Institutional investors, climate disclosure, and carbon emissions

Shira Cohen [a], Igor Kadach [b], Gaizka Ormazabal [c, *]

[a] *San Diego State University, CA, USA*
[b] *IESE Business School, Spain*
[c] *IESE Business School, CEPR & ECGI, Spain*

ARTICLE INFO

ABSTRACT

Exploiting the unique features of the CDP, the world-leading platform of corporate climate risk disclosures, we study the relationship between institutional investors' demand for climate-related information (as reflected in their CDP signatory status), firms' decision to disclose this information, and corporate carbon emissions. We provide systematic international evidence that ownership by CDP signatories is positively associated with the probability of disclosing information to the CDP, and that such disclosure is associated with subsequent lower carbon emissions. We also observe that CDP signatories are more likely to engage with and divest from top emitters disclosing to the CDP. Overall, these results are consistent with the notion that investor demand for climate-related information results in greater corporate disclosure and contributes to firms' decisions to lower future carbon emissions.

1. Introduction

There is an ongoing debate over the role of institutional shareholders in the current efforts to achieve net-zero emissions by 2050. While some contend that asset managers can contribute significantly in pushing companies to reduce their carbon footprint, others are more skeptical and recommend that authorities focus on traditional regulatory tools (i.e., carbon taxes, cap-and-trade systems, and prescriptive regulation).[1] This skepticism is fueled by the perception that a substantial number of institutional investors engage in "greenwashing" (i.e., "window-dressing" actions that have little real impact on the reduction of actual emissions).[2] This paper contributes to this debate by exploring two interrelated questions: Does investor demand for

---

* Corresponding author. Avenida Pearson 21, 08034 Barcelona, Spain.
  E-mail address: gormazabal@iese.edu (G. Ormazabal).
[1] For a recent discussion, see Tallarita (2023).
[2] Recent regulatory developments illustrate that the concern about "greenwashing" is perceived as first-order. On November 27, 2019, the European Parliament approved Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector. The U.S. Securities and Exchange Commission (SEC) announced in March 2021 the creation of a Climate and ESG Task Force with the goal of identifying climate and ESG-related misconduct.

climate-related data induce firms to disclose this information? And is such firm disclosure followed by a decrease in carbon emissions?[3]

To address these questions, we rely on the world's largest platform of (voluntary) climate risk disclosure: the CDP (formerly known as the Carbon Disclosure Project).[4] The CDP is a uniquely suited setting for the purpose of this study. Unlike other institutional networks with an interest in climate change — notably the UN Principles for Responsible Investment (PRI) — the CDP offers its signatories private access to corporate climate risk information, collected by the platform specifically on their behalf. Furthermore, the CDP publicly discloses the list of its signatories, and as such, becoming a CDP signatory can be interpreted as equivalent to publicly requesting climate-related information.

From an empirical perspective, the fact that institutional investors publicly sign up to the CDP platform allows us to observe both cross-sectional and time-series variation in investors' demand for climate risk disclosures. Moreover, the CDP gathers climate-related information from a wide cross-section of firms around the world. This is important given that our research questions relate to a global effort to reduce emissions. Finally, unlike other data sources that cover all aspects of ESG (Environmental, Social, and Governance) information, the CDP focuses only on environmental data. Empirically, this helps us avoid the potential confounding effect of non-environmental ESG information.

Our first hypothesis is that institutional investors' demand for climate-related information (as reflected in an investor becoming a CDP signatory) induces firms to disclose information to the CDP. Asset managers could demand climate-related information for two reasons that should not be viewed as mutually exclusive: they believe that climate-related performance affects prices (e.g., Friedman and Heinle, 2016; Krueger et al., 2020); and/or they believe that improving the environmental performance of their portfolio will help them attract or retain clients that are sensitive towards climate risk (Barzuza et al., 2020). As a result, firms are plausibly induced to disclose to the CDP to attract/retain investors that care about the content of the CDP database and/or to avoid other investor actions that may be potentially costly for managers and/or directors (e.g., withheld votes at annual meetings).

However, it is also possible that investor demand for climate-related information does not induce firms to disclose information to the CDP. First, CDP disclosures are costly for firms to complete. Such costs might outweigh expected benefits, thereby preventing full unravelling (Grossman and Hart, 1980). Moreover, investors could sign up to the CDP because they care about the signaling value of being a signatory, rather than the information content itself.[5] In this case, it is unclear whether firms would feel pressured to disclose their climate information. This possibility is supported by anecdotal evidence and by recent empirical work looking at institutional investors that sign up as PRI signatories but do not exhibit superior environmental performance in their portfolios (e.g., Gibson et al., 2022; Kim and Yoon, 2022; Liang et al., 2022).

Our second hypothesis is that CDP disclosure predicts relatively lower levels of carbon emissions. There are at least two plausible mechanisms through which this may occur. First, investors could use the CDP disclosures to engage with firms on environmental issues. For example, the CDP data could be used to select engagement targets and/or to identify environmental issues in preparation for meetings with firm management. As shown in prior work (e.g., Dimson et al., 2021), engagement activities often pressure firms to enhance their environmental performance. Second, investors could use the disclosed information for portfolio allocation decisions, which would pressure firms to decrease emissions to preempt potential divestment.

That said, it is also plausible that investors use the CDP information in ways that do not induce firms to improve environmental performance. For example, asset managers could use the CDP data to short stocks of pro-environmental firms. Furthermore, investors could use the CDP information in ways that induce only a relatively small decrease in emissions. As such, whether CDP disclosure contributes to a significant decrease in corporate carbon emissions is an open empirical question.

Our tests are based on a sample of more than 7000 public firms from 51 countries during the period from 2003 to 2020. Our first main finding is a positive firm-level association between the ownership of CDP signatories and the probability of disclosing climate-related information to the CDP, a result that is consistent with our first hypothesis, namely that the presence of CDP signatories induces firms to disclose. The association is robust to a demanding battery of tests: we use a variety of fixed effect structures, an instrumental variables (IV) approach to isolate plausible exogenous variation in institutional ownership by CDP signatories, and a quasi-natural experiment using additions of stocks into the Morgan Stanley Capital International All Country World Index (MSCI ACWI).

Consistent with our second hypothesis, we also find that disclosing information to the CDP is associated with a decrease in carbon emissions. This result also holds in a matching analysis around the time firms start disclosing to the CDP. To gauge whether the documented association relates to the signatory institutions, rather than to other potential users of the CDP information, we apply three cumulative restrictions to the sample. First, we include only cases where only CDP signatories have access to the disclosures.[6] Second, we further focus the analysis on cases where CDP signatories own a substantial stake

---

[3] The reporting of corporate information related to climate risk is in itself an issue of significant public interest in the current economic and social context. In a recently published report examining the potential implications of climate risk for global financial stability, the Financial Stability Board warns that the success of mitigating climate related risks depends directly on the information (i.e., disclosures) available to assess these risks (FSB, 2020).

[4] The CDP is a global not-for-profit organization that maintains the world's largest comprehensive database on corporate response to climate change related risks, including carbon emissions.

[5] In addition to being highlighted on the CDP website, signatories often publicize their signatory status on their annual CSR reports.

[6] The CDP offers firms the option to make the information available only to signatory investors. Please see section 2 for a detailed discussion.

in the firm and thus likely have enough clout to influence firm decision-making. Third, we restrict the analysis to CDP signatories that are also PRI signatories (i.e., institutional investors that have made further public environmental commitments). All three analyses confirm the firm-level association between CDP disclosure and corporate carbon emissions. Additional tests further indicate that the negative association between CDP disclosure and carbon emissions is not driven by a reduction in firm-level business activity (as measured by sales and total asset volume).

We next explore the empirical validity of the two hypothesized mechanisms that may explain the association between CDP information and carbon emissions: engagement and divestment. For tractability purposes, when looking at engagement, our analysis focuses on data from the three largest asset managers – BlackRock, Vanguard, and State Street – often referred to as the "Big Three". Our results suggest that firms that disclose to the CDP and emit higher levels of carbon emissions are more likely to be engaged by the Big Three (via calls and in-person meetings, as disclosed in investment stewardship reports). When looking at divestment as another potential mechanism, we find that disclosing firms with higher levels of emissions are more likely to exhibit a decrease in ownership by CDP signatories. These patterns continue to hold when we restrict the sample to observations in which the information is only disclosed to CDP signatories; to observations where CDP signatories hold a substantial stake in the firm; and to observations where these institutional investors also publicly commit to the UN PRI. Overall, the evidence supports the validity of the two hypothesized mechanisms explaining the association between CDP disclosure and carbon emissions.

To the extent that disclosing to the CDP and reducing emissions are both decisions made by the firm, the documented association between CDP disclosure and carbon emissions needs to be interpreted with caution. The cause of the emission reductions might not be disclosure per se, as disclosure is part of a bundle of actions and firms might decide to disclose because they anticipate making emission reductions. Nonetheless, taken together with our tests on engagement and divestment, the association between CDP disclosure and carbon emissions is consistent with the notion that investors use the information in ways that –directly or indirectly– prompt firms to improve environmental performance.

The results of this paper inform several strands of research in accounting and finance. Most prominently, our paper contributes to the nascent literature on the role of institutional investors in the current efforts to meet societal environmental objectives. Central to the debate is the underlying motivation behind institutional investors' public commitment to sustainability. In a survey on climate risk perceptions, Krueger et al. (2020) find that one of the main motivations for institutions to incorporate climate risk into their investment decision processes is to protect their own public image and reputation. This survey evidence also suggests that some investors believe that reducing carbon emissions increases the value of their portfolio. However, whether these perceptions and incentives are strong enough to enable real change remains an open question. Some papers suggest that institutional investors are effective in inducing firms to improve environmental performance (Dyck et al., 2019; Azar et al., 2021; Dimson et al., 2021; Barko et al., 2022).[7] In contrast, other papers highlight inconsistencies between institutional investors' public commitment to sustainability and their actions (Gibson et al., 2022; Kim and Yoon, 2022; Liang et al., 2022; Raghunandan and Rajgopal, 2022), and attribute these inconsistencies to greenwashing.[8] Our work contributes to this line of research by showing that institutional investors' demand for climate-related information is associated with an increase in corporate disclosure and a reduction in carbon emissions.[9]

Our study also contributes to the literature on voluntary disclosure of climate risk information. Prior research documents that firms that voluntarily disclose climate risk information, and in particular, carbon emissions data, exhibit higher market valuations (e.g., Matsumura et al., 2014) and lower cost of capital (Matsumura et al., 2017). More closely related to our study, a paper by Ilhan et al. (2023) provides survey and archival evidence suggesting that a higher concentration of institutional investors, particularly those from high social norm countries, is associated with a greater likelihood that firms disclose their climate risk information to the CDP. Our paper contributes to this line of research by documenting that the disclosure of climate-related information is associated with investors' demand for this information (reflected in their status as CDP signatories) and by providing suggestive evidence that these investors use the information in ways that may explain an association between climate disclosure and firm-level carbon emissions.

---

[7] Dyck et al. (2019) and Barko et al. (2022) focus on the effect of institutional investors' impact on firm-level ESG scores. More closely related to our study are Dimson et al. (2021), who analyze the coordinated engagement of PRI members committed to responsible investment, and Azar et al. (2021), who pose that the Big Three induce firms to reduce their carbon emissions. These papers, however, do not look at climate risk disclosure. We study a specific, but particularly important, shareholder request for climate-related information.

[8] Gibson et al. (2022) find no improvement in ESG scores among U.S. firms that sign onto the PRI. However, for institutions domiciled outside of the U.S., these authors find that PRI signatories that claim to incorporate ESG considerations into their active equity holdings have better portfolio ESG scores than non-PRI signatories. Looking at active managers, Kim and Yoon (2022) find that PRI signatories do not improve their ESG scores and experience a decrease in returns. Liang et al. (2022) examine hedge funds and find that PRI signatories underperform both green and non-green matched funds. Raghunandan and Rajgopal (2022) document that the portfolios of self-denominated ESG funds do not exhibit lower emissions.

[9] Our results are not necessarily inconsistent with those in recent papers concluding that institutional investors engage in greenwashing. First, the incentives to become a CDP signatory could be different from those to become a PRI signatory. Moreover, prior studies often measure the real outcomes of environmental performance using ESG scores, whereas we focus on subsequent reduction in carbon emissions. Finally, taken together with these prior studies, our paper helps shed light on the extent to which greenwashing is pervasive in the current economy.

2. Institutional background and hypotheses

2.1. Institutional background

The CDP is a global nonprofit organization founded in 2000 to help companies and cities disclose their environmental impact. The CDP began sending out requests for climate-related information in 2003 on behalf of 35 investors, and as such became the first platform attempting to link firm environmental performance with investor fiduciary duty. In response to that first questionnaire, 245 companies disclosed their climate risk information. In 2006, the CDP began sending out question-naires to constituents of widely used indexes such as the S&P 500, FTSE 600, ASX 200 and the MSCI ACWI. Today the CDP houses disclosures from over 9600 global companies, representing over 50 percent of the global market capitalization. It is the largest global repository of carbon emissions information and the largest comprehensive database on corporate response to climate change-related risks. The CDP platform has been endorsed by numerous institutions and world leaders and some have referred to it as the "gold standard" of environmental reporting.[10] Institutions gain access to the full set of corporate climate-related disclosures maintained by the CDP when they become CDP signatories.

