

Institutional Investors' Views and Preferences on Climate Risk Disclosure

Emirhan Ilhan

Philipp Krueger

Zacharias Sautner

Laura T. Starks

April 2019

Abstract

We survey institutional investors on firm-level climate risk disclosure. Many investors believe that climate risk reporting is as important as traditional financial reporting. However, current quantitative and qualitative disclosures on climate risks are regarded as being insufficient and imprecise. Many investors believe that climate reporting should be mandatory and more standardized. Disclosure is seen as more important for assessing physical climate risks, and less important for regulatory risks. Investors that believe that current climate-related disclosures are deficient perceive stronger underpricing of climate risks in equity markets.

Emirhan Ilhan is at the Frankfurt School of Finance & Management (e.ilhan@fs.de). Philipp Krueger is at the University of Geneva and the Swiss Finance Institute (Philipp.Krueger@unige.ch). Zacharias Sautner is at the Frankfurt School of Finance & Management (z.sautner@fs.de). Laura T. Starks is at the McCombs School of Business, University of Texas at Austin (Laura.Starks@mcombs.utexas.edu).

1. Introduction

The efficiency of financial markets relies on timely and accurate information about the exposure of firms to important risks. Many firms increasingly face risks related to climate change, originating from natural disasters or regulation to combat a global rise in temperature (Litterman 2016, Krueger, Sautner, and Starks 2019). High-quality information on firms' exposures to climate risks has therefore become relevant for investors to make informed investment decisions, and for markets to correctly price the risks and opportunities related to climate change.

However, many regulators and investors argue that climate risk disclosure is currently insufficient. For example, Mark Carney, Governor of the Bank of England, demanded that more needs to be done *“to develop consistent, comparable, reliable and clear disclosure around the carbon intensity of different assets”* (Carney 2015). In a similar spirit, Anne Stausboll, former CEO of CalPERS, argued that *“consistent and comparable corporate disclosure of material climate issues is critical [and that] investors require better climate disclosure”* (Stausboll 2014). More recently, Yngve Slyngstad, CEO of Norges Bank Investment Management, echoed these concerns by commenting on the difficulty of obtaining climate risk-related data: *“The only surprise [...] is how hard it is to get the data [...] I think it will take years to get good data from the majority of companies we are invested in.”*¹

To address potential shortcomings in current climate disclosures, regulators, governments, and NGOs started to take actions aimed at improving firm-level reporting on climate risks. For instance, the Financial Stability Board initiated in 2015 the Task Force on Climate-related Financial Disclosures (TCFD), with the objective to develop voluntary climate-related financial risk disclosures. In a similar spirit, CDP collects climate-related information by means of a voluntary questionnaire on behalf of investors representing over \$87tr in assets under management. On top of these largely voluntary initiatives, U.K. securities law mandates since 2013 the disclosure of carbon emissions for

¹ See “Norway wealth fund builds tool to analyze climate risk to portfolio,” *Reuters Market News*, October 31, 2018.

quoted companies (see Krueger 2015; Jouvenot and Krueger 2019), and U.S. lawmakers are currently developing mandatory climate-risk disclosure.² In France, institutional investors are required since 2016 by law to report the carbon footprints of their investment portfolios.

While these initiatives suggest that investors increasingly require climate-related information for their decision making, little systematic evidence exists on institutional investors' beliefs with respect to such disclosures. In this paper, we directly survey institutional investors about their views and preferences with respect to climate-related disclosures. We are able to link the survey responses to data on investor characteristics which we also collect by means of the survey. The main benefit of our survey is that it allows us to shed light on important climate-related investor perspectives and actions that cannot be studied using archival data. Our respondent group consists of important decision makers at some of the world's largest investors. About one-third of the respondents works at the executive level in their institutions, and 11% work for institutions with more than \$100bn in assets under management. Surveys are increasingly used in the finance literature, enabling better understandings of such topics as corporate financing (Graham and Harvey 2001), investor activism (McCahery, Sautner, and Starks 2016), investor relations (Karolyi and Liao 2017), or ESG investing (Amel-Zadeh and Serafeim 2018).

In the first part of the analysis, we survey investors' views regarding the importance of firm-level climate reporting, the shortcomings of available reporting, and the need for mandatory and standardized reporting. This analysis enables us to identify areas on which firms or regulators should focus to satisfy the disclosure demands of investors. In the second part, we provide some first evidence on the relation between investor beliefs regarding the quality of current climate disclosures and perceived climate risk mispricing in equity markets. In the third part, we address important recent

² Recently, the *Climate Risk Disclosure Act of 2018* was introduced in the U.S. Senate, with the objective to introduce mandatory climate disclosure. If accepted, the bill would require firms to disclose greenhouse-gas emissions, risk-management strategies to address climate change, and discussion about how climate change affects valuations in different climate scenarios.

developments in climate disclosure, namely disclosure-motivated engagement with portfolio firms and the disclosure of the investors' own portfolio-level carbon footprint.

Reporting on non-financial information can have benefits and costs (Christensen, Hail, and Leuz 2019), so it is theoretically ambiguous whether investors attribute value to climate risk disclosure by firms. For example, while such reporting may increase stock liquidity, reduce a firm's costs of capital, and make the pricing of risks more efficient, it may also allow competitors to infer proprietary information about a firm's future strategy (e.g., if future CO₂ emission targets are disclosed).

Our institutional investors share a strong general belief that climate disclosure is important. In fact, 51% of respondents believe that climate risk reporting is as important as traditional financial reporting, and almost one-third even considers it to be more important. Only 22% of respondents regard climate reporting as less (or much less) important compared to financial reporting. Climate disclosure is perceived as more important among those investors who also believe more strongly that climate risks are important, and among those who expect larger global temperature increases due to climate change.

Climate change can affect the portfolio firms through three channels. Physical climate risks arise because of adverse effects of changes in the physical climate (e.g., temperatures increases). Technological climate risks originate from climate-related innovations that disrupt traditional producers (e.g., when electric car manufacturers may displace traditional manufacturers), and regulatory risks result from costs associated with changes in policies or regulations to combat climate change (e.g., carbon taxes).

Climate disclosure is deemed most important by those investors that worry strongly about the financial consequences of these three types of climate risks for their portfolio firms. In terms of their relative importance, concerns about physical climate risks matter the most for the perceived importance of climate reporting, while regulatory risks matter the least. An implication of this finding

is that disclosure is likely to be most valuable when it enables investors to better evaluate the physical climate risks of firms. One reason may be that physical risks tend to be more firm and location specific, thus requiring precise information about a firm's exposure to evaluate them correctly. Regulatory risks, on the other hand, are usually more firm-independent and regulator-dependent, and information on such risks may be easier to obtain from sources outside of the firm.

The vast majority of our respondents believe that current quantitative and qualitative disclosures on climate risks are uninformative and imprecise. Many investors also share the view that climate risk reporting should be mandatory and standardized, as it is currently the case with financial reporting. Investors that worry more about the financial effects of climate risks also agree more strongly that there should be more and better disclosure on climate risks. Our respondents also believe that investors should put pressure on firms to disclose more information about their climate risks. This widespread view echoes recent investor initiatives at Exxon Mobil and Occidental Petroleum, where a group of institutions submitted shareholder proposal calling for these firms to share more information on their climate policies.³

Next, we build on recent theoretical work that predicts a link between climate mispricing and disclosure (Daniel, Litterman, and Wagner 2017). Investors' views on the availability and quality of current climate reporting are strongly related to the perceived underpricing of climate risks in equity markets (i.e., climate-related overvaluation of firms). Notably, respondents who believe that current reporting is lacking also observe more mispricing in current equity valuations. An important consequence of this finding is that better disclosure may contribute to the more efficient pricing of climate risks. This implication is consistent with the view expressed by Michael R. Bloomberg, Chair of

³ See "Exxon Shareholders Pressure Company on Climate Risks," *The Wall Street Journal*, May 31, 2017 and "Occidental Shareholders Vote for Climate Proposal," *The Wall Street Journal*, May 31, 2017.

the TCFD, that *“increasing transparency makes markets more efficient, and economies more stable and resilient.”*⁴

In terms of embracing current developments in climate disclosure, the majority of our investors engage or plan to engage portfolio firms to report according to the recommendations of the TCFD.⁵ Further, our respondents indicate support for the French approach to require also reporting on the carbon footprints of the investment portfolios: 60% of respondents either currently disclose or plan to disclose the CO₂ footprints of their portfolios. This result indicates support for ongoing policy efforts at the European Union level that head in the same direction.

In terms of generalizability of our findings, we should note that our respondent group is likely biased toward investors with a relatively high awareness of climate risks. The reason is that such investors are probably more disposed to participate in a climate risk survey. In addition, some of our responses were obtained at ESG conferences. Nevertheless, understanding the views and preferences of such investors is particularly important, because they are more likely to shape future disclosure policies through industry initiatives (e.g., CDP, CERES, or UN-PRI) or lobbying with regulators.

Our paper contributes to a relatively scarce academic literature on climate-related disclosure. Solomon et al. (2011) interview institutional investors who reveal that they use private channels of discourse with their portfolio firms to compensate for the inadequacies of public climate reporting. Matsumura, Prakash, Vera-Muñoz (2014) find that markets discount firms that do not disclose carbon emissions, and Plumlee et al. (2015) find a positive association between disclosure quality and firm value. Ilhan, Sautner, and Vilkov (2019) show that information about carbon risks (if disclosed) are used by investors, as firms with larger carbon emissions exhibit higher tail risk. Matsumura, Prakash,

⁴ See <https://www.fsb-tcfid.org/>.

⁵ These recommendations include disclosing climate-related risks and opportunities and their impact on firms' businesses; how firms governance structures deal with these risks and opportunities; how firms identify, assess, and manage climate risks; and which metrics and targets firms use to assess and manage carbon emissions.

and Vera-Muñoz (2018) analyze voluntary 10-K climate risk disclosures and find that disclosers have lower costs of equity than non-disclosers.

Krueger (2015) examines the valuation effects of the introduction of mandatory greenhouse-gas (GHG) disclosures in the U.K., and shows beneficial valuation effect resulting from the regulation. More recently, Jouvenot and Krueger (2019) examine the real effects of the introduction of mandatory GHG reporting in the U.K. They document strong reductions in carbon emissions for U.K. firms relative to control firms from other jurisdictions. Focusing on the oil and gas industry, Eccles and Krzus (2018) examine to what extent firms disclose information in line with the TCFD recommendations.

