both for own first-order beliefs and incentivized predictions of other CFA Institute members' beliefs (i.e., second-order beliefs).

G. Manipulation check

This table provides odds ratios from ordered logit regressions of models with participants' second-order beliefs after the treatment as dependent variables. The treatment dummy indicates whether the respondent was in the UP treatment, compared to being in the DOWN treatment. The odds ratios shows that after the treatment, respondents in the UP treatment were more likely to report higher second-order beliefs of importance of climate risks for pricing (Column 1) and lower second-order beliefs of reflection of climate risks in prices (Column 2) compared to respondents in the DOWN treatment. Hence, our intervention was successful in manipulating experts' second-order beliefs.

Table XXII. Manipulation check.

	(1) Importance (sec., post)	(2) Reflection (sec., post)	(3) Importance (sec., post)	(4) Reflection (sec., post)
Treatment	5.402***	0.298***	5.797***	0.279***
	(0.57)	(0.04)	(0.60)	(0.03)
Importance for pricing			1.677***	
			(0.10)	
Reflection in prices				1.752***
				(0.12)
Estimated cut points				
cut1	0.189***	1.272***	0.790	2.878***
	(0.02)	(0.09)	(0.14)	(0.36)
cut2	0.771***	3.673***	3.449***	8.612***
	(0.06)	(0.31)	(0.61)	(1.16)
cut3	3.507***		16.955***	
	(0.31)		(3.23)	
cut4	12.968***		65.818***	
	(1.40)		(13.75)	
N	1,461	1,435	1,461	1,435
Pseudo R^2	0.06	0.05	0.09	0.07

Notes: This table contains the odds ratios and robust standard errors (in parentheses) of ordered logit regressions. The dependent variables are respondents' post-treatment second-order beliefs whether climate risks are important for pricing (*Importance*) and about the level of pricing of climate risks (*Reflected*). *Treatment* is a dummy variable that equals 1 if the respondent was assigned to the UP treatment and 0 if the respondent was assigned to the DOWN treatment. *, **, and *** denote significance at the 10%, the 5%, and the 1% level, respectively, testing for differences from 1.