The CDP questionnaire includes information related to climate change governance and strategy; greenhouse gas reduction targets; regulatory, physical, and other risks and opportunities; greenhouse gas emissions; external verification, and other topics. The CDP asks companies to report their greenhouse gas emissions according to the Greenhouse Gas Protocol (i.e., including scope 1, scope 2, and scope 3). The information is collected on an annual basis. While exact dates may vary each year, typically the CDP sends out its questionnaires in January. The platform also provides companies with guidance for preparing their information. The CDP's online response system opens around March/April and firms can provide their information until July/August of a given year. The firms' disclosures are available on the CDP site in October, and the CDP's official scores and annual reports are produced in December/January.

Answering the CDP questionnaire entails non-trivial preparation costs. Just the set of instructions needed to answer the CDP questionnaire contains more than 100 pages. The questionnaire itself includes a large amount of detailed information. Producing this information requires effort and costs on the part of the firm in terms of data collection, estimation, and/or verification. The information requested on carbon emissions is a case in point. Further, the costs to answer the questionnaire are higher for first-time disclosers, as answers to some questions could be partially re-used in subsequent years.

Firms' participation in the CDP questionnaire is voluntary. Disclosing firms have the option to mark their response as either "Public" or "Private". Particularly relevant to our study, responses marked as "Private" are available only to the signatory investors of the CDP (non-signatory investors and the general public cannot access this information). Responses marked as "Public" can be accessed by the public at no cost.[11] Note that marking the information as "Private" on the CDP is not necessarily in violation of Regulation Fair Disclosure (Reg FD) or other similar international regulations. Central to these regulatory requirements is that if material information is disclosed privately, it must also be made available publicly. However, the CDP information is not material in the regulatory sense of the term. In fact, the "Private" disclosure to the CDP by thousands of firms around the world confirms that, in practice, this is not an issue (please see Online Appendix OA for a more detailed discussion).

2.2. Investor demand for CDP information and firm disclosure to the CDP (H1)

Our first hypothesis (H1) is that investor demand for climate information (reflected by the investor becoming a CDP signatory) induces firms to disclose information to the CDP.[12] Two considerations suggest that investors likely find the content within the CDP disclosures to be informative. First, unlike climate-related information found in public filings (e.g., annual reports or corporate social responsibility reports), CDP disclosures are standardized. This facilitates comparability across firms, as respondents follow a consistent disclosure format. Moreover, the climate-related information in the CDP is typically more extensive than that in public filings (which is often limited or non-existent). These considerations are particularly important in light of recent survey evidence suggesting that investors use climate-related information for portfolio allocation

---

[10] For example, Christiana Figueres, former Executive Secretary of the UN Framework Convention on Climate Change, commented in 2010: "The Carbon Disclosure Project is to the future of business what the x-ray machine was to the then future of medicine. Without it we would never see inside of the patient's health." (www.cdp.net). In 2018 the CDP aligned its disclosure platform with the Task Force on Climate-related Financial Disclosure (TCFD), which is endorsed by the Financial Stability Board and supported by major institutional investors. Currently, the CDP represents hundreds of global signatories, with over $106 trillion in assets under management.

[11] Firms have the option to (1) respond to the questionnaire and allow the CDP to make the responses publicly available (in which case the response permission is marked as "Public"); (2) respond to the questionnaire but allow the CDP to make the responses available only to institutional investors who are signatories of the CDP (in which case the response permission is marked as "Private"); (3) provide partial information, such as links to information generally available on the firm's website, for instance their CSR reports, without answering the CDP questionnaire; (4) respond indicating their decision to decline participation; or (5) not respond.

[12] Investors could induce firms to disclose to the CDP without explicitly asking for it (firms could interpret investor's signatory status as an implicit demand for the information). However, in some cases the call to disclose to the CDP is explicit. For example, Janus Henderson Investors, in their 2020 Annual Sustainability Report, state that "[t]he Carbon Disclosure Project (CDP) organization has become the 'gold standard' for reporting globally on carbon emissions, climate change risks, and opportunities. We encourage portfolio companies to participate in the disclosure project. Climate change is a key engagement topic for the strategy."

decisions and for engagement purposes (Krueger et al., 2020). As shown in prior literature, institutional investors care about environmental performance because they believe that such performance may affect prices (e.g., Krueger et al., 2020; Bolton and Kacperczyk, 2021; Bolton and Kacperczyk, 2022) and/or can help them attract or retain clients that are sensitive towards climate risk (Barzuza et al., 2020).[13]

Moreover, the release of the CDP information may also trigger divestment and/or activism by shareholders.[14] However, that said, it is likely that the costs of disclosing to the CDP are lower than those of releasing that same information in public filings, as the CDP information is not filed with regulators and access is often restricted to CDP signatories (which potentially results in lower litigation risk and less activism from stakeholders other than CDP signatories).[15]

Yet, on the other hand, institutional investors may benefit from signing up to the CDP in ways that do not necessarily induce firms to answer the CDP questionnaire. Similar to PRI signatories, CDP signatories often display their association on their corporate websites and sustainability reports.[16] This suggests that signing up to the CDP could be a form of signaling mechanism for investment firms, a commitment that could attract environmentally conscious investors. Moreover, PRI signatories have an added incentive to become CDP signatories in that doing so helps satisfy certain requirements needed to remain active PRI members.[17] If investors sign up to the CDP because they care about the signaling value of being a signatory, but not about the information content itself, it is unclear whether firms would feel pressured to disclose to the platform.

Whether the costs of signing up to the CDP are significant enough to strengthen the credibility of investors' pledges to improve environmental performance is an open empirical question. The monetary cost is trivial; an annual fee of $1475 for investors with more than $1bn in AUM and $975 for all others (the charge was introduced in 2018 to deter signatories with little real interest in the information). However, this does not necessarily mean that signing up to the CDP is costless. The CDP asks signatories to leave if their behavior is deemed inconsistent with the environmental objectives of the initiative. The exclusion could damage the affected institution's public image. Even if permitted to remain, signatories could bear reputational costs to the extent that clients, analysts, or commentators publicly denounce such inconsistencies.

2.3. CDP disclosure and carbon emissions (H2)

Our second hypothesis (H2) is that CDP disclosure predicts relatively lower levels of carbon emissions. The hypothesized association does not require that CDP disclosure per se causes the emission reductions; we recognize that disclosure is typically part of a bundle of simultaneous corporate actions and that firms might decide to disclose because they anticipate making emission reductions. Rather, the argument is that investors demand climate risk disclosure and use it in ways that — directly or indirectly — prompt firms to reduce emissions. This idea is consistent with prior research suggesting that investors care about corporate emissions because they believe environmental performance may affect prices and/or helps attract investment clients (e.g., Barzuza et al., 2020; Krueger et al., 2020; Bolton and Kacperczyk, 2021; Bolton and Kacperczyk, 2022).

We explore two plausible mechanisms for H2: (i) engagement and (ii) divestment. Investors could use the CDP disclosures in engagements with firms on environmental issues. In particular, the CDP data could be used to select engagement targets and/or to identify environmental issues in preparation for a meeting with corporate managers.[18] Investors could also use information from the CDP for portfolio allocation decisions. In this case, it is also plausible that firms might decrease emissions to preempt potential divestment or to avoid further divestment.

Yet, investors could use CDP information in ways that do not influence firms to improve environmental performance. For example, arbitrageurs could be interested in the disclosed data if they believe that climate policies are value-destroying and/ or overpriced. Furthermore, investors could use CDP information in ways that induce only a relatively small decrease in emissions (i.e., a decrease that is not large enough to be reflected in statistically significant results). As such, whether CDP disclosure is accompanied by a decrease in emissions is an open empirical question.

3. Data and sample

Our initial sample includes the universe of public firms contacted by the CDP from 2003 to 2020. We start the analysis in 2003 because that was the first year the CDP conducted its survey by sending out its questionnaire to a cross-section of FT Global 500 constituents. We obtain greenhouse gas emissions data from Trucost, a commercial provider of corporate carbon

---

[13] Indeed, some major investors have been quite vocal in their support of a sustainable economy and in pledging their commitment to responsible investment. For example, in his 2021 annual letter to CEOs Larry Fink (CEO of BlackRock) writes: "We have long believed that our clients, as shareholders in your company, will benefit if you can create enduring, sustainable value for *all* of your stakeholders" (see https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter).

[14] The CDP information released could generate investor reactions that are costly for the firm, but not responding to an explicit demand for such data could elicit even more costly reactions (Matsumura et al., 2014).

[15] Consistent with this argument, the annual reports (and social responsibility reports) of the firms that answer the CDP questionnaire rarely contain information as detailed as in the CDP database. We confirm this by analyzing the public disclosures of 20 firms randomly selected from our sample of CDP disclosers. In their public filings we found a general discussion of potential risks associated with climate change, but no mention of the CDP and its data.

[16] For examples, see the websites of Troy Asset Management, Janus Henderson Investments, and Franklin Templeton.

[17] In recent years, the PRI has introduced some requirements that increase signatory accountability. Signing up to the CDP helps satisfy PRI Principles 1–4.

[18] This possibility is supported by recent survey evidence by Krueger et al. (2020). A number of institutional investors surveyed by these authors state that they select firms for engagements on climate related issues by analyzing their portfolio firms' carbon footprint.

emissions data.[19] Trucost collects carbon emission data from publicly available sources, such as corporate websites, annual reports, CSR reports, the CDP, and direct communications with companies. If a covered firm does not publicly disclose its carbon emissions, Trucost estimates the firm's annual carbon emissions based on an environmental profiling model.

We obtain accounting and market data from Compustat Global, Compustat North America, and Datastream/WorldScope. These datasets provide stock price, balance sheet, and income statement information for a large number of international firms. We gather information on institutional ownership from the FactSet/LionShares database.

Table 1, Panel A, outlines the sample selection procedure. We start with 108,787 firm-year observations in the CDP dataset (i.e., the firms to which the CDP sent a request to complete the questionnaire). To be included in our sample, we require non-missing institutional ownership and financial data. The resulting sample consists of 76,284 firm-year observations corresponding to 8614 firms from 51 countries. Some of the tests require non-missing Trucost data, which is only available from 2005 to 2020. This restricts the sample size in these analyses to 56,432 observations corresponding to 7155 firms.

Table 1, Panels B-E, present descriptive statistics for our sample (see Appendix A for variable definitions). As shown in Panel B, the average ownership by CDP signatories is 11%, with a standard deviation of 12% and a 75th percentile of 17%. This suggests that, on average, the CDP signatories can exert substantial influence on firms (for example, in the form of voting). Total institutional ownership (i.e., the sum of *Signatories_Hldg* and *OtherInst_Hldg*) is 28% on average, a value that is in line with prior studies examining institutional ownership around the world (Bena et al., 2017). Panel B also shows that our sample composition includes a wide variety of firms in terms of size, leverage, and profitability.

Panel C of Table 1 provides descriptive information on our key variables by year. Carbon emissions and institutional ownership are higher in earlier years of our sample period. These patterns are probably due to the fact that the CDP has gradually expanded its coverage (by increasing its universe to include smaller firms with lower emissions and lower institutional ownership). Panel C also shows an increase in the number of CDP signatories during the sample period and an increase in PRI signatories, especially after the 2015 Paris Agreement.

Panel D of Table 1 presents descriptive statistics by industry. Our sample covers a wide range of industries and is consistent with prior literature on international investing. In addition, we observe that companies from industries with relatively high level of carbon emissions (e.g., oil and petroleum products, steel works) are less likely to disclose to the CDP.

Panel E of Table 1 presents descriptive statistics by country. Our sample covers a wide range of countries from Europe, Asia, North and South America, Africa, and the Middle East. We observe that disclosure to the CDP is more common among companies from Scandinavia and Western Europe.

4. Institutional investors and the disclosure of climate-related information

Our first set of tests aims to shed light on hypothesis H1, namely that investor demand for climate information (reflected in an investor becoming a CDP signatory) induces firms to disclose information to the CDP.

4.1. The association between CDP signatories and firms' disclosure to the CDP

We start our empirical analysis by testing the association between the probability of answering the CDP questionnaire and the fraction of shares held by CDP signatories. Finding a positive association would be consistent with H1. We estimate the following OLS model:

$$CDP\_Disclosure_{it} = \alpha + \beta*Signatories\_Hldg_{it-1} + \eta*OtherInst\_Hldg_{it-1} + \gamma*Controls_{it-1} + \tau_t + \delta_i + \varepsilon_{it}, \qquad (1)$$

The dependent variable, *CDP_Disclosure$_{it}$*, is defined as an indicator variable that equals one if company *i* submitted the CDP questionnaire in year *t*, and zero otherwise. The experimental variable *Signatories_Hldg* is defined as the fraction of the firm's equity held by institutional investors with CDP signatory status. The influence of CDP signatories in the firm increases with the fraction of shares owned by these investors.

Equation (1) includes a vector of firm-level control variables. We first control for ownership of non-signatory institutions. *OtherInst_Hldg* is the fraction of the firm's equity held by institutional investors other than CDP signatories. We also control for firm fundamentals potentially associated with climate disclosure. The corresponding variables are included in the vector *Controls*, defined as follows. *Size* is the logarithm of total assets. *Log(BM)* is the logarithm of the book-to-market ratio (book value of equity divided by market value of equity). *ROA* is defined as net income scaled by total assets. *Return* is computed as the buy and hold return over the year. *Leverage* is computed as the sum of the long-term debt and the debt in current liabilities over the firm's total assets. *Tangibility* is the ratio of property, plant, and equipment over the firm's total assets. *Dividends* is measured as total amount of dividends scaled by net income.

---

[19] Trucost is a widely used source of firm carbon emission data within the corporate sector (for example, both MSCI and S&P use Trucost data in their indexes) and among international organizations such as UNEP FI (i.e., the United Nations Environment Program Finance Initiative). It has also been used and validated in academic studies (e.g., Bolton and Kacperczyk, 2021).