Our main contribution to this literature is detailing institutional investors' views and actions on climate-related disclosures. More generally, we also contribute to the literature on non-financial (or sustainability) reporting, of which climate risks are an important component. Christensen, Hail, and Leuz (2019) review the current literature on sustainability reporting.

2. Methodology and Survey Design

2.1 Survey Development and Delivery

We used both an online and a paper version of the survey that we distributed through four delivery channels, yielding a total of 439 responses.⁶ First, we personally distributed the paper version of the survey at four institutional investor conferences: The Sustainable Investment Conference in Frankfurt on November 9, 2017; the ICGN Paris Event on December 6-7, 2017; the Asset Management with Climate Risk Conference at Cass Business School in London on January 23, 2018; and the ICPM Conference in Toronto on June 10-12, 2018. We obtained a total of 72 responses from these four conferences.

⁶ The survey instrument is provided in the Internet Appendix. We used an iterative process for developing the survey. Details of this process are provided in Krueger, Sautner, and Starks (2019). The original survey also contained questions on climate risk management and shareholder engagement, which are covered in Krueger, Sautner, and Starks (2019).

Second, we distributed the online version of the survey to 1,018 individuals in senior functions at institutional investors. We identified these individuals using the help of a survey service provider that manages a global panel of more than 5m registered professionals. The panel contains detailed data on these individuals' job titles and their age to identify relevant subsamples. The provider invited these individuals in March 2018 to participate in the survey and we obtained 410 initial responses. We then excluded 90 participants that took less than five minutes to complete the survey and participants for which basic checks yielded logical inconsistencies in the responses (Meade and Craig 2012). This process left us with 320 responses of good quality. These respondents took on average 15 minutes to complete the survey. The service provider had several mechanisms in place to ensure the authenticity of the participants.

Third, in April 2018, we emailed invitations to participate in the survey to a list of institutional investors that cooperate with a major asset owner through CERES and IIGCC on climate risk topics. We obtained 28 responses through this channel. Fourth, we sent invitations to participate in the online survey to personal contacts at different institutional investors, yielding 19 additional responses.

We are confident that in the vast majority of cases we have only one observation per institution. The reason is that, for 87% of the observations, key identifying characteristics do not coincide.⁷ In the remaining cases we cannot exclude the possibility that respondents work for the same institution. However, the responses are sufficiently different among these respondents to discount that possibility with some degree of assurance. We provide a discussion of potential survey response bias in Krueger, Sautner, and Starks (2019).

2.2 Respondent Characteristics

Table 1 provides an overview of the characteristics for our respondent groups. The largest numbers of respondents are fund or portfolio managers (21%), followed by executive or managing

⁷ These characteristics are location, assets under management, institutional investor type, investor horizon, ESG share (+/-10% variation in the variable), equity share (+/-10%), and passive share (+/-10%).

directors (18%). About one-third works at the executive level in their institutions, as CIO (11%), CEO (10%), or in related functions (10%). Most respondents work for asset managers (23%) and banks (22%), followed by pension funds (17%), insurance companies (15%), and mutual funds (8%). Our sample includes 23% of respondents that work for institutions with assets between \$20bn and \$50bn, 16% with assets between \$50bn and \$100bn, and 11%, with assets of more than \$100bn.

Only 5% of respondents' institutions typically hold investments for less than six months, 38% have medium holding periods (six months to two years), 38% have long holding periods (two years to five years), and the remaining 18% typically hold investments for more than five years. Our respondent' institutions are headquartered around the world: 32% are located in the U.S., 17% in the U.K. and Ireland, 12% in Canada, and 11% in Germany, among others. The average portfolio share of our respondents' institutions that incorporates ESG aspects is 41%, they invest on average 47% in equities (43% in fixed income), and 38% of their assets are on average passively invested.

Table 2 reports summary statistics of other survey variables that we study in the subsequent sections. These variables will be discussed in detail below.

3. Evidence on Climate Risk Disclosure

3.1 Importance of Climate Risk Disclosure

Reporting on non-financial information through CSR or climate risk reporting can have benefits and costs to investors. On the one hand, non-financial disclosure can increase stock liquidity by alleviating adverse selection among investors (Verrecchia 2001). Reporting on non-financial information can also lower the cost of capital of portfolio firms (Plumlee et al. 2015, Matsumura, Prakash, and Vera-Muñoz 2018) and may allow for a better pricing and hedging of climate risks. On the other hand, non-financial disclosure can be costly to portfolio firms if it reveals proprietary information to competitors (Ellis, Fee, and Thomas 2012). Such costs are less relevant for high level or aggregated disclosures, but they can be substantial for detailed disclosures. For example, if a firm

discloses detailed carbon reduction targets, this may allow competitors to infer a firm's future product market strategy. In light of these benefits and costs, it is theoretically ambiguous what importance investors attribute to reporting on climate risks.

To evaluate this theoretical ambiguity, we asked respondents to indicate how important they consider reporting on climate risks *relative to* reporting on financial information (Question B1). The corresponding responses are reported in Figure 1. We find that 51% of respondents believe that climate risk reporting is as important as financial reporting, and almost one-third even considers it to be more important. Interestingly, only 22% of respondents regard climate risk reporting as less or much less important compared to traditional financial reporting. Overall, these figures imply that there is a broad belief that climate reporting is important.

Next, we perform in Table 3 regressions that shed light on how investor beliefs about the relative importance of climate reporting vary in the cross-section. Building on the responses displayed in Figure 1, the dependent variable in the table is an integer-valued measure that varies between one (climate risk reporting is much less important) and five (climate risk reporting is much more important). Across the difference columns in the table, we try to evaluate whether climate reporting is perceived as more important if investors attribute also a higher importance to climate change and its financial impact on portfolio firms.

As a starting point, Column (1) examines whether climate reporting is perceived as more important among investors that attribute a higher general importance to climate risks when investing in firms. We measure the importance of climate risks using *Climate risk ranking*, which is the ranking an investor attaches to climate risk considerations when making investment decisions. To construct this variable, we asked the respondents to indicate the importance of climate risks relative to other investment risks (Question A1).⁸ The resulting rank variable ranges between one (climate risks are

⁸ These other risks included traditional financial risks (e.g., earnings risk), operational risks, governance risks, social risks, and other environmental risks.

most important) and six (climate risks are least important). Summary statistics on this variable are reported in Table 2, and Krueger, Sautner, and Starks (2019) discuss the variable in more detail.

Next to this variable, we control in this and subsequent regressions for investor horizon, investor size, an investor's ESG and passive shares, whether an investor is an independent institution (Ferreira and Matos 2008), and the social and environmental norms in an investor's country (Dyck et al. 2019). We further include fixed effects for the respondents' positions in their institutions and for the distribution channels.

Examining the coefficient estimate on *Climate risk ranking* in Column (1), we find that those investors who rank climate risks higher also believe that climate reporting is more important. The effects are economically meaningful. Compared to the median investor—who regards climate reporting to be just as important as financial reporting—an investor who ranks climate risks one standard deviation higher deems climate reporting 16% $((-0.3 \times -1.6)/3)$ more important.

Next, Column (2) examines whether the respondents' climate change expectations help explain the importance of climate reporting. To elicit expectations, we used the 2°C target of the Paris Climate Accord as an anchor, and then asked the respondents about their own global temperature expectations by the end of this century (Question E1).⁹ Responses could vary between one (no expectation of a temperature rise) and five (more than 3°C expected). Across all respondents, only 3% do not expect any temperature increase by 2100, 16% expect an increase by up to 1°C, and 30% by up to 2°C. Four in ten respondents expect a temperature rise that exceeds the Paris 2°C target, with 12% expecting an increase of more than 3°C.

Personal climate expectations seem to be highly relevant for explaining the perceived importance of climate reporting. Column (2) indicates that investors who expect a higher temperature rise also consider climate reporting to be more important. A standard deviation increase in the

⁹ Under the 2015 Paris Climate Accord, 195 countries agreed to take significant measures to keep the global temperature rise under 2°C by the end of this century.

expected temperature rise, which corresponds to moving up one notch in the possible response category, corresponds to a 10% (0.34/3) higher value for the importance attached to climate disclosures.

Climate change can affect the value of portfolio firms through three channels. Physical climate risks can affect firms because of severe weather events, draughts, or rises in sea levels. Regulatory risks encompass costs that result from regulations aimed at reducing the negative impacts of climate change.¹⁰ Technological risks relate to climate-related technological disruption that may adversely affect portfolio firms. In our survey, we asked the investors to rate the financial materiality of each of these risks and then construct three variables to measure their financial effects (*Regulatory climate risk*, *Physical climate risk*, and *Technological climate risk*). Each of the variables can vary between one (not at all important) and five (very important).

Columns (3) to (5) examine whether the importance of climate disclosure varies across investors based on how financially material they evaluate each of these three risks. Across all columns, we find that investors who deem climate risks more financially material also attach greater importance to climate reporting. This finding is consistent with Amel-Zadeh and Serafeim (2018) who find that investment professionals consider ESG information whenever they consider it financially material to investment performance. Most interestingly, the three coefficient estimates differ substantially in magnitude. The estimate in Column (4) on *Physical climate risk* is almost 2.5 times as large as the estimate on *Regulatory climate risk* in Column (3). In a similar but less pronounced way, the estimate on *Technological climate risks* in Column (5) is substantially larger than the estimate on *Regulatory climate risk* in Column (3).¹¹ These differences suggest that disclosure is seen as most important when it comes to physical climate risks, followed by technological and then regulatory risks.

¹⁰ Examples for such regulation include a carbon tax such as the one proposed in the *Washington Initiative 1631*.

¹¹ As the distribution of the three risk variables is almost identical (see Table 2), we can directly compare the coefficient estimates to evaluate their relative importance. The coefficient on *Regulatory climate risk* is

The strong role of physical risks in explaining the importance of climate disclosure may be because such risks tend to be more firm and location specific, requiring relatively precise information about a firm's exposure to evaluate them. Regulatory climate risks, on the other hand, are more firm-independent and regulator-dependent, and information on such risks may be easier to obtain since firms in the same industry and country face similar regulatory risks (e.g., information could also be obtained from competitors). In addition, Krueger, Sautner, and Starks (2019) show that a relatively large fraction of investors believe that regulatory climate risks have already started materializing, while physical and technological risks are expected to materialize over longer horizons only. The more immediate character of regulatory risks might therefore imply that disclosure about them is less important than information about (potentially more distant) technological and physical risks.