Table 1
Sample and descriptive statistics.

Panel A. Sample construction

Sample observations	# Firm-Years	# Distinct Firms
Observations in CDP from 2003 to 2020	108,787	10,640
Observations with non-missing institutional ownership information	81,155	9015
Observations with non-missing accounting and market data	76,284	8614
Observations with non-missing Trucost data	56,432	7155

Panel B. Main variables

	# Obs.	Mean	Std Dev	P25	Median	P75
CDP_Disclosure	76,284	0.40	0.49	0.00	0.00	1.00
Inst_Hldg	76,284	0.28	0.28	0.07	0.17	0.39
Signatories_Hldg	76,284	0.11	0.12	0.02	0.08	0.17
OtherInst_Hldg	76,284	0.18	0.23	0.02	0.08	0.21
Size	76,284	8.14	1.86	6.89	8.07	9.33
Log(BM)	76,284	−0.70	0.97	−1.16	−0.58	−0.08
ROA	76,284	0.04	0.09	0.01	0.04	0.08
Leverage	76,284	0.25	0.19	0.09	0.23	0.36
Tangibility	76,284	0.30	0.25	0.08	0.24	0.47
Dividends	76,284	0.39	0.64	0.00	0.26	0.53
Return	76,284	0.13	0.52	−0.16	0.04	0.29
Log(Sales)	76,284	7.48	1.81	6.38	7.53	8.68

Panel C. By year

Year	Inst_Hldg	# CDP signatories	Signatories_Hldg	# PRI signatories	CDP_Disclosure	Log (CO_2)
2003	0.44	35	0.02	−	0.36	−
2004	0.45	95	0.05	−	0.50	−
2005	0.46	147	0.07	−	0.58	12.79
2006	0.42	215	0.11	85	0.45	12.22
2007	0.38	309	0.13	158	0.53	12.10
2008	0.33	388	0.12	247	0.50	11.88
2009	0.29	461	0.13	358	0.45	11.58
2010	0.27	526	0.11	462	0.48	11.38
2011	0.26	570	0.11	581	0.46	11.32
2012	0.27	663	0.12	718	0.42	11.19
2013	0.28	733	0.12	836	0.41	11.12
2014	0.28	806	0.12	984	0.39	11.05
2015	0.27	854	0.13	1133	0.38	10.92
2016	0.27	845	0.12	1329	0.37	10.64
2017	0.27	821	0.11	1621	0.37	10.64
2018	0.27	676	0.14	2011	0.32	10.63
2019	0.26	542	0.14	2665	0.34	10.59
2020	−	517	0.11	3575	0.37	10.03

Panel D. By industry

Industry	# Obs.	# firms	Inst_Hldg	Signatories_Hldg	CDP_Disclosure
Food	3773	438	0.24	0.09	0.43
Mining and Minerals	2912	325	0.26	0.10	0.34
Oil and Petroleum Products	3425	382	0.32	0.12	0.40
Textiles, Apparel, and Footware	1072	131	0.23	0.09	0.33
Consumer Durables	1414	173	0.26	0.11	0.38
Chemicals	2587	290	0.23	0.10	0.42
Drugs, Soap, Perfums, and Tobacco	2972	338	0.29	0.10	0.42
Construction and Construction Materials	5481	596	0.21	0.11	0.35
Steel Works	2116	216	0.17	0.10	0.35
Fabricated Products	502	51	0.30	0.12	0.44
Machinery and Business Equipment	7188	808	0.34	0.14	0.47
Automobiles	2188	234	0.27	0.10	0.38
Transportation	4370	447	0.26	0.11	0.42
Utilities	4744	456	0.25	0.08	0.41
Retail Stores	3870	436	0.33	0.12	0.40
Banks, Insurance and Other Financials	11,237	1309	0.26	0.12	0.40
Other	16,435	1984	0.32	0.12	0.39

Panel E. By country

Country	# Obs.	# firms	Inst_Hldg	Signatories_Hldg	CDP_Disclosure
Argentina	91	11	0.17	0.02	0.21
Australia	2650	326	0.14	0.08	0.44
Austria	380	39	0.18	0.12	0.59

Table 1 (*continued*)

Panel E. By country

Country	# Obs.	# firms	Inst_Hldg	Signatories_Hldg	CDP_Disclosure
Belgium	715	100	0.13	0.08	0.30
Brazil	1336	164	0.19	0.11	0.57
Canada	3306	347	0.43	0.14	0.48
Chile	386	49	0.07	0.03	0.21
China	4260	591	0.10	0.03	0.10
Colombia	155	20	0.05	0.02	0.50
Czech Republic	96	12	0.13	0.06	0.21
Denmark	539	52	0.23	0.10	0.56
Egypt	193	19	0.07	0.03	0.03
Finland	634	60	0.28	0.14	0.74
France	3426	377	0.18	0.10	0.37
Germany	3306	345	0.20	0.12	0.47
Greece	138	17	0.17	0.23	0.33
Hong Kong	1319	150	0.15	0.08	0.21
Hungary	155	21	0.10	0.04	0.19
India	3875	400	0.13	0.05	0.19
Indonesia	903	114	0.08	0.04	0.05
Ireland	517	60	0.40	0.18	0.47
Israel	274	31	0.21	0.05	0.19
Italy	1248	152	0.15	0.10	0.49
Japan	8136	765	0.15	0.15	0.45
Luxembourg	27	7	0.05	0.03	0.00
Malaysia	749	85	0.08	0.04	0.13
Mexico	481	74	0.18	0.06	0.42
Morocco	58	7	0.01	0.00	0.00
Netherlands	874	123	0.32	0.16	0.51
New Zealand	649	68	0.10	0.05	0.41
Norway	794	89	0.23	0.18	0.51
Pakistan	356	35	0.06	0.01	0.01
Peru	164	19	0.16	0.04	0.09
Philippines	397	41	0.09	0.05	0.19
Poland	821	103	0.26	0.15	0.08
Portugal	386	41	0.10	0.08	0.50
Qatar	104	18	0.03	0.01	0.04
Russia	758	94	0.09	0.04	0.20
Saudi Arabia	133	31	0.01	0.01	0.04
Singapore	405	40	0.13	0.08	0.42
South Africa	1214	123	0.19	0.08	0.69
South Korea	4522	580	0.08	0.04	0.23
Spain	1197	127	0.15	0.09	0.52
Sweden	1134	138	0.36	0.16	0.66
Switzerland	1671	180	0.24	0.12	0.53
Taiwan	2033	204	0.13	0.07	0.31
Thailand	534	64	0.11	0.02	0.22
Turkey	1257	164	0.07	0.04	0.39
U. A. Emirates	153	25	0.09	0.06	0.22
UK	5528	633	0.37	0.20	0.58
USA	11,847	1279	0.79	0.18	0.50

This table reports descriptive statistics for the sample used in our tests. Panel A describes the procedure to construct our sample. Panel B presents descriptive statistics for the main variables used in our tests. Panel C presents descriptive statistics by year. Panel D presents descriptive statistics by industry affiliation. Panel E presents descriptive statistics by country. See Appendix A for variable definitions.

Because the relationship between *Signatories_Hldg* and *CDP_Disclosure* is likely shaped by economy-wide variation, equation (1) includes year fixed effects. To mitigate the concern that the results may be driven by unobserved time-invariant firm heterogeneity, we also include firm fixed effects. In equation (1), τ_t and δ_i denote year and firm-fixed effects, respectively. In Table OD.1 of the Online Appendix we include a variety of alternative fixed effect structures, namely country-year, industry-year, size-decile-year, and country-industry-year fixed effects. To the extent that they are year-specific, these alternative fixed effects control for any shock affecting the country, the industry, or firms of similar size. The independent variables are measured at the end of the prior year (i.e., they are lagged one period). All continuous variables are winsorized at the 1st and 99th percentiles to mitigate the effect of outliers. Standard errors are clustered at the firm level (see Online Appendix OD, Table OD.2, for robustness to alternative clustering options). Table OD.3 in the Online Appendix repeats the analysis using a logistic regression (instead of an OLS model).

Table 2 presents the results of estimating equation (1). In Panel B we replace the variable *Signatories_Hld* with an indicator variable for observations in which *Signatories_Hld* is larger than 5%, *I(Signatories_Hldg>5%)*. This alternative variable captures cases in which CDP signatories hold a non-negligible ownership stake and thus can exert substantial influence on the firm.

Table 2

Disclosure of carbon emissions and holdings of CDP signatories.

Panel A. Continuous variable

		Dependent Variable: *CDP_Disclosure*			
		(1)	(2)	(3)	(4)
Signatories_Hldg	β_1	0.44***	0.41***	0.38***	0.27***
		(14.94)	(14.29)	(12.78)	(8.22)
OtherInst_Hldg	β_2	0.16***	0.12***	0.13***	0.13***
		(5.15)	(4.11)	(4.53)	(3.81)
Size		0.05***	0.09***	0.10***	0.04***
		(14.95)	(19.63)	(20.47)	(5.91)
Log(BM)		−0.04***	−0.04***	−0.04***	−0.01***
		(−11.40)	(−11.15)	(−12.41)	(−3.90)
ROA		0.09***	0.07**	0.07***	0.12***
		(3.38)	(2.49)	(2.66)	(4.91)
Leverage		−0.10***	−0.11***	−0.12***	−0.04*
		(−5.36)	(−6.12)	(−6.26)	(−1.73)
Tangibility		0.08***	0.01	0.01	−0.01
		(5.99)	(0.66)	(0.51)	(−0.44)
Dividends		0.01***	0.01***	0.01***	−0.00
		(3.14)	(3.19)	(3.27)	(−1.08)
Return		0.00	0.00	−0.01***	−0.01***
		(0.34)	(0.05)	(−5.03)	(−4.65)
Log(Sales)		0.07***	0.04***	0.04***	0.02***
		(19.39)	(10.02)	(9.70)	(3.12)
Country FE		YES	YES	YES	n.a.
Industry FE		NO	YES	YES	n.a.
Year FE		NO	NO	YES	YES
Firm FE		NO	NO	NO	YES
R^2		0.30	0.32	0.33	0.65
# Obs.		76,284	76,284	76,284	75,755
H0: $\beta_1 = \beta_2$ (p-value)		<0.001	<0.001	<0.001	<0.001

Panel B. Indicator for significant holdings

	Dependent Variable: *CDP_Disclosure*			
	(1)	(2)	(3)	(4)
I(Signatories_Hldg>5%)	0.12***	0.11***	0.10***	0.04***
	(18.52)	(17.24)	(15.14)	(6.23)
OtherInst_Hldg	0.10***	0.07**	0.08***	0.05
	(3.37)	(2.39)	(2.86)	(1.56)
Size	0.05***	0.09***	0.10***	0.05***
	(14.85)	(19.46)	(20.30)	(6.45)
Log(BM)	−0.04***	−0.04***	−0.04***	−0.01***
	(−11.03)	(−10.87)	(−12.14)	(−4.38)
ROA	0.07***	0.05*	0.06**	0.13***
	(2.69)	(1.95)	(2.19)	(5.23)
Leverage	−0.09***	−0.10***	−0.10***	−0.05*
	(−4.63)	(−5.30)	(−5.48)	(−1.94)
Tangibility	0.08***	0.01	0.01	−0.00
	(5.92)	(0.65)	(0.46)	(−0.14)
Dividends	0.01**	0.01***	0.01***	−0.00
	(2.43)	(2.59)	(2.75)	(−1.17)
Return	0.00	0.00	−0.01***	−0.01***
	(0.73)	(0.35)	(−4.82)	(−4.66)
Log(Sales)	0.07***	0.04***	0.04***	0.02***
	(19.01)	(9.95)	(9.60)	(3.10)
Country FE	YES	YES	YES	n.a.
Industry FE	NO	YES	YES	n.a.
Year FE	NO	NO	YES	YES
Firm FE	NO	NO	NO	YES
R^2	0.30	0.32	0.33	0.65
# Obs.	76,284	76,284	76,284	75,755

This table presents an analysis of the association between CDP disclosure and ownership by CDP signatories. The dependent variable, *CDP_Disclosure*, is an indicator variable that equals one if a company submits the CDP questionnaire in year *t*, and zero otherwise. In Panel A, the experimental variable, *Signatories_Hldg,* is the fraction of the firm's equity owned by mutual funds that are CDP signatories in year *t*-1. *OtherInst_Hldg* is the fraction of the firms' equity owned by funds managed by institutions that are not CDP signatories in year *t*-1. In Panel B, the experimental variable, *I(Signatories_Hldg>5%),* is an indicator variable that equals one if CDP signatories own more than 5% of the firm's equity in year *t*-1, and zero otherwise. The control variables are defined in Appendix A. Control variables are measured in year *t*-1. See Appendix A for variable definitions. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

The coefficient on *Signatories_Hldg* in Table 2, Panel A, is positive and statistically significant across all specifications, regardless of the fixed effect structure. The magnitude of the coefficient on *Signatories_Hldg* ranges from 0.27 to 0.44, depending on the specification. A coefficient of 0.27 suggests that a one within-fixed-effect standard deviation increase in *Signatories_Hldg* (0.06) is associated with an increase of approximately 1.6 percentage points in the probability that the firm answers the CDP questionnaire.[20] Furthermore, the coefficient on *Signatories_Hldg* is significantly larger than the coefficient on *OtherInst_Hldg* (Table 2, Panel A, shows that the coefficients on *Signatories_Hldg* and *OtherInst_Hldg* are significantly different at a *p*-value of less than 0.001). That is, the observed association between *Signatories_Hldg* and carbon disclosure does not merely reflect a general association between institutional ownership and disclosure (e.g., Bushee and NOE, 2000).

The results in Table 2, Panel B, are consistent with those in Panel A. The coefficient on *I(Signatories_Hldg>5%)* is positive and statistically significant in all specifications, with the magnitude of the coefficient ranging from 0.04 to 0.12. As such, these patterns also support the notion that the CDP signatories influence the probability that firms answer the CDP questionnaire. The estimates suggest that the magnitude of the effect ranges from 4% to 12%. Overall, the results from Table 2 are consistent with H1.

In Table OD.4 of the Online Appendix we repeat the analysis in Table 2 for the subsample of observations with non-missing Trucost data. We conduct this additional analysis to enhance comparability with the results presented in later sections of the paper that require restricting the sample to observations with non-missing Trucost data. As a further robustness check, the test in Table OD.4 also controls for the firm's lagged carbon emissions. As shown in Table OD.4, we obtain similar results.

4.2. Regression discontinuity design around the bottom of the MSCI index

Our next set of analyses exploits plausible exogenous variation in the ownership of CDP signatories induced by inclusion/exclusion of the sample firms in the MSCI ACWI (i.e., the Morgan Stanley Capital International All Country World Index). This methodological approach is grounded in prior literature (e.g., Aggarwal et al., 2011; Bena et al., 2017).[21] The MSCI index includes large and mid-cap companies from 23 developed and 23 developing countries. For each country, companies are ranked in descending order based on their market capitalization. We restrict our analysis to the vicinity of the bottom of the index (i.e., to those firms around the addition threshold into MSCI ACWI in that year). We focus on the period from 2005 to 2020 due to limitations in the availability of data on MSCI ACWI membership. We estimate the following model:

$$CDP\_Disclosure_{it} = \alpha + \beta_1 * MSCI_{it} + \beta_2 * Rank_{it} + \beta_3 * Rank_{it} * MSCI_{it} + \gamma * Controls_{it-1} + \tau_t + \delta_s + \mu_k + \varepsilon_{it}, \qquad (2)$$

CDP_Disclosure and *Controls* are as in equation (1). *MSCI* is an indicator variable that equals one if the firm is included in the MSCI index, and zero otherwise. In line with prior literature (Boone and White, 2015; Crane et al., 2016) equation (2) also includes two additional variables, *Rank* and *Rank*MSCI*, where *Rank* is defined as the position of the company in the ranking of sample firms based on market capitalization. In the narrow bandwidth around the index threshold, the variable *MSCI* captures random variation in companies' market capitalization, which largely determines the composition of the index. As such, *MSCI* could be treated as plausibly exogenous. τ_t, δ_s, and μ_k indicate year, industry, and country fixed effects, respectively.

To confirm that this plausibly exogenous variation in the MSCI index is associated with signatory holdings, we estimate the following model:

$$Signatories\_Hldg_{it} = \alpha + \beta_1 * MSCI_{it} + \beta_2 * Rank_{it} + \beta_3 * Rank_{it} * MSCI_{it} + \gamma * Controls_{it-1} + \tau_t + \delta_s + \mu_k + \varepsilon_{it}, \qquad (3)$$

Table 3 presents the results of estimating equations (2) and (3). The estimation of equation (2) confirms that the plausibly exogenous variation in the inclusion in the MSCI index is associated with a higher probability that the firm discloses to the CDP. The estimation of equation (3) confirms that such exogenous variation is accompanied by an increase in the holdings of CDP signatories. Overall, these results are consistent with H1.

Tables OD.5 and OD.6 of the online appendix include two variants of this test that estimate a 2SLS model using the inclusion in the MSCI as an instrumental variable. In the first test, we restrict the analysis around the bottom of the index (as in the above tests). In the second test, we include all sample observations. As shown in the online appendix, the results of these tests are also consistent with H1. In addition, Table OD.7 includes higher orders polynomials of *Rank*. We find similar results.

4.3. Stock additions to the MSCI index

To complement the previous tests, we take a second approach by focusing on additions of stocks to the MSCI ACWI. This variant of the analysis in Table 3 is also used in the literature studying the effect of institutional ownership around the world

---

[20] We use the within-fixed-effect standard deviation to interpret the magnitude of the coefficient on *Signatories_Hldg* (0.27) in Table 2, Panel A, since the specification corresponding to this estimation includes firm fixed effects (deHaan 2021). A similar computation is not feasible in Table 2, Panel B, as the variable of interest, *I(Signatories_Hldg>5%)*, is binary (deHaan, 2021).

[21] Firms are sequentially included in the index starting from the largest ones until the cumulative share of index constituents reaches 85% of the free float-adjusted market capitalization of the country's listed equity. To promptly adjust for changes in market capitalizations, MSCI adjusts the set of constituents at the end of every calendar quarter.

Table 3
Analysis around the lower threshold of the MSCI ACWI.

	Dep. var.: Signatories_Hldg			Dep. var.: CDP_Disclosure		
	Bandwidth [-100; +100] (1)	Bandwidth [-200; +200] (2)	Bandwidth [-300; +300] (3)	Bandwidth [-100; +100] (4)	Bandwidth [-200; +200] (5)	Bandwidth [-300; +300] (6)
MSCI	0.02***	0.03***	0.02***	0.04**	0.04***	0.04***
	(7.90)	(8.75)	(8.15)	(2.45)	(3.38)	(3.35)
Rank	−0.00	−0.00	−0.001*	0.00	−0.00	−0.001*
	(−0.88)	(−0.32)	(−1.70)	(0.05)	(-0.35)	(-1.86)
Rank*MSCI	0.00	0.00	0.00	0.001*	0.00	0.00
	(0.36)	(0.24)	(0.86)	(1.65)	(0.55)	(0.14)
Controls	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R^2	0.29	0.28	0.28	0.35	0.34	0.34
# Obs.	18,962	24,239	27,285	18,962	24,239	27,285

This table presents an analysis of variation in ownership by CDP signatories and CDP disclosure in the vicinity of the lower threshold of the MSCI ACWI. *Signatories_Hldg* is the fraction of the firm's equity owned by institutional investors that are CDP signatories in year *t*. *CDP_Disclosure* is an indicator variable that equals one if the firm submits the CDP questionnaire in year *t*, and zero otherwise. *MSCI* equals one if the firm is included in the MSCI ACWI in year *t*, and zero otherwise. *Rank* is the position of the company in the ranking of sample firms based on market capitalization year *t*. *Controls* includes the same control variables as in Table 2, also measured in year *t*-1. See Appendix A for variable definitions. "Bandwidth" indicates the number of ranking positions (based on market capitalization) above and below the threshold. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

(i.e., Bena et al., 2017).[22] Following this prior work, we examine ownership and disclosure patterns around the time a stock is added to the MSCI ACWI. Our treatment group includes the 1848 sample firms added to this index at some point between 2006 and 2020. In the control group, we include all the sample firms that are not added to the MSCI index during that period. For both groups of firms, we include all the observations during the sample period and estimate the following model:

$$Signatories\_Hldg_{it} = \beta_1 * Treatment_i * Post_{it} + \gamma * Controls_{it-1} + \tau_t + \delta_i + \varepsilon_{it}, \qquad (4)$$

$$CDP\_Disclosure_{it} = \beta_1 * Treatment_i * Post_{it} + \gamma * Controls_{it-1} + \tau_t + \delta_i + \varepsilon_{it}, \qquad (5)$$

where *Treatment* is an indicator variable that equals one if a firm *i* is added to the MSCI ACWI at some point during the sample period, and zero otherwise. *Post* is an indicator variable that equals one in the year a firm is added to the MSCI ACWI and thereafter, and zero otherwise. Similar to previous tests, the specification includes firm and year fixed effects.

We also conduct a variant of the previous analysis using propensity score matching. We match every treatment observation with one non-treated observation from the same industry and year. For every treatment and control firm we include observations for a five-year period (−2; +2) around the treatment year. Including these five years of data around the addition to MSCI ACWI requires restricting the sample of potential treatment years to the period 2006−2018. The test of covariate balance (Table OD.8 in the Online Appendix) confirms that the matched treatment and control groups are comparable.

Table 4 presents the results. Panel A corresponds to the analysis including all observations. Panel B corresponds to the analysis including the subsample of matched treatment-control pairs. The results parallel those in Table 3; compared to the control sample, ownership by CDP signatories increases significantly after a treated firm is added to the MSCI ACWI and the treated firms are more likely to answer the CDP questionnaire. Fig. 1 maps out the results of estimating a dynamic version of Table 4, Panel A (the figure shows differences in the probability of CDP disclosure between the treatment and control groups in each year relative to the year of the addition to the MSCI index). The results confirm that there is no pre-trend (the differences are not statistically significant before the addition) and show an increase in CDP disclosure for the treatment firms after the addition.

Overall, the evidence presented in Table 4 and Fig. 1 support our interpretation of the results in Table 2, namely that the presence of CDP signatories induces firms to disclose climate-related information to the CDP, and thus are consistent with H1.

5. Climate-related disclosure and subsequent carbon emissions

Our second set of tests aims to shed light on hypothesis H2, namely that CDP disclosures predict lower levels of carbon emissions.

---

[22] Our approach based on the MSCI index is "one-sided" (i.e., the firms included in the index experience an increase, not a decrease, in institutional ownership). An alternative approach used in the literature exploits the reconstitution of the Russell indexes. Prior studies use two discontinuities created by the design of the Russell indexes: (i) the Russell 1000/2000 cut-off, which is "two-sided" in the sense that firms on both sides of the threshold experience changes in institutional ownership, and (ii) the Russell 3000 cut-off (i.e., the lower cut-off of the index), which is "one-sided". The approaches based on the Russell indexes are restricted to the U.S.; our sample contains international firms.

Table 4
Additions to the MSCI ACWI.

Panel A. All sample observations

Variable	Dependent variable:	
	Signatories_Hldg (1)	CDP_Disclosure (2)
Treatment*Post	0.01*	0.03***
	(1.78)	(2.65)
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
R^2	0.73	0.65
# Obs.	75,755	75,755

Panel B. Propensity score matching

Variable	Dependent variable:	
	Signatories_Hldg (1)	CDP_Disclosure (2)
Treatment*Post	0.01***	0.03*
	(3.16)	(1.92)
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
R^2	0.85	0.76
# Obs.	6176	6176

This table presents an analysis of ownership by CDP signatories and CDP disclosure around the time a stock is added to MSCI ACWI. The treatment group includes firms added to the MSCI ACWI during the sample period. In Panel A, the control group includes all sample firms that are never included in the index during the sample period. The test includes all sample observations for both the treatment and the control group. In Panel B the analysis is restricted to treatment and control observations obtained through propensity score matching. For every treated firm, a control firm is selected among non-treated firms from the same industry and year using propensity scores. The covariates used to construct propensity scores are the vector of controls in Table 2 (see also Table OD.8 in the Online Appendix). For every treatment and control observation the test includes a 5-year period around the treatment year $(-2; +2)$. *Signatories_Hldg*, is the fraction of the firm's equity owned by institutional investors that are CDP signatories in year t. *CDP_Disclosure*, is an indicator variable that equals one if the firm submits the CDP questionnaire in year t, and zero otherwise. *Treatment* is an indicator variable that equals one if a firm is added to the MSCI ACWI in year t, and zero otherwise. *Post* is an indicator variable that equals one in the year a firm is added to the MSCI ACWI and thereafter, and zero otherwise. *Controls* includes the same control variables as in Table 2, also measured in year t-1. See Appendix A for variable definitions. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

5.1. CDP disclosures and subsequent CO_2 emissions

We start by exploring whether CDP disclosures are associated with subsequent levels of carbon emissions. Finding a negative association would be consistent with H2. We estimate the following model:

$$Log(CO_2)_{it+s} = \alpha + \beta * CDP\_Disclosure_{it} + \gamma * Controls_{it-1} + \tau_t + \delta_i + \varepsilon_{it} \qquad (6)$$

where *Log(CO₂)* is the natural logarithm of a firm's direct GHG emissions (scope 1) measured in equivalents of metric tons of CO_2 and $s = \{0, 1, 2\}$.[23] *CDP_Disclosure* and the control variables are as previously defined (please see Appendix A for variable definitions). Sub-indexes i and t refer to firm i and year t, respectively. τ_t and δ_i denote year and firm fixed effects, respectively.

Table 5 presents the results of this test.[24] The coefficient on our main variable of interest, *CDP_Disclosure*, is negative and statistically significant, which is consistent with H2. The magnitude of the coefficient on *CDP_Disclosure* ranges from -0.07 to -0.10, which indicates that, after disclosing to the CDP, corporate CO_2 emissions are between 7% and 10% lower on average

---

[23] The GHG Protocol breaks down total GHG emissions into three "scopes". Scope 1 emissions relate to direct GHG emissions (i.e., sources that are owned or controlled by the company); scope 2 emissions relate to emissions from purchased heat and electricity; scope 3 emissions relate to emissions from the supply chain and other sources not owned or controlled by the company (e.g., employee business travel, outsourced business activities).