Turning to the control variables, we find that investors with more assets under management believe that climate reporting is more important, which is plausible as such investors tend to be universal owners and stand to lose more from climate risks. Perhaps surprisingly, medium- and long-term investors do not differ from short-term investors in their perceptions of the importance of climate reporting. More ESG oriented investors generally regard climate disclosure as being more important, which is not surprising since the investment mandate of such investors is partially based on environmental aspects. Investors based in more climate-conscious countries generally regard climate disclosure as being more important, consistent with Dyck et al. (2019).

3.2 Evaluation of Current Disclosure Practice

Investors attribute great importance to climate risk reporting by portfolio firms, but such reporting is still in its infancy and largely voluntary and unstandardized.¹² It is therefore important to better understand investors' views on the informativeness of current qualitative and quantitative

statistically different from those on *Physical climate risk* and *Technological climate risk*, while the latter two do not differ statistically.

¹² To the best of our knowledge, the only country that entertains a mandatory and prescriptive climate disclosure regime is the U.K., which introduced this with the *The Companies Act 2006*, Regulations 2013). For an analysis of this regulation see Krueger (2015).

disclosures on climate risks (Question B3). Qualitative disclosure may include narratives of how climate change affects business models and how climate risks are governed in firms, while quantitative disclosures can contain information on carbon emissions or emission reduction targets. To assess investors' views on these disclosure, respondents were asked to indicate their agreement with a set of statements on these topics on a scale of one ("strongly disagree") through five ("strongly agree").

Table 4 shows that there exists a widespread view that current quantitative and qualitative disclosures are not sufficiently informative and also imprecise. Specifically, many of our respondents strongly agree that management discussions on climate risk (20.8% strongly agree) as well as quantitative information on these risks (19.4% strongly agree) are not sufficiently precise. These numbers suggest that the current voluntary reporting regime does not enable fully informed investment decisions, at least for firms with large exposures to climate risks. This could be one reason why climate risks are considered difficult to price in equity markets, an issue we address in more detail below.

The responses to the previous two questions suggest that many firms currently do not consider the net benefits of reporting on climate risks to be sufficiently high, as they would otherwise reveal such information voluntarily. At the same time, investors seem to value such information, which raises the question whether mandatory and standardized reporting on climate risks is needed. In general, the economic rationale for mandatory disclosure regulation on climate risks requires the existence of externalities and/or market-wide cost savings that regulations can mitigate (Shleifer 2005). A firm's contribution to climate change can be viewed as such an externality. Standardization of climate reporting could make it easier and less costly for investors to acquire and interpret climate risk information and it could facilitate cross-firm and cross-industry benchmarking. A mandatory disclosure regime could also provide commitment and credibility for firms' climate disclosure, especially if the standards are specific and well enforced (Christensen, Hail, and Leuz 2019).

Indeed, Table 4 documents that many investors believe that standardized and mandatory reporting on climate risk would be valuable (27% strongly agree). Similarly, there is a widespread view among our respondents that there should be more standardization in climate-related financial disclosure across markets (27%). However, one challenge for changing the current reporting environment seems to be that standardized disclosure tools and guidelines are not yet widely available (21.3%), at least according to our respondents.

Overall, our respondents' views are consistent with recent initiatives that increase transparency on climate topic. For example, in June 2017, TCFD released its recommendations on climate-related financial disclosures, which centers on the role of climate risks for a firm's governance, strategy, and its risk management, and how climate risks are reflected in metrics and targets. Using this comprehensive approach, the TCFD recommendations go well beyond simply disclosing carbon emissions.

Though still voluntary, it is likely that the TCFD recommendations will eventually constitute the basis for mandatory and standardized climate disclosure in many countries. At the same time, it will most likely take considerable amounts of time until such regulations are eventually introduced in a large set of countries. In the meantime, investors themselves may take initiatives to improve their access to climate risk data. In fact, many of our respondents hold the strong belief that investors should put pressure on firms to disclose more on their climate risks (28% strongly agree), echoing the recent investor initiatives at Exxon Mobil or Occidental Petroleum discussed earlier. This view of our respondents is also in line with the increasing role that climate topics played in the most recent proxy seasons (see Ceres, 2018).

Table 5 provides regressions explaining investors' views on current disclosure practices. Building on the responses in Table 4, the dependent variables in the table equal one if a respondent indicated "strong agreement" with a statement on the current disclosure practices, and zero otherwise. Our main explanatory variable that might drive investors' views about current disclosures

is *Climate risk materiality*, which measures how respondents evaluate the financial effects of climate risks (Question A2). This variable averages the responses to the three questions about the materiality of regulatory, physical, and technological climate risks, and it can range between one (“not at all important”) and five (“very important”).

Columns (1) and (2) indicate that investors who believe that climate risks are more material also think more strongly that current information on climate risks is imprecise and uninformative. These investors also believe more strongly that there should be more standardization and mandatory requirements in climate disclosures (see Columns (3) and (4)). The results in Column (7) further suggest that investors who believe strongly that climate risks matter also strongly believe that investors should demand better disclosure from portfolio firms.

Turning to our control variables, we find that investors whose portfolios are more subject to ESG analysis believe more strongly that quantitative information on climate risks is imprecise. They also tend to agree more strongly that management discussions and disclosure forms are lacking in quality and informativeness. In addition, investors with more assets under ESG principles also believe more strongly that tools and guidelines for standardized disclosure are currently not available.

3.3 Climate Risk Disclosure and Climate Risk Mispricing

Recent research suggests that climate risks may be mispriced. On the empirical side, Hong, Li, and Xu (2019) document that markets underreact to climate risks because of poor disclosure, suggesting that value exists in improving disclosure. On the theoretical side, Daniel, Litterman, and Wagner (2017) develop a model in which uncertainty about the effect of CO₂ emissions on global temperature (and on eventual damages) is gradually resolved over time. Their model suggests a high carbon price today that is expected to decline over time as uncertainty about climate risks is resolved. One mechanism through which these uncertainties disappear is via climate risk disclosures. As firms evaluate the risks climate change poses on their business models and make their assessments public,

equity prices should converge towards their fair valuations through the harmonization and comparability benefits of disclosures.

To contribute to this important literature, we first asked the investors whether they believe that current equity valuations in different sectors of the economy correctly reflect the risks and opportunities related to climate change (Question D1).¹³ Responses for each sector could vary between plus two (valuations much too high) and minus two (valuations much too low). Figure 2 reports the mean responses across sectors, showing that overvaluations are highest in the oil and automotive sector. (Krueger, Sautner, and Starks (2019) provide more discussion on how overvaluation varies across sectors.)

We use these data to create two dependent variables. For each respondent, *Climate risk underpricing* averages all positive mispricing scores across sectors (score of one or two), to capture the extent to which a respondent believes that there is climate-related overvaluation. Relatedly, *Climate risk mispricing* averages for each respondent the absolute values of the mispricing scores across all sectors, to capture nondirectional mispricing. Table 2 shows that the average respondent believes that equity valuations in the average sector do not fully reflect the risks from climate change, as the mean value of *Climate risk underpricing* exceeds zero.

We next estimate whether investors' views on climate disclosure help partially explain any perceived climate risk mispricing. We focus on three independent variables that are informative about our respondents' views on climate reporting. The first variable measures whether a respondent "strongly agrees" that investors should demand more disclosure from portfolio firms about their exposure to climate risks (*Demand more disclosure*). The other two variables capture perceptions

¹³ We allowed for over- and undervaluation across different sectors as some sectors may be overvalued (e.g., the oil or coal sectors), while other sectors may be undervalued (e.g., the battery producers, water utilities).

about the quality of available climate information, both in terms of hard (*Quantitative information imprecise*) and soft information (*Management discussion imprecise*).

Table 6 reports the corresponding results. The estimate in Column (1) indicates that respondents who more strongly agree that investors should demand disclosure on climate risks also see stronger overvaluations. In terms of magnitudes, climate risk-related overvaluations are almost 35% ($=0.2/0.57$) higher, relative to the mean score of 0.57, among respondents who strongly agree that investors should demand more disclosure on climate risks. In Columns (2), we also find more perceived overvaluation among investors who believe that the available quantitative information about climate risks are imprecise. We find similar results in Column (3) for investors who think that management discussions on climate risk are not sufficiently precise. Taken together, this suggests that a lack of hard and soft information on climate risks contributes to the perception of climate risk underpricing in equity markets.

Columns (4) to (6) confirm these results using the measure that captures both directions of mispricing. The fact that we also find similar effects for this alternative variable suggests that better climate disclosure is useful in alleviating both directions of climate risk mispricing, i.e., the underpricing and overpricing of climate risks. Overall, the evidence in Table 6 indicates that the demand for climate-related information, and beliefs about the quality of climate-related disclosure, are associated with mispricing in equity markets, at least as perceived by our respondents. An important implication of our evidence is that better disclosure may contribute to a more efficient pricing of climate risks.

3.4 Recent Trends in Climate risk Disclosure

We used two questions to evaluate recent trends in climate risk disclosure. In the first question, we evaluated the respondents' views related to a new investor practice championed by a French law, which requires since 2016 carbon reporting on the portfolios of institutional (Article

173).¹⁴ Our respondents indicate support for this approach, which is considered to be one of the most ambitious climate risk regulations in the world: 60% stated in response to Question B2 that they already disclose or plan to disclose the carbon footprint of their own investment portfolios (Figure 3). This result also speaks to ongoing policy efforts at the European Union level. Under Article 7 of the European Commission’s action plan on sustainable finance, it is discussed to amend EU Directive 2016/2341 (IORP 2-Pensions), which would require increased disclosures by institutional investors relating to sustainability risks.

In the second question, we asked whether the investors engage or plan to engage portfolio firms to report in accordance with the TCFD recommendations (Question E5). This is a highly relevant topic given that several major investors recently announced that this will be a prime area for their shareholder engagement (Blackrock 2017). Figure 4 shows that this approach is shared widely, as 59% of investors plan to engage firms on this topic. Interestingly, a quarter of our survey participants responded with “Do not know”, which could indicate that some institutional investors are still unaware of the TCFD recommendations.