[24] Table OD.9 in the online appendix presents the results of repeating the analysis for indirect emissions (i.e., scope 2 and scope 3). In contrast to Table 5, Table OD.9 reveals that the coefficient on *CDP_Disclosure* is not significant for scope 2 and 3 emissions in year $t+1$. One possible explanation for these weaker results is that, unlike scope 1 emissions, a firm's scope 2 and scope 3 emissions are not directly controlled by the firm's management.
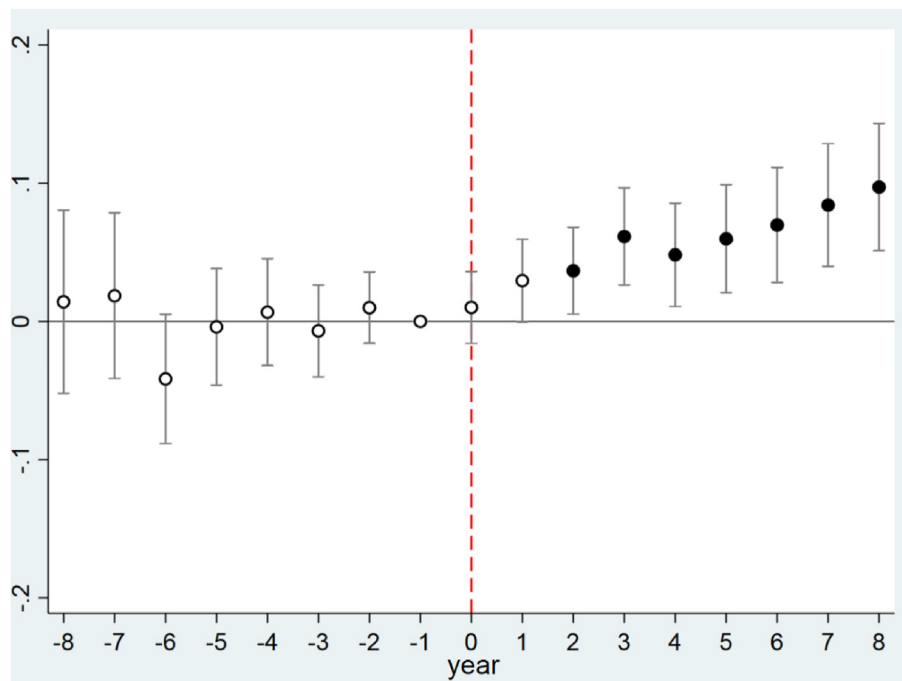
Fig. 1. Addition to MSCI ACWI and Disclosure to the CDP. This figure depicts the firm's disclosure to CDP status around the firm's addition to MSCI ACWI. We re-estimate the specification from column (2) of Table 4, Panel A, replacing the *Treatment*Post* interaction with separate indicator variables, each marking one year over the t−8 to t+8 period relative to the year of the addition to MSCI ACWI (t = 0). We omit the indicator for year t−1. It therefore serves as a benchmark and has a coefficient value of zero (and no confidence interval). The figure plots the coefficient estimates of the 16 years together with their 95 percent confidence intervals. The dependent variable is *CDP_Disclosure*, is an indicator variable that equals one if the company submits the CDP questionnaire in year *t*, and zero otherwise. Black dots denote that the coefficient is statistically different from that of the indicator for period t-1 (two-tailed, 5% level).

over the next years.[25] As shown in the Online Appendix (Table OD.10), our inferences are unaffected when we use alternative fixed effect structures (i.e., country-year and industry-year fixed effects).

Table 5 shows that the disclosure to the CDP is followed by lower scope 1 emissions in t, t+1 and t+2. While some strategies to reduce emissions need more than one year to yield results, firms could also curb emissions relatively quickly. For example, companies could rebalance their product mix based on their carbon emissions and/or reduce the amount of input materials (Starbucks' introduction of a strawless cold drink lid is a case in point).

We consider the possibility that the results in Table 5 are driven by our sample firms divesting their CO_2 producing assets after the first CDP disclosure. While this could be one way (among others) to reduce emissions, it could also reflect a change in firm strategy not necessarily related with an intent to improve environmental performance. To explore the empirical validity of this concern, we replace the dependent variable in Table 5 with the logarithm of sales and with the logarithm of total assets. As shown in Table OD.11 in the Online Appendix, future sales and total assets increase (rather than decrease) among firms disclosing to the CDP, which is not consistent with the idea that the reduction in CO_2 emissions is driven by a reduction in the economic activity of the disclosing firms.

5.2. First-time disclosure to the CDP

As an alternative test of H2, we repeat the previous analysis focusing on the year when firms initiate disclosure to the CDP. Accordingly, our "treatment" group includes the 4352 sample firms that are CDP respondents (i.e., firms that disclose to the CDP at least once between 2005 and 2020).[26] As a "control" group, we include all the sample firms that are not CDP respondents (i.e., firms that never disclose to the CDP during the sample period). For both groups of firms, we include all the observations during the sample period and estimate the following model:

$$Log(CO_2)_{it} = \beta_1 * CDP\ Respondent_i * Post_{it} + \gamma * Controls_{it-1} + \tau_t + \delta_i + \varepsilon_{it}, \tag{7}$$

---

[25] While smaller in magnitude, our results are comparable to the findings of prior literature on the mandatory disclosure of carbon emissions. Studies examining the UK's mandatory greenhouse gas disclosure requirement find that firms reduce their carbon emissions by an average of 16 percent (Jouvenot and Krueger, 2019; Downar et al., 2021). Other studies, examining the mandatory disclosure requirement for powerplants in the United States, find that powerplants reduce their emissions by approximately 8 percent (Tomar, 2023) and by 10 percent for those publicly traded (Yang et al., 2021).

[26] We use the language "treatment" and "control" in the interest of clarity in the description of the test. However, we emphasize that this is a descriptive test and that the "treatment" is an endogenous choice by the firm.

Table 5
Disclosure to the CDP and CO2 emissions.

Indep. variables:	Dependent variable: Log [CO_2 $(t + s)$]		
	$s = 0$ (1)	$s = 1$ (2)	$s = 2$ (3)
CDP_Disclosure	−0.07***	−0.08***	−0.10***
	(−4.23)	(−5.07)	(−6.21)
Inst_Hldg	0.08	0.10	0.08
	(1.00)	(1.19)	(0.90)
Size	0.23***	0.28***	0.27***
	(6.96)	(9.04)	(8.91)
Log(BM)	−0.01	−0.04***	−0.05***
	(−0.98)	(−3.00)	(−4.00)
ROA	0.18*	0.28***	0.28***
	(1.90)	(2.71)	(2.66)
Leverage	0.00	−0.01	−0.04
	(0.01)	(−0.09)	(−0.50)
Tangibility	0.44***	0.42***	0.32**
	(3.16)	(3.05)	(2.37)
Dividends	0.01	0.00	0.01
	(1.11)	(0.60)	(1.25)
Return	0.05***	0.05***	0.05***
	(6.99)	(6.68)	(6.93)
Log(Sales)	0.53***	0.30***	0.17***
	(14.72)	(9.39)	(5.50)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
R^2	0.95	0.95	0.95
# Obs.	66,816	64,977	62,963

This table presents an analysis of the association between carbon emissions and CDP disclosure. Log[CO_2 $(t + s)$] is the logarithm of the firm's direct CO_2 emissions (scope 1) measured in year $t + s$, where t is the year of the CDP disclosure and $s = 0, 1, 2$ in columns (1), (2), and (3), respectively. CDP_Disclosure is an indicator variable that equals one if the company submits the CDP questionnaire in year t, and zero otherwise. Control variables are defined in Appendix A and measured in year t-1. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

where Log(CO_2) is the natural logarithm of the firm's direct CO_2 emissions (scope 1). CDP Respondent is an indicator variable that equals one if a firm i starts disclosing to the CDP for the first time during the sample period, and zero otherwise. Post is an indicator variable that equals one in the year a firm files its first CDP questionnaire and thereafter, and zero otherwise. We include Controls (i.e., the vector of controls in Table 5) to account for any remaining covariate imbalance. The coefficient on CDP Respondent*Post captures the differential effect between the "treatment" and "control" groups following the firms' initial disclosure to the CDP.

As in section 4.3, we conduct a variant of the previous analysis using propensity score matching. We match every CDP respondent in the first year of disclosure with one observation with no CDP disclosure from the same industry and year. In this second test, we focus on a (−2; +2) year window around the first disclosure year. The test of covariate balance (Table OD.12 in the Online Appendix) confirms that the two matched groups of observations are comparable.

Table 6
First-time disclosure to the CDP.

Indep. variables:	Dep. Var: Log [CO_2 (t)]	
	All sample observations (1)	Propensity score matching (2)
CDP Respondent*Post	−0.11***	−0.11***
	(−5.32)	(−4.05)
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
R-squared	0.95	0.96
Observations	66,816	8500

This table presents an analysis of carbon emissions around the time a firm starts disclosing to the CDP. The test in column (1) includes all CDP respondents (i.e., all the sample firms that disclosed at least once to the CDP during the sample period) and all CDP non-respondents (i.e., all the sample firms that never disclose to the CDP during the sample period).The test includes all sample observations for both CDP respondents and non CDP respondents The test in column (2) restricts the sample to observations obtained through propensity score matching. Each CDP respondent in the first year of disclosure is matched to an observation with no CDP disclosure from the same industry and year. The analysis is based on a window of (−2; +2) years around the year of first CDP disclosure. Log[CO_2 (t)] is the logarithm of the firm's direct CO_2 emissions (Scope 1). CDP Respondent is an indicator variable that equals one if a firm starts disclosing to the CDP for the first time during the sample period, and zero otherwise. Post is an indicator variable that equals one in the year when the first CDP questionnaire is filed and thereafter, and zero otherwise. Controls includes the same control variables as in Table 5, also measured in year t-1. See Appendix A for variable definitions. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.
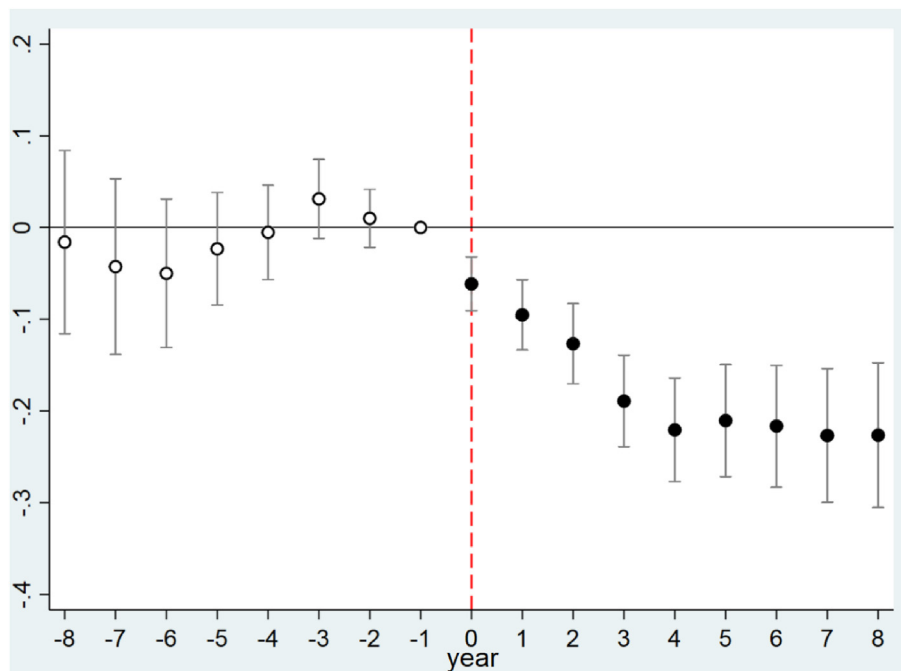
Fig. 2. First disclosure to the CDP and CO2 Emissions. This figure depicts the corporate carbon emissions around the first disclosure to CDP. We re-estimate the specification from column (1) of Table 6, replacing the *CDP Respondent*Post* interaction with separate indicator variables, each marking one year over the t−8 to t+8 period relative to the year of the first disclosure to CDP TPD (t = 0). We omit the indicator for year t−1. It therefore serves as a benchmark and has a coefficient value of zero (and no confidence interval). The figure plots the coefficient estimates of the 16 years together with their 95 percent confidence intervals. The dependent variable is the logarithm of the firm's direct CO_2 emissions (Scope 1). Black dots denote that the coefficient is statistically different from that of the indicator for period t-1 (two-tailed, 5% level).

Table 6 presents the results. Column (1) corresponds to the analysis including the full sample. Column (2) corresponds to the analysis including the matched control group. Consistent with H2, the interaction *CDP Respondent*Post* is negative and significant indicating that, relative to the control group, firms that disclose to the CDP for the first time exhibit significantly lower CO_2 emissions in the subsequent years.[27] As shown in Table OD.13 in the Online Appendix, our inferences are robust to using coarsened exact matching. Fig. 2 shows the results of a dynamic version of the Column (1) of Table 6. Consistent with H2, we observe no significant reduction in emissions in the years prior to the firm's first disclosure to the CDP, but a significant reduction thereafter.

5.3. Signatory investors' exclusive access to CDP data

We also refine the analysis in Table 5 by exploiting a key institutional feature of the CDP platform. As previously explained, if a firm decides to respond to the questionnaire and disclose its information to the CDP, it then has the option to mark its response as either "Public" or "Private". Responses marked as "Private" are available only to the signatory investors of the CDP; non-signatory investors and the general public cannot access this information. Responses marked as "Public" can be accessed by the general public at no cost through the CDP website. To the extent that other parties (e.g., non-signatory institutions, environmental activists, regulators) do not have access to information restricted to CDP signatories, any observed outcomes in cases marked as "Private" should be driven by CDP signatories.[28]

Table 7 presents the results of estimating equation (6) restricting the analysis to observations where a firm opts to grant access to its disclosed information only to CDP signatories. In columns (1) and (2) we exclude firms that marked their responses as "Public". In columns (3) and (4) we introduce an additional condition: we exclude cases in which CDP signatories own less than five percent of the firm's equity. This restriction ensures that the CDP signatories have enough clout to influence

---

[27] *CDP_Disclosure* in Table 5 equals zero if the firm stops disclosing to the CDP (temporarily or permanently). In contrast, *CDP Respondent*Post* in Table 6 equals one in these cases (it flags all observations after the firm starts disclosing for the first time). There are 7459 such cases in our sample. This explains the difference in the magnitude of the two coefficients.