In Table 7, we run regressions to understand which investor characteristics explain investors’ behavior in terms of action according to these recent developments. We use two dependent variables: *Carbon footprint* equals one if an investor discloses (or plans to disclose) the carbon footprint of the own portfolio, and zero if not. *TCFD* equals one if an investor engages (or plans to engage) portfolio firms to report according to the recommendations of the TCFD.

Column (1) indicates that investors who believe that climate risks are more financially material are also more likely to disclose the carbon footprint of their portfolios. Investors with more assets under management, and investors whose portfolios have higher ESG shares, are also more likely to disclose their own carbon footprints. These findings are plausible as investors who believe in the

¹⁴ See “France Gets Climate Risks Disclosures from Invest Firms,” *Wall Street Journal*, December 7, 2017. The law also requires investors to report on how they identify and manage climate risks.

financial materiality of climate risks, and those that are more ESG oriented, have stronger incentives to make the carbon footprint of their portfolios publicly available. To the extent that calculating and disclosing the carbon footprints of portfolios is costly, it is also unsurprising that bigger institutions are more likely to do so (perhaps because they have more financial resources). Larger investors might also face more scrutiny by stakeholders on these issues, making them more likely to initiate actions. The latter argument is consistent with Krueger, Sautner, and Starks (2019), who find that reputational concerns are one of the most important drivers for institutional investors to incorporate climate risk into the investment process. Contrary to our expectation, medium- and long-term investors have a lower propensity to disclose/plan to disclose the carbon footprint of their portfolios compared to short-term investors.

Column (2) suggest that investors with bigger ESG shares are more likely to engage their portfolio firms to report according the TCFD recommendations. We also find that investors in countries where environmental issues are seen to be more important are more likely to engage their portfolio firms over climate risk disclosure, which is consistent with Dyck et al. (2019). We do not find that investors differ in their likelihood of engaging portfolio firms along dimensions of climate risk materiality, investment horizons, or assets under management. This suggests that the adoption of these recommendations is widespread among a variety of institutional investors.

We close our analysis by examining whether and how investor adoption of recent developments in climate disclosure relate to investor demand about more and better reporting on climate risks. We test several predictions. First, to more accurately disclose the carbon footprint of their portfolios, investors may want more high-quality reporting on climate risks. Such investors may also believe more strongly that investors should demand disclosures from their portfolio firms. Second, investors who engage or plan to engage firms to report according to the TCFD recommendations may see a stronger need for better quality, and more standardized, disclosures.

Table 8 reports results from regressions which use as dependent variables our measures of investor beliefs about the current disclosure trends. We focus on three aspects, namely the quantity of available information, the quality of information, and standardization and mandatory reporting requirements (see Question B3). To capture the adoption of current trends in climate reporting, we use the explanatory variables *Carbon footprint* and *TCFD*.

The estimates indicate that investors who disclose (or plan to disclose) the carbon footprint of their portfolios demand more disclosure about climate risks, and they also believe that such firms' disclosure should be in a more standardized and mandatory way. Investors planning or already disclosing their portfolio footprint also believe that management discussions about climate risks are currently imprecise.

Given that calculating portfolio footprints is primarily about the use of quantitative information, we find surprisingly little evidence that investors who (plan to) disclose their footprints perceive current quantitative information as imprecise. Hence, it seems that firm-level quantitative information relevant for investors' carbon footprint calculations is not overly insufficient. This is possibly the result of initiatives such as CDP, which already collects emissions data by means of a survey. Nevertheless, there is a strong view among investors who (plan to) disclose their carbon footprints that climate disclosures should be more standardized and mandatory. This is consistent with the idea that, to disclose a portfolio carbon footprint, standardized issuer-level information is required and that such data is often not available for all firms in the same format. This interpretation is echoing the concerns by Yngve Slyngstad of Norges Bank Investment Management (see Introduction). Indeed, Jouvenot and Krueger (2019) show that mandatory and prescriptive carbon requirements dramatically increase the availability of carbon data at the issuer level.

We further find that investors that plan to engage firms to report according to the TCFD recommendations see a stronger need for more disclosure, and they also believe more strongly that disclosure should be standardized and mandatory. On the other hand, such investors do not seem to

think that current quantitative information or management discussions are imprecise. Thus, investors seem to be interested in TCFD recommendations as it provides them with one way to impose some structure on climate risk reporting towards their portfolio firms (rather than as a way to obtain more precise information).

4. Conclusion

We use a global survey of institutional investors to examine firm-level climate risk disclosure. A large majority of our survey respondents believes that climate risk reporting by portfolio firms is important. In fact, many respondents consider it as important, or even more important, than reporting on traditional financial risks. At the same time, a widespread view exists that climate risk disclosure needs improvement, in terms of the availability and quality of hard and soft climate-related information. Many investors further believe that firm-level reporting should be more standardized and mandatory.

In cross-sectional tests, we find that investors who think that climate risks are more financially material also deem climate disclosure to be more important. In a similar spirit, investors who expect larger global temperature increases by the end of the century also believe that climate disclosure is more important. Our analysis also suggests that firm-level disclosure seems more important for assessing physical and technological climate risks, and less so for regulatory risks.

The views on the availability and quality of climate-related disclosures are associated with investor-level perceptions of climate risk mispricing in the equity market. Respondents who believe that investors should require firms to report on climate risks, and investors who regard both quantitative and qualitative climate information to be insufficient, perceive more mispricing in current equity valuations. Finally, the majority of our respondents plans to engage portfolio firms to report

according to the TCFD recommendations. A majority of investors also discloses or plans to disclose the carbon footprint of the own investment portfolio.

Our analysis is important because through our survey we are able to shed light on many important investor perspectives and actions that cannot be studied using archival data. This enables us to contribute to the emerging literature on climate finance and, more generally, to the literature on non-financial disclosure.

References

Amel-Zadeh, Amir, and George Serafeim, 2018, Why and how investors use ESG information: Evidence from a global survey, *Financial Analysts Journal* 74, 1-17.

Blackrock, 2017, How BlackRock Investment Stewardship engages on climate risk, Blackrock Market Commentary March 2017.

Carney, Mark, 2015, Breaking the tragedy of the horizon-climate change and financial stability, Speech 29 September, Bank of England, Lloyds of London.

Ceres, 2018, The Hidden Story of Climate Proposals in the 2018 Proxy Season, available at <http://bit.ly/2L4eJpv>.

Christensen, Hans B., Luzi Hail, L., and Christian Leuz, 2019, Economic analysis of widespread adoption of CSR and sustainability reporting standards, Working Paper, Chicago Booth School of Business.

Daniel, Kent D., Robert B. Litterman, and Gernot Wagner, 2017, Applying asset pricing theory to calibrate the price of climate risk, Working Paper, Columbia Business School.

Dyck, Alexander, Karl Lins, Lukas Roth, and Hannes Wagner, 2019, Do institutional investors drive corporate social responsibility? International evidence, *Journal of Financial Economics* 131, 693-714.

Eccles, Robert G., Michael P. Krzus, and George Serafeim, 2011, Market interest in nonfinancial information, *Journal of Applied Corporate Finance* 23, 113-127.

Ellis, Jesse A., Edward C. Fee, and Shawn Thomas, 2012, Proprietary costs and the disclosure of information about customers, *Journal of Accounting Research* 50, 658-727.

Ferreira, Miguel A., and Pedro Matos, 2008, The color of investors' money: The role of institutional investors around the world, *Journal of Financial Economics* 88, 495-533.

Graham, John R., and Campbell R. Harvey, 2001, The theory and practice of corporate finance: Evidence from the field, *Journal of Financial Economics* 60, 187-243.

Hong, Harrison G., Frank Weikai Li, and Jiangmin Xu, 2019, Climate risks and market efficiency, *Journal of Econometrics*, 208, 265-281.

Ilhan, Emirhan, Zacharias Sautner, and Grigory Vilkov, 2019, Carbon tail risk, Working Paper, Frankfurt School of Finance & Management.

Jouvenot, Valentin and Philipp Krueger, 2019, Reduction in Corporate Greenhouse Gas Emissions Under Prescriptive Disclosure Requirements, Working Paper, University of Geneva.

Karolyi, George Andrew, and Rose C. Liao, 2017, The economic consequences of investor relations: A global perspective, Working Paper, Cornell University.

Krueger, Philipp, 2015, Climate change and firm valuation: Evidence from a quasi-natural experiment, Working Paper, Swiss Finance Institute.

Krueger, Philipp, Zacharias Sautner, and Laura T. Starks, 2019, The importance of climate risks for institutional investors, Working Paper.

Litterman, Bob, 2016, *Climate Risk: Tail Risk and the Price of Carbon Emissions---Answers to the Risk Management Puzzle*. Hoboken, NJ: John Wiley & Sons.

Matsumura, Ella M., Rachna Prakash, and Sandra C. Vera-Munoz, 2014, Firm-value effects of carbon emissions and carbon disclosures, *The Accounting Review* 89, 695-724.

Matsumura, Ella M., Rachna Prakash, and Sandra C. Vera-Munoz, 2018, Capital market expectations of risk materiality and the credibility of managers' risk disclosure decisions, Working Paper.

McCahery, Joseph, Zacharias Sautner, and Laura T. Starks, 2016, Behind the scenes: The corporate governance preferences of institutional investors, *Journal of Finance* 71, 2905-2932.

Meade, Adam, and Bart Craig, 2012, Identifying careless responses in survey data, *Psychological Methods* 17, 37-55.
17, 37-55.

Plumlee, Marlene, Darrell Brown, Rachel M. Hayes, and R. Scott Marshall, 2015, Voluntary environmental disclosure quality and firm value: Further evidence, *Journal of Accounting and Public Policy* 34, 336-361.

Shleifer, Andrei, 2005, Understanding regulation, *European Financial Management* 11, 439-451.

Solomon, Jill F., Aris Solomon, Simon D. Norton, Nathan L. Joseph, 2011, Private climate change reporting: an emerging discourse of risk and opportunity?, *Accounting, Auditing & Accountability Journal* 24, 1119-1148.

Stausboll, Anne, 2014, Analyzing climate risk: Why mandatory reporting matters, Institutional Investors, Retrieved from <http://www.institutionalinvestor.com/blogarticle/3371660/analyzing-climate-risk-why-mandatory-reporting-matters/investors-pensions.html>.

Verrecchia, Robert E., Essays on disclosure, *Journal of Accounting and Economics* 32, 97-180.

Data Appendix

Variable	Definition	Survey Question
<i>Importance climate risk disclosure</i>	This variable measures how important investors consider reporting by portfolio firms on climate risks compared to reporting on financial information. The variable ranges between one and five, with one indicating that climate risk reporting is “much less importance” and five indicating that it is “much more important”.	Question B1
<i>Climate risk ranking</i>	This variable is the outcome of a ranking of the importance of climate risks relative to other more standard investment risks. The variable ranges from one (if climate risks are considered the most important risk) to six (if they are considered the least important risk).	Question A1
<i>Regulatory climate risk</i>	This variable measures the financial materiality of regulatory climate risk. The variable can range between one (not at all important) and five (very important).	Question A2
<i>Physical climate risk</i>	This variable measures the financial materiality of physical climate risk. The variable can range between one (not at all important) and five (very important).	Question A2
<i>Technological climate risk</i>	This variable measures the financial materiality of technological climate risk. The variable can range between one (not at all important) and five (very important).	Question A2
<i>Temperature rise expectation</i>	<i>Temperature rise expectation</i> measures investors’ expectations about what the global temperature rise will be by the end of the 21 st century. This variable can vary between one (no expectation of a temperature rise) and five (more than 3°C expected).	Question E1
<i>Climate risk materiality</i>	This variable averages the responses to three questions about the financial materiality of regulatory, physical, and technological climate risk. Each of these three variables can range between one (not at all important) and five (very important).	Question A2
<i>Management discussions imprecise</i>	This variable takes the value of one if a respondent strongly agrees that management discussions on climate risk are not sufficiently precise, and zero otherwise.	
<i>Quant. information imprecise</i>	This variable takes the value of one if a respondent strongly agrees that firm-level quantitative information on climate risk is not sufficiently precise, and zero otherwise.	
<i>Stand. and mandatory reporting necessary</i>	This variable takes the value of one if a respondent strongly agrees that standardized and mandatory reporting on climate risk is necessary, and zero otherwise.	
<i>More standardization</i>	This variable takes the value of one if a respondent strongly agrees that there should be more standardization across markets in climate-related financial disclosure, and zero otherwise.	
<i>Disclosure tools not available</i>	This variable takes the value of one if a respondent strongly agrees that standardized disclosure tools and guidelines are currently not available, and zero otherwise.	
<i>Disclosure forms not informative</i>	This variable takes the value of one if a respondent strongly agrees that mandatory disclosure forms are not sufficiently informative regarding climate risk, and zero otherwise.	
<i>Demand more disclosure</i>	This variable takes the value of one if a respondent strongly agrees that investors should demand that portfolio firms disclose their exposure to climate risk, and zero otherwise.	
<i>Climate risk underpricing</i>	This variable averages positive mispricing scores (negative scores are set to zero). The variable ranges between plus two (strong average overvaluation) and zero (no average overvaluation).	Question D1
<i>Climate risk mispricing</i>	This variable averages the absolute values of all mispricing scores and can take the values of zero, one, and two.	Question D1

<i>Carbon footprint</i>	This variable takes the value of one if a respondent discloses or plans to disclose the overall carbon footprint of their portfolio, and zero otherwise.	Question B2
<i>TCFD</i>	This variable takes the value of one if a respondent engages or plans to engage portfolio companies to report according to the recommendations of the Task Force on Climate related Financial Disclosures, and zero otherwise.	Question E5
<i>Medium horizon</i>	This variable takes the value one if the indicated typical holding period of an institutional investor is between six months and two years, and zero otherwise.	Question G2
<i>Long horizon</i>	This variable takes the value one if the indicated holding period of an institutional investor is above two years, and zero otherwise.	Question G2
<i>Assets under management</i>	This variable indicates the size of an institutional investor and takes the values of one (assets under management less than \$1bn); two (between \$1bn and \$20bn); three (between \$20bn and \$50bn); four (between \$50bn and \$100bn); and five (more than \$100bn).	Question G6
<i>ESG share</i>	This variable is the percentage of the institution's portfolio that incorporates ESG issues	Question G5
<i>Passive share</i>	This variable is the percentage of the institution's portfolio that is passively managed.	Question G4
<i>Independent institution</i>	This variable takes the value one if an institutional investor is considered to be an independent institution, and zero otherwise. As in Ferreira and Matos (2008) and Dyck et al. (2019), independent institutions are more likely to collect information, have fewer potential business relationships with the corporations they invest in, and therefore are anticipated to be more involved in monitoring management. We classify mutual funds, asset managers, hedge funds, private equity funds, and public pension funds as independent institutions.	Question G1
<i>HQ Country Norms</i>	This variable captures the importance of environmental issues in the country in which an institutional investor is headquartered. The data are from Dyck et al. (2019), who construct the variable based on the Environmental Performance Index obtained from the Yale Center for Environmental Law (Yale University) and the Center for International Earth Science Information Network (Columbia University) for 2004. Larger numbers reflect a stronger common belief in the importance of environmental issues.	Question G7

Figure 1: Disclosure of Climate Risks

This figure illustrates how important investors consider reporting by portfolio firms on climate risks compared to reporting on financial information (Question B1). We ask survey participants how important they consider reporting by portfolio firms on climate risk compared to reporting on financial information. The data are based on the responses of 439 individuals that participated in our survey.

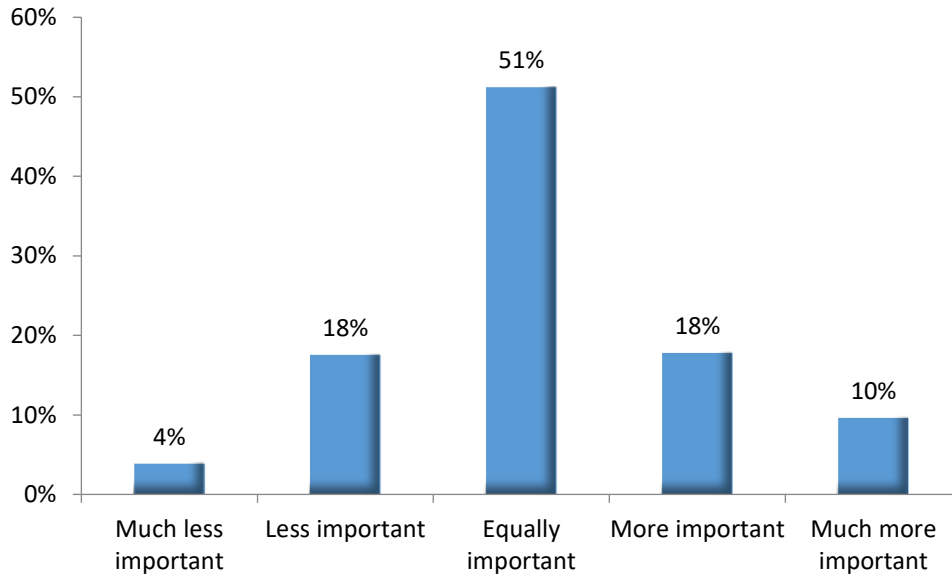


Figure 2: Climate Risk Mispricing

This figure reports investors' beliefs about whether current equity valuations in different sectors correctly reflect the risks and opportunities related to climate change (Question D1). Responses for each sector could vary between plus two (valuations much too high) and minus two (valuations much too low). The figure reports the mean response scores per sector. The data are based on the responses of 439 individuals that participated in our survey.

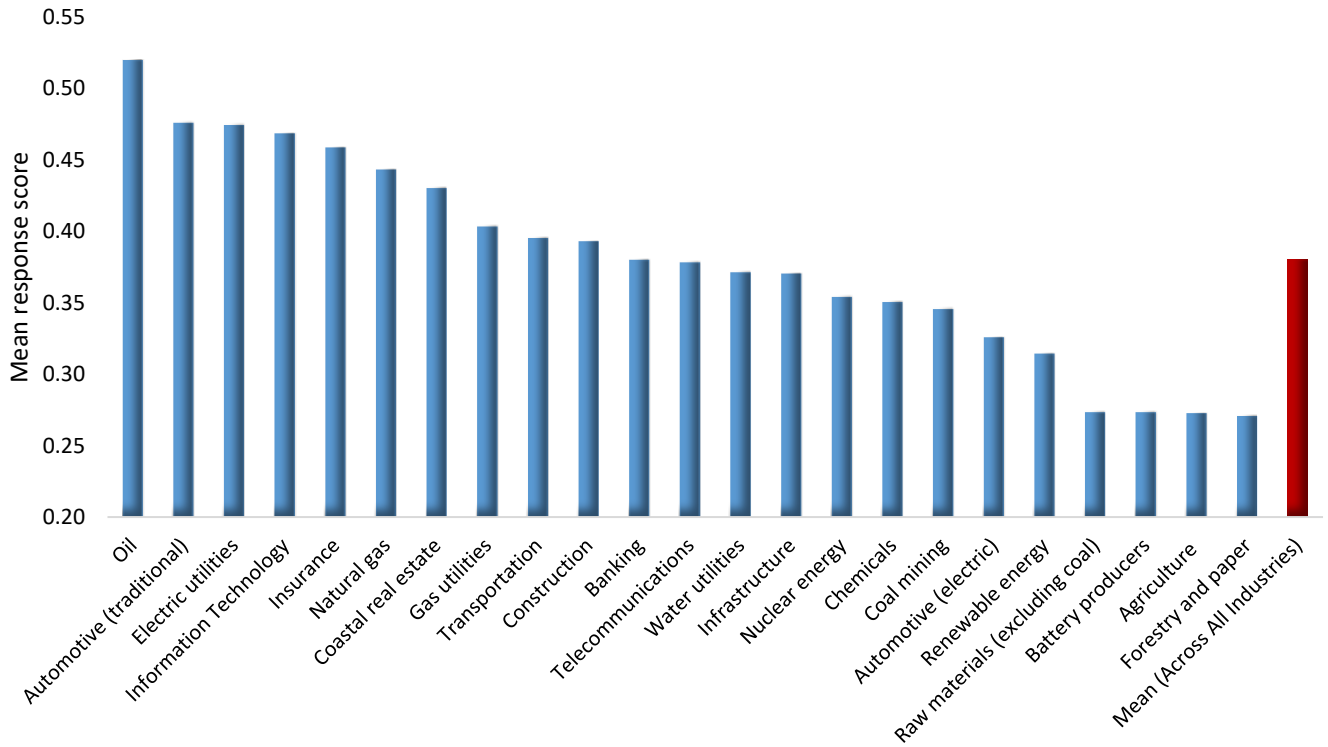


Figure 3: Carbon-Footprint Disclosure by Investors

This figure reports whether which fraction of investors discloses or plans to disclose the overall carbon footprint of their portfolios (Question B2). The data are based on the responses of 439 individuals that participated in our survey.