[28] Several considerations suggest that stakeholders other than CDP signatories do not systematically obtain CDP disclosures marked as "Private". First, if the information leaked in all cases, we would not observe, as we do, a high percentage of firms choosing "private" disclosure. Second, it is unclear that investors have an incentive to leak the information. Note that access to the CDP disclosures is an informational advantage for signatory investors. Sharing the information would dilute this benefit. Moreover, investors are not allowed to "resell" the CDP information (see: www.cdp.net/en/info/terms-and-conditions). Breaking the CDP rules is not inconsequential; the CDP asks signatories to leave if their behavior is deemed inconsistent with the environmental objectives of the initiative. The exclusion could damage the affected institution's public image. Furthermore, as argued in detail in Online Appendix OA private disclosure to the CDP is unlikely to be prosecuted for violation of Reg FD.

Table 7
Signatory investors' exclusive access to CDP data.

	Dependent variable: Log [CO_2 (t + s)]					
	Only Signatories have access		Only Signatories have access and Signatories own >5%		Only Signatories have access and Signatories of both CDP and PRI own >5%	
	s = 1	s = 2	s = 1	s = 2	s = 1	s = 2
	(1)	(2)	(3)	(4)	(5)	(6)
CDP_Disclosure	−0.06***	−0.08***	−0.08***	−0.10***	−0.09***	−0.12***
	(−3.35)	(−4.24)	(−3.66)	(−4.53)	(−4.12)	(−5.00)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
R^2	0.95	0.95	0.95	0.94	0.95	0.94
# Obs.	50,090	49,623	47,755	47,282	46,404	45,941

This table presents an analysis of the association between carbon emissions and CDP disclosure applying several additional sample restrictions. The dependent variable is the logarithm of the firm's direct CO_2 emissions (scope 1). *CDP_Disclosure* is an indicator variable that equals one if a company submits the CDP questionnaire in year *t*, and zero otherwise. Columns (1)–(2) report results restricting the analysis to cases in which only CDP signatories have access to the CDP data (i.e., the test excludes firms whose CDP questionnaire can be accessed by the general public). Columns (3)–(4) introduces the additional restriction that CDP signatories own more than 5% of shares in the firm. Columns (5)–(6) introduces the additional restriction that the CDP signatories are also PRI signatories. *Controls* includes the same control variables as in Table 5, also measured in year *t*-1. See Appendix A for other variable definitions. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

corporate decisions, including reporting choices. In columns (5) and (6) we introduce a further condition: we impose that the CDP signatories owning more than five percent of the shares be PRI signatories as well.[29] That is, we focus on CDP signatories that have made public commitments to sustainability principles.

As shown in Table 7, the coefficient on *CDP_Disclosure* is negative and significant across specifications. This coefficient increases in magnitude as we progressively impose additional restrictions. The results are strongest in the most restrictive specifications (i.e., models (5) and (6)), namely when the information is only disclosed to CDP signatories, CDP signatories hold a substantial stake in the firm, and these investors also publicly commit themselves to sustainability principles.

Taken together, the results in Tables 5−7 are consistent with H2 (the disclosure to the CDP is followed by lower carbon emissions). To the extent that the patterns are attributable to CDP signatories (only they have access to the disclosed information), the evidence implies that institutional investors could be using the CDP information in ways that induce firms to reduce corporate emissions. In section 6 we provide more direct evidence on two such ways: engagement and divestment.

5.4. Alternative explanations

We consider two possible alternative explanations of the patterns documented in Tables 5−7 Online Appendix OB analyzes the possibility that Trucost systematically overestimates emissions in the period before a firm starts disclosing to the CDP and subsequently follows firm CDP disclosures (under the assumption that these are more accurate). As we explain in detail in the Online Appendix, this possibility is remote, as Trucost does not have access to the CDP data for firms that choose to make their CDP disclosures "Private".

Online Appendix OC analyzes the possibility that the results in Tables 5−7 are driven by firms' underreporting of emissions to the CDP. If, as shown in prior literature, firms manipulate earnings disclosures, it is also plausible that they manipulate CDP disclosures. In the Online Appendix, we offer several considerations suggesting that, while plausible, firms' misreporting to the CDP is unlikely to drive our results.[30]

6. CDP disclosures and mechanisms to influence corporate behavior

Our third set of tests aims to shed light on the economic mechanisms underlying H2 (i.e., the mechanisms explaining an association between CDP disclosures and subsequent carbon emissions). As discussed in section 2.3., we explore two such mechanisms: engagement and divestment.

---

[29] The number of CDP signatories and the number PRI signatories do not necessarily go hand-in-hand; while the majority of CDP signatories are PRI signatories, the reverse does not hold. One potential explanation is that the two organizations serve different purposes (the PRI encompasses ESG-related matters, whereas the CDP focuses on issues related to the 'E' portion of ESG).

[30] CDP disclosures could have spillover effects on non-disclosing firms. One possibility is that non-disclosure affects investors' beliefs about non-disclosing firms. If investors typically interpreted lack of disclosure as bad news, they would also act on non-disclosure firms, and we would not observe statistical patterns in Tables 5−7 Instead, our results suggest that there is no full unravelling. Another possibility is that non-disclosing firms learn from CDP disclosures. If non-disclosing firms believed that cutting emissions gives disclosing firms a competitive advantage, non-disclosing firms would also decrease emissions and we would find no results in Tables 5−7 But non-disclosing firms do not have access to "Private" CDP disclosures (only investors do).

6.1. Engagement

We start by analyzing institutional investors' engagements with the firms in their portfolios. To keep the analysis tractable, we focus on the three largest CDP signatories: BlackRock, Vanguard, and State Street. We focus on these investment firms, often referred to as the "Big Three," for the following reasons. The first is data availability; the Big Three recently started publicly disclosing in investment stewardship reports (ISR) detailed data on private engagements with their portfolio firms. Second, while the public disclosure of engagements may not be unique to the Big Three, collecting these data for all the investment funds present in our sample would be prohibitively costly. Third, studying the Big Three is in and of itself interesting in light of the recent debate on the role of these large investment managers in the economy (e.g., Tallarita, 2023).

We manually collect engagement information from the ISRs published by BlackRock, State Street, and Vanguard. Black-Rock's ISRs include engagements data from 7/1/2017 to 6/30/2020. Vanguard's ISRs include engagements data from 7/1/2018 to 6/30/2020. State Street's ISRs include engagements data from 1/1/2014 to 12/31/2020. Consistent with prior research (Azar et al., 2021), we exclude engagements by letters and include only comprehensive engagements via calls and in-person meetings.[31]

We next check that our main inference from Table 2 also holds for the Big Three; we re-estimate our benchmark specifications from Table 2 replacing *Signatories_Hldg* with *Big3_Hld*, and replacing *I(Signatories_Hldg>5%)* with *I(Big3_Hldg>5%)*. The results of these tests (presented in Table 8, Panel A) are consistent with those in Table 2; the coefficients on *Big3_Hldg* and *I(Big3_Hldg>5%)* are positive and statistically significant. That is, higher level of ownership by the Big Three institutions is associated with higher probability of CDP disclosure. Columns 1 and 3 suggest that one within-firm standard deviation increase in *Big3_Hldg* (i.e., 0.018) is associated with 2% higher frequency of CDP disclosure. Columns 2 and 4 suggest that the frequency of CDP disclosure is 11% higher among firms where the Big Three hold more than 5% of shares.

Having checked that the Big Three are among the CDP signatories that appear to induce firms to disclose information to the CDP, we next conduct a multivariate test on the determinants of the probability that a given firm is engaged by each of the Big Three. We construct three separate left-hand side indicator variables, one for each of the Big Three investors. Each indicator variable equals one if the firm is included in the list of engagements disclosed in the ISR of the respective Big Three institution, and zero otherwise. The corresponding three variables are labelled as *Engagement by BlackRock*, *Engagement by State Street*, and *Engagement by Vanguard*, respectively.

The right-hand side variables are as follows. *CDP_Disclosure* is as previously defined (i.e., an indicator variable that equals one if the firm discloses to the CDP, and zero otherwise). *Top_Emitter* is an indicator variable that equals one if the firm is in the top quartile by carbon emissions in its industry, and zero otherwise. *BlackRock_Hldg* is the fraction of the firm's shares held by funds managed by BlackRock (similar variables are constructed for Vanguard and State Street). The specification also includes a vector of controls for firm characteristics: *Size*, *Log(BM)*, *ROA*, *Leverage*, *Tangibility*, *Dividends* and *Return*, all of them as previously defined (see Appendix A for variable definitions).

Table 8, Panel B, presents the results. The coefficient on the interaction *Top_Emitter*CDP_Disclosure* is positive and statistically significant. This result is consistent with the likelihood of a Big Three engagement being greater if the target firm exhibits higher levels of carbon emissions in the previous year and discloses this information through the CDP questionnaire. The coefficients on Big Three ownership (i.e., *BlackRock_Hldg*, *StateStreet_Hldg*, *Vanguard_Hldg*) are positive and statistically significant, which is consistent with the notion that the Big Three are more likely to engage with firms on which they have greater influence. To the extent that the ownership metrics also gauge the economic interest of the Big Three in the firm, the evidence is also consistent with the notion that these large investors believe that the value of their portfolios could vary with the level of carbon emissions. Finally, the coefficient on *Size* is positive and significant, confirming that the Big Three focus their engagement efforts on relatively larger firms. The focus on larger firms is consistent with these firms being more influential (more visible) and having a potentially stronger impact on climate change. As shown in Table OD.14 in the Online Appendix, our inferences do not change if we conduct the analysis considering the Big Three as one combined group of investors (i.e., pooling their engagements and holdings).

Overall, the results in Table 8 suggest that the Big Three selectively engage with portfolio firms on environmental issues. But more importantly for the purpose of our paper, the results in Table 8 suggest that the Big Three demand emission information through the CDP platform and use the information to select engagement targets among a plethora of portfolio companies.[32]

6.2. Divestment

We next explore whether signatories use the CDP information for asset allocation purposes. In parallel to our analysis in section 6.1, we examine whether investors use the disclosed information to divest from firms with higher emissions. We conduct the analysis distinguishing between active and index funds among CDP signatories. We use two alternative measures

---

[31] According to our data, BlackRock engaged with 3102 firms, State Street engaged with 1999 firms, and Vanguard engaged with 1301 firms. See Azar et al. (2021) for more details on the engagement data.

[32] Consistent with this interpretation, in a recent survey by Krueger et al. (2020) institutional investors responded that they select firms for engagements on climate related issues by analyzing their portfolio firms' carbon footprint.

Table 8
Engagement.

Panel A. Big Three ownership and disclosure

	Dependent Variable: *CDP_Disclosure*			
	(1)	(2)	(3)	(4)
Big3_Hldg	1.03***		0.95***	
	(7.37)		(7.03)	
I(Big3_Hldg>5%)		0.11***		0.03***
		(11.42)		(3.72)
Controls	YES	YES	YES	YES
Country FE	YES	YES	n.a.	n.a.
Industry FE	YES	YES	n.a.	n.a.
Year FE	YES	YES	YES	YES
Firm FE	NO	NO	YES	YES
R^2	0.33	0.33	0.65	0.65
# Obs.	76,284	76,284	75,755	75,755

Panel B. Disclosure and Big Three engagement

	Dependent variable:		
	Engagement by Black Rock	*Engagement by State Street*	*Engagement by Vanguard*
	(1)	(2)	(3)
*CDP_Disclosure*Top_Emitter*	0.05***	0.04***	0.04***
	(4.88)	(8.52)	(4.28)
CDP_Disclosure	0.04***	0.00	0.00
	(5.44)	(0.52)	(0.72)
BlackRock_Hldg	3.68***		
	(19.96)		
StateStreet_Hldg		4.00***	
		(17.62)	
Vanguard_Hldg			0.80***
			(5.05)
Top_Emitter	−0.03***	−0.01***	−0.01
	(−3.03)	(−3.47)	(−1.02)
Size	0.07***	0.03***	0.04***
	(16.71)	(15.46)	(12.23)
Log(BM)	−0.02***	−0.01***	−0.02***
	(−7.39)	(−9.30)	(−7.78)
ROA	−0.05	0.01	−0.02
	(−1.37)	(0.41)	(−0.70)
Leverage	−0.08***	−0.04***	−0.06***
	(−5.08)	(−6.31)	(−4.37)
Tangibility	−0.02	0.00	0.00
	(−1.17)	(0.46)	(0.19)
Dividends	−0.00	0.00	0.01*
	(−0.38)	(0.83)	(1.76)
Return	−0.00	0.001*	−0.01
	(−0.74)	(1.71)	(−0.95)
Log(Sales)	0.01	0.00	0.00
	(1.44)	(0.91)	(0.52)
Country FE	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
R^2	0.26	0.14	0.22
# Obs.	17,114	36,468	11,125

This table presents an analysis of the association between CDP disclosures and engagements by the Big Three with portfolio companies. Panel A presents an analysis of the association between Big Three ownership and firms' disclosure to the CDP. The dependent variable *CDP_Disclosure* is an indicator variable that equals one if a company submits the CDP questionnaire in year *t*, and zero otherwise. *Big3_Hldg* is the fraction of the firm's equity owned by BlackRock, Vanguard, and State Street in year *t*; *I(Big3_Hldg>5%)* is an indicator variable that equals one if BlackRock, Vanguard, and State Street own more than 5% of the firm's equity in year *t*. In Panel A all independent variables are measured in year *t*-1. Panel B presents an analysis of the association between the probability of engagement by the Big Three and CDP disclosure. *Engagement by X* equals one if X engages with the firm in that year, and zero otherwise (X being one of the Big Three). *Top_Emitter* is an indicator variable that equals one if the company is in the top industry quartile based on the amount of CO_2 emissions in that year, and zero otherwise. *Top_Emitter* and *CDP_Disclosure* are measured in year *t*. *Controls* includes the same control variables as in Table 2, also measured in year *t*-1. See Appendix A for variable definitions. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

as the dependent variable: *Active_Signatories_Hldg* is the fraction of shares owned by signatories that are active funds and *Index_Signatories_Hldg* is the fraction of shares owned by signatories that are index funds. We regress each of the dependent variables on the interaction of *Top_Emitter* with *CDP_Disclosure* (defined as in Table 8, Panel B). That is, we test whether firms with the highest levels of emissions, and that disclose to the CDP, exhibit relatively lower ownership by CDP signatories representing active and passive funds.