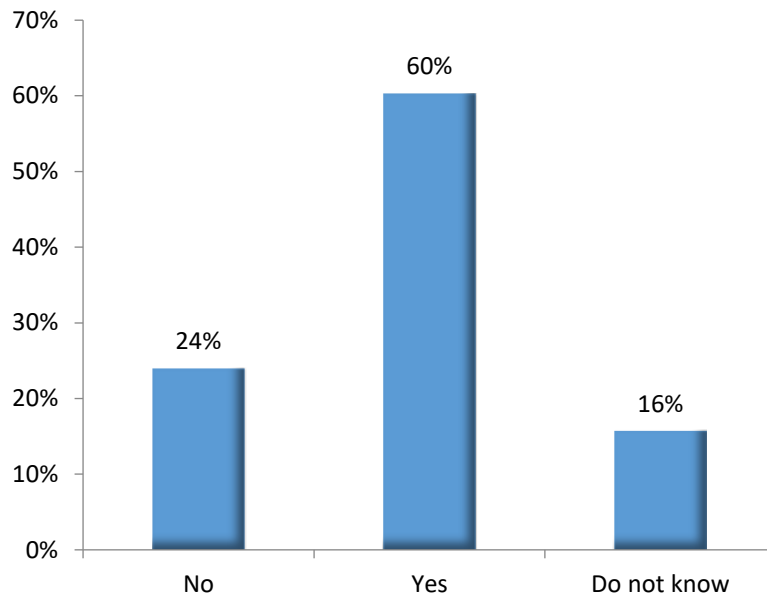


Figure 4: Engagement of Portfolio Firms to Report According to TCFD Recommendations

This figure reports information about whether the investors engage or plan to engage their portfolio firms to report according to the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) (Question E5). The data are based on the responses of 439 individuals that participated in our survey.

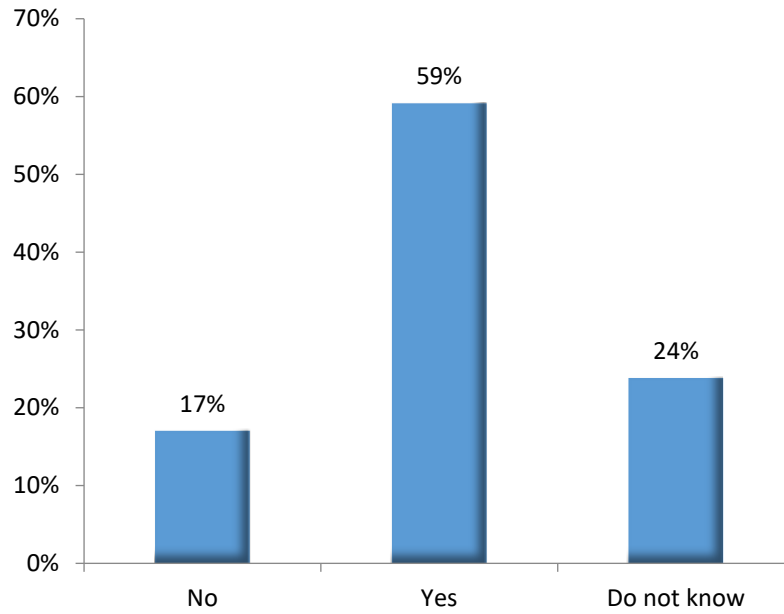


Table 1: Survey Respondent Characteristics

This table provides summary statistics on the characteristics of the 439 individuals that participated in our survey. As not all respondents provided information on all characteristics, the number of observations used in the different parts of the table can fall below 439. We report data on the distribution channel, position of the responding individuals (Question G8), type of institution (Question G1), institution size (Question G6), investment horizon (Question G2), geographic distribution (Question G7), the ESG share (Question G5), the equity and fixed-income share (Question G3), and the passive share (Question G4).

Distribution channels (N=439)		Percentage	Investor horizon (N=432)		Percentage
Panel		73	Short (less than 6 months)		5
Conferences		16	Medium (6 months to 2 years)		38
Asset owner		6	Long (2 years to 5 years)		38
Personal		4	Very long (more than 5 years)		18
Respondent Position (N=428)		Percentage	Region (N=429)		Percentage
Fund/Portfolio manager		21	United States		32
Executive/Managing director		18	United Kingdom		17
Investment analyst/strategist		16	Canada		12
CIO		11	Germany		11
CEO		10	Italy		7
CFO/COO/Chairman/Other executive		10	Spain		5
ESG/RI specialist		10	The Netherlands		4
Other		2	France		3
Institutional investor type (N=439)		Percentage	Others (<3%)		9
Asset manager		23	Investment structure		Mean
Bank		22	ESG share (N=415)		40.6%
Pension fund		17	Equity share (N=400)		47.0%
Insurance company		15	Fixed-income share (N=402)		43.1%
Mutual fund		8	Passive share (N=419)		38.2%
Other institution		15			
Assets under management (N=430)		Percentage			
Less than \$1bn		19			
Between \$1bn and \$20bn		32			
Between \$20bn and \$50bn		23			
Between \$50bn and \$100bn		16			
More than \$100bn		11			

Table 2: Descriptive Statistics

This table provides summary statistics of the main survey-based variables that we use in the regression analysis. The data are based on the responses of 439 individuals that participated in our survey. As not all respondents provided answers to all questions, the number of observations used in the different parts of the table can fall below 439. Detailed variable definitions are in the Data Appendix.

Variable	Mean	STD	Median	Obs.	Survey Question
<i>Importance climate risk disclosure</i>	3.1	0.9	3.0	416	B1
<i>Climate risk ranking</i>	4.0	1.6	4.0	386	A1
<i>Temperature rise expectation</i>	3.3	1.0	3.0	342	E1
<i>Regulatory climate risk</i>	3.8	1.0	4.0	393	A2
<i>Physical climate risk</i>	3.5	1.1	4.0	393	A2
<i>Technological climate risk</i>	3.8	1.0	4.0	393	A2
<i>Climate risk materiality</i>	3.7	0.8	3.7	393	A2
<i>Demand more disclosure</i>	0.3	0.4	0.0	413	B3
<i>Quantitative information imprecise</i>	0.2	0.4	0.0	413	B3
<i>Management discussions imprecise</i>	0.2	0.4	0.0	413	B3
<i>Standardized and mandatory reporting necessary</i>	0.3	0.4	0.0	413	B3
<i>Disclosure forms not informative</i>	0.2	0.4	0.0	411	B3
<i>More standardization</i>	0.3	0.4	0.0	412	B3
<i>Tools not available</i>	0.2	0.4	0.0	413	B3
<i>Climate risk overpricing</i>	0.6	0.4	0.5	357	D1
<i>Climate risk mispricing</i>	0.8	0.4	0.7	357	D1
<i>Carbon footprint</i>	0.7	0.5	1.0	327	B2
<i>TCFD</i>	0.8	0.4	1.0	304	E5
<i>Medium horizon</i>	0.8	0.4	1.0	432	G2
<i>Long horizon</i>	0.2	0.4	0.0	432	G2
<i>Assets under management</i>	2.7	1.3	2.0	430	G6
<i>ESG share</i>	0.4	0.3	0.3	415	G5
<i>Passive share</i>	0.4	0.2	0.4	419	G4
<i>Independent Institution</i>	0.5	0.5	1.0	439	G1
<i>HQ Country Norms</i>	0.6	0.1	0.6	425	G7

Table 3: Importance of Climate Risk Disclosure

This table reports ordered logit regressions explaining the perceived importance of disclosure (relative to financial disclosure). The dependent variable, *Importance climate risk disclosure*, measures how important investors consider reporting by portfolio firms on climate risks compared to reporting on financial information. The variable ranges between one and five, with one indicating that climate risk reporting is “much less importance” and five indicating that it is “much more important” (see Figure 1). We use the following independent variables: *Climate risk ranking* is the outcome of a ranking of the importance of climate risks relative to other risks. The variable ranges from one (most important risk) to six (least important risk). *Temperature rise expectation* measures investors’ expectations about what the global temperature rise will be by the end of this century (Question E1). *Regulatory, physical, and technological climate risk* measure the financial materiality of regulatory climate risk, physical climate risk and technological climate risk (Question A2). All three variables can range between one (not at all important) and five (very important). This variable can vary between one (no expectation of a temperature rise) and five (more than 3°C expected). We additionally control for: *Medium horizon; Long horizon; Assets under management; ESG share; Passive share; Independent institution; HQ Country Norms*. Detailed variable definitions are in the Data Appendix. *t*-statistics (reported in parentheses) are based on standard errors that are clustered at the investor-country level. ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively.

	<i>Importance climate risk disclosure</i>				
	(1)	(2)	(3)	(4)	(5)
<i>Climate risk ranking</i>	-0.30*** (-4.37)				
<i>Temperature rise expectation</i>		0.34*** (2.93)			
<i>Regulatory climate risk</i>			0.30*** (4.05)		
<i>Physical climate risk</i>				0.71*** (6.58)	
<i>Technological climate risk</i>					0.53*** (6.57)
<i>Medium horizon</i>	-0.22 (-0.52)	0.08 (0.16)	-0.11 (-0.21)	-0.2 (-0.33)	-0.2 (-0.48)
<i>Long horizon</i>	-0.1 (-0.20)	-0.03 (-0.05)	-0.14 (-0.23)	-0.37 (-0.50)	-0.22 (-0.36)
<i>Assets under management</i>	0.21*** (2.70)	0.25** (2.43)	0.23** (2.41)	0.18* (1.93)	0.23** (2.52)
<i>ESG share (x100)</i>	0.83 (1.54)	0.98** (2.37)	0.88* (1.80)	0.66 (1.56)	0.7 (1.56)
<i>Passive share (x100)</i>	-0.01 (-0.03)	-0.22 (-0.49)	0.07 (0.18)	-0.11 (-0.24)	0.01 (0.03)
<i>Independent Institution</i>	-0.05 (-0.17)	0.01 (0.04)	-0.15 (-0.62)	-0.07 (-0.29)	-0.19 (-0.81)
<i>HQ Country Norms</i>	1.28 (1.34)	1.46 (1.00)	1.59 (1.50)	2.48*** (3.14)	2.12** (2.16)
Respondent Position FE	Yes	Yes	Yes	Yes	Yes
Distribution Channel FE	Yes	Yes	Yes	Yes	Yes
Obs.	361	326	370	370	370
Pseudo R ²	0.06	0.05	0.05	0.09	0.07

Table 4: Evaluations of Current Practice of Climate Risk Disclosure

This table reports survey responses to questions on different aspects of the current climate risk disclosure practice (Question B3). Respondents were asked to indicate their agreement with different statements on a scale of one (“strongly disagree”) through five (“strongly agree”). Column (1) presents the percentage of respondents indicating strong agreement with a statement. Column (2) reports the mean score, where higher values correspond to stronger agreement. Column (3) reports the number of respondents. Column (4) reports the results of a *t*-test of the null hypothesis that each mean score is equal to 3 (neither agree nor disagree). *** indicates statistical significance at the 1% levels. Column (5) reports the results of a *t*-test of the null hypothesis that the mean score for a given reason is equal to the mean score for each of the other reasons, where significant differences at the 10% level are reported.

Views on climate risk disclosure		% with 5 (“strongly agree”)	Mean score	N	H ₀ : Mean Score = 3	Significant differences in Mean Score vs. Rows
		(1)	(2)	(3)	(4)	(5)
(1)	Management discussions on climate risk are not sufficiently precise	20.8%	3.78	413	***	1-4, 7
(2)	Firm-level quantitative information on climate risk is not sufficiently precise	19.4%	3.77	413	***	1-4
(3)	Standardized and mandatory reporting on climate risk is necessary	26.9%	3.91	413	***	4-7
(4)	There should be more standardization across markets in climate-related financial disclosure	27.4%	3.92	412	***	4-7
(5)	Standardized disclosure tools and guidelines are currently not available	21.3%	3.64	413	***	1-3, 5-6
(6)	Mandatory disclosure forms are not sufficiently informative regarding climate risk	17.8%	3.70	411	***	1-3, 5
(7)	Investors should demand that portfolio firms disclose their exposure to climate risk	27.6%	3.90	413	***	4-7

Table 5: Explaining Views on Current Practice of Climate Risk Disclosure

This table reports logit regressions explaining investors' views on the current climate risk disclosure practice (Question B3). Respondents could indicate their agreement with different statements on a scale of one ("strongly agree") through five ("strongly disagree"). The dependent variables are dummy variables that equal one if a respondent indicated strong agreement with a statement on the current disclosure practice, and zero otherwise. We use the following independent variables: *Climate risk materiality* (larger numbers reflect greater perceived importance); *Medium horizon*; *Long horizon*; *Assets under management*; *ESG share*; *Passive share*; *Independent institution*; *HQ Country Norms*. Detailed variable definitions are in the Data Appendix. *t*-statistics (reported in parentheses) are based on standard errors that are clustered at the investor-country level. ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively.

	Management discussions imprecise	Quant. information imprecise	Stand. and mandatory reporting necessary	More standardization	Disclosure tools not available	Disclosure forms not informative	Demand more disclosure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Climate risk materiality	0.65** (2.34)	0.47** (2.28)	0.55*** (3.73)	0.81*** (3.98)	0.59* (1.90)	0.51*** (2.60)	0.90*** (3.88)
Medium horizon	0.83 (0.95)	-0.37 (-0.46)	0.64 (0.79)	0.14 (0.15)	0.58 (0.84)	-0.58 (-0.83)	-0.65 (-0.72)
Long horizon	1.08 (1.26)	0.12 (0.16)	0.75 (1.00)	0.18 (0.34)	0.57 (1.04)	-0.69 (-0.88)	-0.99 (-1.20)
Assets under management	0.11 (1.20)	0.02 (0.16)	-0.13 (-1.44)	-0.08 (-0.85)	0.23* (1.81)	0.15*** (3.46)	-0.04 (-0.94)
ESG share (x100)	1.67*** (3.73)	1.01** (2.14)	1.47*** (3.15)	0.45 (0.96)	1.19** (2.21)	1.14*** (2.78)	0.32 (0.52)
Passive share (x100)	-0.46 (-0.71)	0.41 (1.04)	0.67 (1.01)	-0.00 (-0.01)	0.63 (1.32)	-0.65 (-0.99)	0.80 (1.26)
Independent institution	0.29 (0.51)	0.11 (0.35)	-0.30 (-1.55)	-0.42 (-1.25)	0.53** (2.20)	0.33 (1.23)	-0.14 (-1.04)
HQ Country Norms	2.49 (1.38)	-1.38 (-0.82)	-0.16 (-0.12)	-0.80 (-0.53)	0.55 (0.32)	0.35 (0.20)	0.06 (0.04)
Respondent Position FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distribution Channel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	369	369	369	369	369	369	369
Pseudo R ²	0.13	0.09	0.11	0.11	0.10	0.11	0.15

Table 6: Climate Risk Disclosure and Climate Risk Mispricing

This table reports OLS regressions explaining perceptions of climate risk mispricing. We use two dependent variables to capture the respondents' views on the mispricing of climate risks (Question D1). *Climate risk underpricing* averages positive mispricing scores (negative scores are set to zero). The variable ranges between plus two (strong average overvaluation) and zero (no average overvaluation). *Climate risk mispricing* averages the absolute values of all mispricing scores across all industries. We use the following independent variables: *Demand more disclosure* equals one if a respondent indicated strong agreement to the statement that investors should demand that portfolio firms disclose their exposure to climate risk, and zero otherwise (Question B3). *Quantitative information imprecise* equals one if a respondent indicated strong agreement to the statement that firm-level quantitative information on climate risk is not sufficiently precise, and zero otherwise (Question B3). *Management discussions imprecise* equals one if a respondent indicated strong agreement to the statement that management discussions on climate risk are not sufficiently precise, and zero otherwise (Question B3). We additionally control for: *Climate risk materiality* (bigger numbers reflect greater perceived importance); *Medium horizon*; *Long horizon*; *Assets under management*; *ESG share*; *Passive share*; *Independent institution*; *HQ Country Norms*. Detailed variable definitions are in the Data Appendix. *t*-statistics (reported in parentheses) are based on standard errors that are clustered at the investor-country level. ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively.

	<i>Climate risk underpricing</i>			<i>Climate risk mispricing</i>		
	Average across all sectors			Average across all sectors		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Demand more disclosure</i>	0.20*** (4.29)			0.16*** (3.28)		
<i>Quantitative information imprecise</i>		0.24** (2.84)			0.24*** (4.79)	
<i>Management discussions imprecise</i>			0.22*** (3.53)			0.19*** (3.98)
<i>Climate risk materiality</i>	-0.01 (-0.43)	-0.01 (-0.14)	-0.01 (-0.16)	0.02 (0.73)	0.02 (0.64)	0.02 (0.70)
<i>Medium horizon</i>	-0.03 (-0.27)	-0.04 (-0.30)	-0.07 (-0.54)	0.01 (0.12)	0.01 (0.06)	-0.02 (-0.15)
<i>Long horizon</i>	-0.00 (-0.04)	-0.04 (-0.39)	-0.06 (-0.54)	0.03 (0.28)	-0.01 (-0.05)	-0.02 (-0.18)
<i>Assets under management</i>	0.03 (1.59)	0.03 (1.34)	0.03 (1.36)	0.00 (0.06)	0.00 (0.00)	-0.00 (-0.17)
<i>ESG share (x100)</i>	0.29*** (3.60)	0.28*** (3.09)	0.26** (2.48)	0.19*** (3.01)	0.18** (2.52)	0.16* (2.03)
<i>Passive share (x100)</i>	-0.02 (-0.21)	-0.00 (-0.05)	0.01 (0.08)	-0.05 (-0.49)	-0.03 (-0.34)	-0.02 (-0.18)
<i>Independent institution</i>	-0.03 (-0.47)	-0.04 (-0.58)	-0.05 (-0.82)	-0.03 (-0.49)	-0.04 (-0.59)	-0.04 (-0.82)
<i>HQ Country Norms</i>	-0.20 (-1.63)	-0.16* (-1.82)	-0.29* (-2.10)	-0.30* (-2.11)	-0.26 (-1.68)	-0.37** (-2.25)
Respondent Position FE	Yes	Yes	Yes	Yes	Yes	Yes
Distribution Channel FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	343	343	343	343	343	343
Adjusted R ²	0.06	0.07	0.06	0.03	0.05	0.03

Table 7: Recent Trends in Climate Risk Disclosure

This table reports logit regressions explaining recent trends in climate risk disclosure. We use two dependent variables. *Carbon footprint* equals one if a respondent discloses or plans to disclose the overall carbon footprint of their portfolio, and zero if the investor does not (Question B2). *TCFD* equals one if a respondent engages or plans to engage portfolio firms to report according to the recommendations of the Task Force on Climate related Financial Disclosures (Question E5), and zero otherwise. We use the following independent variables: *Climate risk materiality*; *Medium horizon*; *Long horizon*; *Assets under management*; *ESG share*; *Passive share*; *Independent institution*; *HQ Country Norms* (larger numbers reflect a stronger belief in the importance of environmental issues in an institutions' country). Detailed variable definitions are in the Data Appendix. *t*-statistics (reported in parentheses) are based on standard errors that are clustered at the investor-country level. ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively.