We conduct the analysis measuring holdings in t and $t+1$ to allow for the possibility that funds incorporate in $t+1$ information disclosed at the end of t. The specification also includes the vector of controls for firm characteristics used in prior tests, including *Size*, *Log(BM)*, *ROA*, *Leverage*, *Tangibility*, *Dividends*, and *Return* (see Appendix A for variable definitions). We also include firm (and year) fixed effects to control for potentially confounding variation. In parallel to previous tests, we apply the sequential refinement process described in section 5.3 (see also Table 7). That is, in addition to focusing exclusively on disclosures marked as "Private" and restricted to CDP signatories, we impose that CDP signatories hold a substantial stake in the firm and that these investors also be publicly committed to sustainability (PRI) principles (as in Table 7, we apply these restrictions sequentially and cumulatively).

Table 9
Institutional holdings: Firm-level analysis.

Panel A. Active funds

	Dependent variable: *Active_Signatories_Hldg* ($t + s$)					
	Only Signatories have access		Only Signatories have access Signatories own >5%		Only Signatories have access Signatories of both CDP and PRI own >5%	
	s = 0	s = 1	s = 0	s = 1	s = 0	s = 1
	(1)	(2)	(3)	(4)	(5)	(6)
CDP_Disclosure* Top_Emitter	−0.005**	−0.005**	−0.008***	−0.009***	−0.010***	−0.012***
	(−2.00)	(−2.19)	(−2.77)	(−2.81)	(−3.17)	(−3.30)
CDP_Disclosure	0.006***	0.004***	0.013***	0.009***	0.017***	0.012***
	(4.23)	(2.85)	(6.87)	(4.60)	(7.88)	(5.31)
Top_Emitter	0.002	0.003	0.003	0.003	0.003	0.003
	(1.35)	(1.42)	(1.44)	(1.52)	(1.49)	(1.60)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
R²	0.759	0.758	0.760	0.759	0.761	0.760
# Obs.	47,243	42,532	44,947	40,323	43,575	38,965

Panel B. Index funds

	Dependent variable: *Index_Signatories_Hldg* ($t + s$)					
	Only Signatories have access		Only Signatories have access Signatories own >5%		Only Signatories have access Signatories of both CDP and PRI own >5%	
	s = 0	s = 1	s = 0	s = 1	s = 0	s = 1
	(1)	(2)	(3)	(4)	(5)	(6)
CDP_Disclosure* Top_Emitter	−0.001	0.000	0.000	0.002	0.001	0.003
	(−0.59)	(0.16)	(0.25)	(1.19)	(0.40)	(1.37)
CDP_Disclosure	0.003***	0.003***	0.005***	0.005***	0.006***	0.006***
	(4.57)	(4.30)	(5.18)	(4.89)	(5.86)	(5.62)
Top_Emitter	0.002*	0.003**	0.002*	0.003*	0.002*	0.003**
	(2.00)	(2.15)	(1.88)	(2.04)	(1.84)	(2.00)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
R²	0.763	0.774	0.764	0.776	0.766	0.777
# Obs.	47,243	42,532	44,947	40,323	43,575	38,965

This table presents a firm-level analysis of the association between CDP disclosures and institutional holdings. The unit of observation is firm-year. In Panel A, *Active_Signatories_Hldg* is the fraction of shares owned by signatories that are active funds in year t. In Panel B, *Index_Signatories_Hldg* is the fraction of shares owned by signatories that are index funds in year t. *CDP_Disclosure* is an indicator variable that equals one if a company submits the CDP questionnaire in year t, and zero otherwise. *Top_Emitter* is an indicator variable that equals one if the company is in the top industry quartile based on the amount of CO_2 emissions in in year t, and zero otherwise. Columns (1)–(2) report results restricting the analysis to cases in which only CDP signatories have access to the CDP data (i.e., we exclude firms whose CDP questionnaire can be accessed by the general public). Columns (3)–(4) introduces the additional restriction that CDP signatories own more than 5% of shares in the firm. Columns (5)–(6) introduces the additional restriction that the CDP signatories are also PRI signatories. *Controls* includes the same control variables as in Table 2, also measured in year t-1. See Appendix A for other variable definitions. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table 9 presents the results. To the extent that index investors are less likely to adjust their portfolios based on specific information releases (such as climate-related disclosures), we expect the results to be stronger among active funds. Consistent with this idea, Panels A and B of Table 9 show that the negative coefficient on the interaction *CDP_Disclosure*Top_Emitter* is significant for active fund ownership, but not for index fund ownership. We obtain the same inferences when we repeat the analysis using total signatory holdings as an alternative dependent variable (see Table OD.15).

Table OD.16 repeats the analysis at the fund level. The dependent variable is the annual change in the holdings of the fund at a firm in a given year (the unit of observation is fund-firm-year). The specification includes fund-year fixed effects (in addition to firm fixed effects). Focusing on the variation within the portfolio of a given fund in a given year allows us to control for the determinants of the funds' investment decisions at the portfolio level. As shown in Table OD.16, we find that CDP signatories are more likely to adjust their portfolios by decreasing their position in firms that disclose to the CDP with the highest levels of emissions within their industries (see column 1). In contrast, we do not find such a pattern for other funds (see column 2 of Table OD.16). The results in Table OD.16 confirm our interpretation of Table 9: signatory investors use the CDP information to divest from firms with higher emissions.

7. Conclusion

We examine whether institutional investors who sign up to the CDP influence firms' disclosure of climate risk information, and whether such disclosure predicts lower levels of carbon emissions. We find that firms with a higher ownership stake of CDP signatories are more likely to disclose their climate risk information to the CDP. This result is robust to the use of demanding fixed effect structures as well as tests exploiting plausible exogenous variation in institutional ownership.

In addition, we find evidence that firm disclosure to the CDP is accompanied by lower carbon emissions. This result continues to hold when we restrict the sample to observations in which CDP signatories are privy to firm-specific climate disclosures not accessible to the public; observations in which CDP signatories hold a substantial stake in the firm; and observations in which CDP signatories also publicly commit themselves to sustainability (PRI) principles.

We also explore the mechanisms potentially explaining the association between CDP disclosure and carbon emissions. We document that investors are more likely to engage with top emitting firms after they disclose to the CDP. We also find lower investor holdings among top emitters after these firms disclose to the CDP. Taken together, the results suggest that investor demand for climate-related information is associated with greater corporate climate disclosure and lower carbon emissions.

Acknowledgements

Appendix A. Variable definitions

CDP_Disclosure	Indicator variable that equals one if a company submits the CDP questionnaire in that year, and zero otherwise.
CDP Respondent	Indicator variable that equals one if a firm starts disclosing to the CDP for the first time during the sample period, and zero otherwise.
Signatories_Hldg	Fraction of the firm's equity owned by mutual funds that are currently CDP signatories.
I(Signatories_Hldg>5%)	Indicator variable that equals one if CDP signatories own more than 5% of the firm's equity.
OtherInst_Hldg	Fraction of the firms' equity owned by funds managed by institutions that are not CDP signatories.
Size	Logarithm of the firm's total assets.
Log(BM)	Logarithm of the book value of common equity scaled by the market value of equity.
ROA	Net income scaled by total assets.
Leverage	Total debt scaled by total assets. Total debt is the sum of long-term debt and the debt in current liabilities.
Tangibility	Property, Plant and Equipment (PPE) scaled by total assets.
Dividends	Total amount of dividends scaled by net income.
Return	Firm's buy and hold return over the year.
Log(Sales)	Logarithm of the book value of sales.
MSCI	The instrumental variable, indicator variable that equals one if stock i is a member of the MSCI ACWI in year t, and zero otherwise.
Rank	The position of the company in the ranking of sample firms based on market capitalization relative to the MSCI ACWI addition threshold.
Log(CO_2)	Logarithm of the firm's direct GHG emissions (scope 1) measured in equivalents of metric tons of CO_2.
Inst_Hldg	Fraction of the firm's equity owned by institutional investors.
Engagement by BlackRock	Indicator variable that equals one if BlackRock engages with the firm from July 1, 2017 until June 30, 2020, and zero otherwise. The data includes all engagements.
Engagement by State Street	Indicator variable that equals one if State Street Global Advisors engages with the firm from January 1, 2014 until December 31, 2020, and zero otherwise. The data includes engagements about Environmental/Social issues.
Engagement by Vanguard	Indicator variable that equals one if Vanguard engages with the firm from July 1, 2018 until June 30, 2020, and zero otherwise. The data includes engagements about "Oversight of strategy and risk" (which include environmental issues).
Big3_Hldg	Big Three's holding in the firm, namely, the fraction of the firms' equity owned by mutual funds managed by BlackRock, Vanguard, or State Street Global Advisors.
I(Big3_Hldg>5%)	Indicator variable that equals one if the fraction of the firm's equity owned by mutual funds managed by BlackRock, Vanguard, or State Street Global Advisors is more than 5%.
BlackRock_Hldg	BlackRock's holdings in the firm, namely, the fraction of the firms' equity owned by BlackRock's mutual funds.
StateStreet_Hldg	State Street's holdings in the firm, namely, the fraction of the firms' equity owned by State Street Global Advisors's mutual funds.
Vanguard_Hldg	Vanguard's holdings in the firm, namely, the fraction of the firms' equity owned by State Vanguard's mutual funds.
NonBig3_Hldg	Non-Big Three's holdings in the firm, namely, the fraction of the firms' equity owned by funds managed by institutions other than BlackRock, Vanguard, and State Street Global Advisors.
Top_Emitter	Indicator variable that equals one if a company is in top quartile by the amount of CO_2 emissions in its industry.

Online Appendix

OA. CDP disclosures and Reg FD

In this appendix we analyze the possibility that "private" CDP disclosures (i.e., disclosures with exclusive access to CDP signatories) are a violation of the SEC's Regulation Fair Disclosure (Reg FD) issued in 2000. Reg FD requires that, if companies disclose material information privately, they must also make this information publicly available.[33] The concern is that making CDP disclosures available only for a subset of investors (i.e., signatories) may not be compliant with Reg FD.

We note that at the time of the writing of this paper, there is still no regulation requiring companies to disclose material information related to climate risk. As such, companies may not necessarily deem their climate risk information to be material. Hence, marking the information as "private" on the CDP platform may not necessarily be in violation of Reg FD.

We add several additional considerations to illustrate this point:

It is well-known that the vast majority of companies do not report climate related information in public filings. And if they do, the disclosure is often considered "boilerplate".

The SEC has recently issued a regulatory proposal to require companies to disclose climate information, but the proposal is still open for comments. Until there is formal regulation the fine line between material and non-material information persists.

Furthermore, if truthful financial reporting is difficult to enforce, it is not a stretch that managers may skirt the ambiguity of materiality. Perhaps this is the reason why the SEC is no longer relying on the 2010 Disclosure Guidance and instead proposing disclosure regulation.

The following quote from Reg FD can be useful to further illustrate the above reasoning:

---

[33] Similar regulations exist around the world. For example, the Market Abuse Directive (MAD) in the European Union.

> *"The regulation does not require use of a particular method, or establish a "one size fits all" standard for disclosure; rather, it leaves the decision to the issuer to choose methods that are reasonably calculated to make effective, broad, and non-exclusionary public disclosure, given the particular circumstances of that issuer. Indeed, we have modified the language of the regulation to note that the issuer may use a method "or combination of methods" of disclosure, in recognition of the fact that it may not always be possible or desirable for an issuer to rely on a single method of disclosure as reasonably designed to effect broad public disclosure."* https://www.sec.gov/rules/final/33-7881.htm

As a further illustration, please see footnote 16 in the following document:
https://www.ici.org/system/files/2022-06/22-ici-cl-sec-climate-proposal.pdf

> *"Disclosure that is furnished, but not filed in Form 10-K is not subject to strict liability under Section 18 of the Exchange Act, disclosure controls or procedures, or certifications. The Commission previously has permitted companies to furnish rather than file certain information. See, e.g., Regulation Fair Disclosure, Release No. 34- 43154 (August 15, 2000), available at* https://www.sec.gov/rules/final/33-7881.htm *(where the Commission noted that while Regulation FD requires a company that discloses material non-public information to make that material information broadly available, it recognizes that companies may not always know if the information is material and providing a means to make it available will help to minimize liability concerns)."*

We conclude that, in the current regulatory framework, it is not easy to make a court case that "private" disclosure to the CDP violates Reg FD. Consistent with this is the fact is that thousands of firms around the world are providing "private" information to the CDP and are not facing legal complications for doing so (we are not aware of any legal action against firms and/or the CDP based on such claim). This suggests that this type of disclosure must not be a blatant violation of Reg FD in the US or similar rules around the world.