	<i>Carbon footprint</i>	<i>TCFD</i>
	(1)	(2)
<i>Climate risk materiality</i>	0.31*** (3.71)	0.23* (1.69)
<i>Medium horizon</i>	-0.72* (-1.87)	-0.21 (-0.44)
<i>Long horizon</i>	-1.03* (-1.79)	-0.24 (-0.61)
<i>Assets under management</i>	0.28* (1.73)	0.04 (0.23)
<i>ESG share (x100)</i>	1.07*** (2.81)	2.36*** (2.95)
<i>Passive share (x100)</i>	1.00 (0.95)	0.23 (0.46)
<i>Independent Institution</i>	0.29 (1.15)	-0.08 (-0.35)
<i>HQ Country Norms</i>	0.62 (0.36)	6.75*** (4.81)
Respondent Position FE	Yes	Yes
Distribution Channel FE	Yes	Yes
Obs.	306	275
Pseudo R ²	0.07	0.11

Table 8: Recent Disclosure Trends and Assessment of Climate Risk Disclosure

This table reports logit regressions explaining investors' views on the current climate risk disclosure practice (Question B3). We use four dependent variables that reflect the respondents' agreement to different statements on a scale of one ("strongly agree") through five ("strongly disagree"). The four dependent variables are dummy variables that equal one if a respondent indicated strong agreement with a statement on the current disclosure practice, and zero otherwise. We use the following independent variables: *Carbon footprint* is a dummy variable equal to one if a respondent discloses or plans to disclose the overall carbon footprint of their portfolio and zero otherwise (Question B2). *TCFD* is a dummy variable equal to one if a respondent engages or plans to engage portfolio firms to report according to the recommendations of the Task Force on Climate related Financial Disclosures (Question E5). The following independent variables are also included: *Medium horizon*; *Long horizon*; *Assets under management*; *ESG share*; *Passive share*; *Independent institution*; *HQ Country Norms*. Detailed variable definitions are in the Data Appendix. *t*-statistics (reported in parentheses) are based on standard errors that are clustered at the investor-country level. ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively.

	<i>Demand more disclosure</i>		<i>Quantitative information imprecise</i>		<i>Management discussions imprecise</i>		<i>Standardized and mandatory reporting necessary</i>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Carbon footprint</i>	1.25** (2.37)		0.40 (1.08)		0.44* (1.88)		0.53** (2.01)	
<i>TCFD</i>		0.87** (2.22)		0.51 (1.27)		0.82 (1.62)		0.96*** (3.10)
<i>Medium horizon</i>	-0.38 (-0.48)	-0.39 (-0.49)	-0.60 (-0.73)	-0.19 (-0.23)	0.73 (0.80)	0.79 (0.90)	0.68 (0.91)	0.77 (0.98)
<i>Long horizon</i>	-0.13 (-0.17)	-0.39 (-0.48)	0.14 (0.13)	0.33 (0.34)	1.52* (1.67)	1.49* (1.85)	1.28 (1.64)	1.25 (1.40)
<i>Assets under management</i>	-0.11 (-1.20)	-0.06 (-0.69)	-0.01 (-0.08)	-0.08 (-0.75)	0.09 (1.20)	0.01 (0.14)	-0.20** (-2.13)	-0.23** (-2.47)
<i>ESG share (x100)</i>	0.48 (0.87)	0.89* (1.89)	0.80* (1.94)	0.77 (1.55)	1.77*** (5.29)	1.87*** (2.84)	1.34*** (3.22)	1.23*** (2.91)
<i>Passive share (x100)</i>	0.71 (0.74)	0.50 (0.66)	1.04** (2.27)	0.30 (0.79)	-0.04 (-0.09)	-0.20 (-0.31)	0.99* (1.90)	0.37 (0.59)
<i>Independent Institution</i>	-0.12 (-0.58)	-0.11 (-0.58)	0.17 (0.66)	-0.10 (-0.37)	0.30 (0.54)	0.31 (0.58)	-0.23 (-1.02)	-0.25 (-1.33)
<i>HQ Country Norms</i>	-1.71 (-0.67)	-1.99 (-1.52)	-2.69 (-1.53)	-2.75* (-1.75)	1.55 (0.51)	0.62 (0.19)	-1.22 (-0.72)	-1.52 (-1.17)
Respondent Position FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distribution Channel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	305	292	309	292	305	292	309	292
Pseudo R ²	0.10	0.12	0.08	0.06	0.08	0.11	0.09	0.09

Internet Appendix: Survey Instrument



**UNIVERSITÉ
DE GENÈVE**



 **Frankfurt School**
of Finance & Management
German Excellence. Global Relevance.

Survey on Climate Risk

We are a team of professors from the University of Geneva, the Swiss Finance Institute, the University of Texas at Austin, and Frankfurt School of Finance & Management.

This survey seeks a better understanding of whether and how institutional investors incorporate **climate risk** when making investment decisions. The survey will take about **10 minutes**.

You can use this survey questionnaire or take the survey online at: [\[LINK\]](#)

We take the **confidentiality** of your responses very seriously. We **will not share your responses** with anyone, nor will individual firms or respondents be identified. Only aggregate data will be made public. We will not link the survey responses to any other data.

Thank you for participating in this survey. If you have any questions, please contact us.

Philipp Krueger, Ph.D. (Philipp.Krueger@unige.ch)

Zacharias Sautner, Ph.D. (z.sautner@fs.de)

Laura T. Starks, Ph.D. (Laura.Starks@mcombs.utexas.edu)

GENERAL INFORMATION

G1: How is the institution at which you work best described?

- | | |
|--|---|
| <input type="checkbox"/> Public pension fund | <input type="checkbox"/> Private pension fund |
| <input type="checkbox"/> Insurance company | <input type="checkbox"/> Hedge fund |
| <input type="checkbox"/> Mutual fund management company | <input type="checkbox"/> Private equity fund |
| <input type="checkbox"/> Asset manager (for pension funds, endowments, etc.) | <input type="checkbox"/> Endowment, charity |
| <input type="checkbox"/> Sovereign wealth fund | <input type="checkbox"/> Bank |
| <input type="checkbox"/> Other (please specify): _____ | |

G2: What is the typical holding period for investments in your portfolio, on average?

- Short (less than 6 months)
- Medium (6 months to 2 years)
- Long (2 years to 5 years)
- Very long (more than 5 years)

G3: What percentage of your portfolio is invested in fixed income versus equity securities?

___ % in fixed income

___ % in equities

G4: What percentage of your portfolio is invested actively versus passively?

___ % in active investments

___ % in passive investments

G5: What percentage of your portfolio incorporates Environmental, Social and Governance (ESG) issues? ___ %

G6: What is the total size of assets under management for your institution?

- | | |
|--|---|
| <input type="checkbox"/> Less than \$1 billion | <input type="checkbox"/> Between \$1 billion and \$20 billion |
| <input type="checkbox"/> Between \$20 billion and \$50 billion | <input type="checkbox"/> Between \$50 billion and \$100 billion |
| <input type="checkbox"/> More than \$100 billion | |

G7: In which country are your institution's headquarters based? _____

G8: What is your position?

- | | |
|---|--|
| <input type="checkbox"/> Fund/Portfolio Manager | <input type="checkbox"/> Chief Executive Officer |
| <input type="checkbox"/> Investment Analyst/Strategist | <input type="checkbox"/> Executive/Managing Director |
| <input type="checkbox"/> Chief Investment Officer | <input type="checkbox"/> ESG/Responsible Investment Specialist |
| <input type="checkbox"/> CFO/COO/Chairman/Other Executive | <input type="checkbox"/> Other (please explain): _____ |

PART A: IMPORTANCE OF CLIMATE RISK

A1: Please rank the following six risks when making investments in portfolio firms from 1 to 6, where 1 is the most important to you and 6 the least important.

- Financial risk (earnings, leverage, payout policy, etc.)
- Operating risk (changes in demand, input costs, etc.)
- Governance risk (board structure, executive pay, etc.)
- Social risk (labor standards, human rights, etc.)
- Climate risk
- Other environmental risk (pollution, recycling, etc.)

A2: We have divided climate risk into *regulatory risks* (changes in regulation), *physical risks* (changes in the physical climate), and *technological risks* (climate-related technological disruption). Please rate the financial materiality of these risks.

	Not at all important	Slightly important	Important	Fairly important	Very important
Regulatory risks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical risks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technological risks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A3 to A5: [NOT COVERED IN THIS PAPER]

PART B: DISCLOSURE ON CLIMATE RISK

B1: How important do you consider reporting by portfolio firms on climate risk compared to reporting on financial information?

Much less important	Less important	Equally important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B2: Do you disclose (or plan to disclose) the overall carbon footprint of your portfolio?

- No Yes Do not know

B3: To what extent do you agree with the following statements regarding climate-risk disclosure by portfolio firms?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
• Investors should demand that portfolio firms disclose their exposure to climate risk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Firm-level quantitative information on climate risk is not sufficiently precise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Management discussions on climate risk are not sufficiently precise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Standardized and mandatory reporting on climate risk is necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Mandatory disclosure forms are not sufficiently informative regarding climate risk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• There should be more standardization across markets in climate-related financial disclosure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Standardized disclosure tools and guidelines are currently not available	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

PART C: CLIMATE RISK MANAGEMENT & ENGAGEMENT

[THIS SECTION IS NOT COVERED IN THIS PAPER]

PART D: PRICING OF CLIMATE RISK

D1: To what extent do equity valuations of firms in different industries reflect the risks and opportunities related to climate change?

Industry	Valuations much too high	Valuations somewhat too high	Valuations more or less correct	Valuations somewhat too low	Valuations much too low
Oil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Natural gas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Renewable energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Nuclear energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electric utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gas utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coal mining	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Raw materials (excluding coal)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chemicals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automotive (traditional)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automotive (electric)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Battery producers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Banking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Insurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agriculture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Forestry and paper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Telecommunications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal real estate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D2 to D4: [NOT COVERED IN THIS PAPER]

PART E: ADDITIONAL INFORMATION

E1: The *Paris Climate Accord* aims to keep the global temperature rise “well below 2 degrees Celsius” above pre-industrial levels by the end of this century. What are your expectations for the global temperature rise by the end of this century?

Increase in global temperature by:					
None	Up to 1 degree	Up to 2 degrees	Up to 3 degrees	More than 3 degrees	Do not know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E2 to E4: [NOT COVERED IN THIS PAPER]

E5: Do you engage (or plan to engage) portfolio companies to report according to the recommendations of the Task Force on Climate related Financial Disclosures (TCFD)?

- No
 Yes
 Do not know