OB. Potential biases in Trucost data

In this section of the appendix we analyze the possibility that our inferences are affected by biases in Trucost data. In fact, prior work documents differences between vendor-estimated and firm disclosed emissions figures that are correlated with firm fundamentals (Aswani et al., 2022). In the context of our study, the concern is that, if Trucost uses CDP disclosures, the results in Table 5 could reflect that Trucost systematically over-estimates carbon emissions before the firm starts disclosing to the CDP.

To address this concern, we proceed in several steps.

  i) We analyze whether this alternative explanation is consistent with all our results.
 ii) We explore the validity of our explanation that Trucost does not have access to CDP data for firms that choose to make their CDP disclosures "private". This means that, for these observations, Trucost estimates emissions both before and after the firm starts disclosing to the CDP.
iii) We offer additional considerations.
  i) Consistency of this alternative explanation with our results:

Some of the documented empirical patterns are hard to reconcile with the notion that the patterns in Table 5 are explained by Trucost's potential overestimation of carbon emissions. The bias correction would occur only in the first year of disclosure. However, we find a subsequent decrease in emissions in year t+1 and t+2, namely a decrease in emissions conditional on the firm disclosing to the CDP.

Moreover, it is unclear why Trucost estimation bias should vary pre/post disclosure specifically in cases where only signatories have access to the CDP data, and in cases where CDP signatories own a substantial stake in the firm and are also PRI signatories (see Table 7). To the extent that the subsample in Table 7 excludes firm-year observations with "public" disclosures to the CDP, the information environment that Trucost faces in this subsample is the same before and after the firm starts disclosing to the CDP. In other words, the patterns in Table 7 are difficult to explain by a potential estimation bias in Trucost estimations for observations corresponding to firms that do not disclose to the CDP in that year.

ii) Trucost does not have access to CDP data for firms that choose to make their CDP disclosures "private"

Trucost is not a CDP signatory (among other things, because Trucost is not an institutional investor). Consequently, in theory Trucost does not have access to the "private" CDP disclosures. There is the possibility that Trucost obtains these data in other ways, but we do not expect this to happen in a systematic way.

To corroborate this point, we analyze the sources of Trucost emissions data for the last year of our sample (2020) (Trucost includes a data item with this information). We focus on observations corresponding to companies that disclose to CDP "publicly" or "privately".

In cases where the firm chooses to disclose to the CDP "publicly", we observe that Trucost indicates CDP as source of emission data in roughly 70% of the cases. This suggests that in the majority of cases Trucost considers that the emission estimates in the CDP are of reasonable quality (i.e., not too different from what Trucost would estimate on its own).

In contrast, in cases where the firm chooses to disclose to the CDP "privately", we observe that Trucost indicates CDP as source of emissions data in only 2% of the cases (13 companies). We investigate these cases one by one. We find that most of these cases likely reflect some sort of error. In particular.

(1) In 3 of these cases, the CDP report is submitted "publicly", but the summary Excel spreadsheet provided by CDP erroneously claim the report to be "private".
(2) In other 3 cases, the company reports to CDP "privately", but then posts the pdf of the CDP report on their corporate website.
(3) In 5 cases, Trucost uses data from prior year reports to the CDP that were "public" (in two cases the information for the current year was still not available and perhaps for this reason reports were mistakenly coded as "private", in the other three cases companies decided to switch from "public" reporting to "private" reporting).
(4) For the remaining 2 cases, we could not find any clear explanation of why Trucost uses "private" CDP information.

Removing these observations does not affect our results.

Taken together, this evidence is hard to reconcile with the idea that Trucost has systematic access to CDP disclosures that a company chooses to restrict to CDP signatories ("private" disclosures). As such, there is no reason to expect that, for these observations, Trucost estimates are fundamentally different in the pre- and post-disclosure periods. In other words, this corroborates point "i" above: A potential overestimation of emissions by Trucost in the period before a firm starts disclosing to the CDP cannot explain the results in Table 7.

iii) Other considerations:

As an additional consideration, we note that it is unclear why Trucost would have an incentive to systematically over-estimate emissions. If there is no intentional bias, Trucost's estimation error should be randomly distributed around zero.

Finally, even if our results in Tables 5–7 do not reflect a real decrease in CO2 emissions, but are driven instead by Trucost's overestimation (which we find unplausible for the reasons described above), the documented patterns suggest that CDP disclosures matter. At the very least, they suggest that the platform is instrumental in correcting a systematic overestimation of carbon emissions. This is particularly important considering that, if Trucost (i.e., a specialized company with estimation expertise) unintentionally overestimates emissions, it is likely that other external parties (i.e., market participants, regulators) also make a similar mistake when estimating emissions.

References

Aswani, J., Raghunandan, A., Rajgopal, S., 2022. Are carbon emissions associated with stock returns? Working paper.

OC. Potential biases in CDP disclosures

In this appendix we analyze the possibility that our inferences are affected by biases in firms' disclosures to the CDP. Considering that misreporting of earnings is well-documented in prior literature, the possibility that firms misreport to the CDP seems realistic.

While we concede that misreporting to the CDP is plausible, we offer several considerations that, taken together, suggest that such misreporting is unlikely to drive our results.

First, the interpretation that our results in Tables 5–7 are driven by firms' underreporting of emissions to the CDP raises the question of why market participants would not see through such misreporting.[34] CDP signatories could detect emissions misreporting by comparing the CDP and Trucost data. The possibility that CDP signatories do not pay attention to firms' CDP disclosures seems particularly remote considering that we document that investors actively engage with firms and make divestment decisions in a way correlated with the information on the platform (see Tables 8, 9). Moreover, it is unlikely that firms under-report when investors are more likely to pay closer attention to the released information (i.e., when monitoring is more intense); note that Table 7 documents that our results are more pronounced in cases where only signatories have access to the CDP data, and in cases where CDP signatories own a substantial stake in the firm and are also PRI signatories. Relatedly, a key benefit of the CDP is that the platform provides standardized information that is easily comparable across portfolio companies. Investors and other users can identify reporting biases by benchmarking the information of a given company with that of its peers, or by checking year-to-year consistency.

Next, even though firms self-report climate risk information to the CDP, the disclosed data is commonly perceived as being of reasonable quality. The CDP encourages firms to verify the data submitted.[35] Moreover, the CDP enhances firms' reporting incentives by publishing an annual a list (called the 'A-list') that includes a selected group of firms based on the quality of their disclosures. Firms that make it to the A-list are highlighted on the CDP site. To qualify for entry into the CDP 'A-list' firms must

---

[34] If detected, untruthful reporting to the CDP will likely impose significant costs on firms. For example, users of the CDP information could penalize the reporting firm through disinvestment or by increasing the cost of capital.
[35] A list of verification standards it accepts is available at: https://www.cdp.net/en/guidance/verification.

verify at least 70% of both scope 1 and 2 emissions. Consistent with the perception that the CDP information is reliable, several previous academic studies have used these data (e.g., Matsumura et al., 2014; Bolton and Kacperczyk 2021).

Finally, to explore the validity of our reasoning, we conduct an additional analysis of our data. For tractability purposes, we focus on the last year of our sample period. In year 2020, 2241 companies completed section "C6: Emissions Data" of the CDP Climate Change Questionnaire. Among these disclosers 789 companies provided information about past years emissions (2016−2018) in addition to the requested emissions data for year 2019. Of these, only 37 firms (1.7%) provided the additional information for the purpose of restating previously disclosed emissions numbers. Overall, restatements of CDP emission data are rare, which suggests that, on average, the information is of reasonable quality.

OD.I. Signatory Holdings and CDP Disclosure:

Additional Robustness Tests

This section of the online appendix includes the following tests:
Table OD.1. Replicating the analysis in Table 2 using alternative fixed effect structures.
Table OD.2. Replicating the analysis in Table 2 using alternative clustering of standard errors.
Table OD.3. Replicating the analysis in Table 2 using alternative econometric model: logistic regression.
Table OD.4. Replicating the analysis in Table 2 using restricted subsample.

Table OD.1
Replicating the analysis in Table 2 using alternative fixed effect structures

	Dependent Variable: *CDP_Disclosure*				
	(1)	(2)	(3)	(4)	(5)
Signatories_Hldg	0.34***	0.26***	0.26***	0.25***	0.27***
	(10.22)	(8.10)	(8.19)	(7.69)	(8.23)
OtherInst_Hldg	0.15***	0.15***	0.14***	0.14***	0.17***
	(4.51)	(4.38)	(4.29)	(4.20)	(4.93)
Size		0.05***	0.05***	0.04***	0.05***
		(6.22)	(6.18)	(3.98)	(6.04)
Log(BM)		−0.01***	−0.01***	−0.01***	−0.01***
		(−3.29)	(−3.73)	(−3.47)	(−2.77)
ROA		0.08***	0.13***	0.11***	0.08***
		(3.37)	(5.43)	(4.71)	(3.04)
Leverage		−0.05**	−0.05*	−0.04*	−0.06**
		(−2.22)	(−1.91)	(−1.89)	(−2.36)
Tangibility		0.00	−0.00	−0.01	0.05*
		(0.06)	(−0.14)	(−0.30)	(1.79)
Dividends		−0.00	−0.00	−0.00	0.00
		(−0.02)	(−1.08)	(−1.25)	(0.24)
Return		−0.01***	−0.01***	−0.01***	−0.01***
		(−4.70)	(−4.90)	(−5.03)	(−4.88)
Log(Sales)		0.02***	0.02***	0.02***	0.02**
		(3.45)	(2.92)	(3.16)	(2.49)
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	NO	NO	NO	NO
Country-Year FE	NO	YES	NO	NO	NO
Industry-Year FE	NO	NO	YES	NO	NO
Size Decile-Year FE	NO	NO	NO	YES	NO
Country-Industry-Year FE	NO	NO	NO	NO	YES
R^2	0.65	0.67	0.65	0.65	0.72
# Obs.	75,755	75,715	75,746	75,753	71,737

This table assesses the sensitivity of the results in Table 2 (i.e., the association between ownership by CDP signatories and carbon emissions disclosure) to alternative fixed-effect structures. Except for the fixed effects, the rest of the specification is as in Table 2 t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.2
Replicating the analysis in Table 2 using alternative clustering of standard errors

Clustering:	Dependent Variable: CDP_Disclosure		
	Country, industry	Country, industry, year	Firm, year
	(1)	(2)	(3)
Signatories_Hldg	0.27***	0.27***	0.27***
	(4.27)	(4.17)	(6.71)
OtherInst_Hldg	0.13*	0.13*	0.13***
	(1.87)	(1.97)	(3.93)
Size	0.04***	0.04***	0.04***
	(3.95)	(4.08)	(5.82)
Log(BM)	−0.01**	−0.01**	−0.01***
	(−2.39)	(−2.28)	(−3.21)
ROA	0.12***	0.12***	0.12***
	(4.59)	(4.58)	(4.62)
Leverage	−0.04	−0.04	−0.04
	(−1.13)	(−1.14)	(−1.69)
Tangibility	−0.01	−0.01	−0.01
	(−0.40)	(−0.40)	(−0.42)
Dividends	−0.00	−0.00	−0.00
	(−1.11)	(−1.10)	(−1.04)
Return	−0.01***	−0.01*	−0.01**
	(−3.61)	(−2.01)	(−2.18)
Log(Sales)	0.02***	0.02***	0.02***
	(3.25)	(3.72)	(3.46)
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
R^2	0.65	0.65	0.65
# Obs.	75,755	75,755	75,755

This table assesses the sensitivity of the results in Table 2 (i.e., the association between ownership by CDP signatories and carbon emissions disclosure) to alternative clustering options. In column 1 standard errors are double clustered at the country and industry level. In column 2 standard errors are triple clustered at the country, industry and year level. In column 3 standard errors are double clustered at the firm and year level. The empirical specification is as in Table 2 t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.3
Replicating the analysis in Table 2 using an alternative econometric model: logistic regression

	Dependent Variable: CDP_Disclosure	
	(1)	(2)
Signatories_Hldg	3.76***	3.70***
	(19.72)	(16.78)
OtherInst_Hldg	−0.04	−0.02
	(−0.42)	(−0.23)
Size	0.14***	0.09***
	(6.43)	(3.23)
Log(BM)	−0.14***	−0.12***
	(−6.75)	(−4.94)
ROA	1.08***	0.96***
	(5.09)	(3.89)
Leverage	−0.40***	−0.37***
	(−3.51)	(−2.79)
Tangibility	0.22**	0.56***
	(2.57)	(4.58)
Dividends	0.09***	0.10***
	(4.68)	(4.65)
Return	0.00	0.01
	(0.06)	(0.38)
Log(Sales)	0.46***	0.58***
	(18.27)	(15.01)

(*continued on next page*)

Table OD.3 (*continued*)

		(1)	(2)
		Dependent Variable: *CDP_Disclosure*	
Log(CO2)			−0.04***
			(−2.95)
Pseudo R²		0.18	0.16
# Obs.		76,284	56,432

This table assesses the sensitivity of the results in Table 2 (i.e., the association between ownership by CDP signatories and carbon emissions disclosure) to using a logistic regression (instead of OLS). The variable definitions are as in Table 2. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.4
Replicating the analysis in Table 2 using restricted subsample

Panel A. Continuous variable

		(1)	(2)	(3)	(4)
		Dependent Variable: *CDP_Disclosure*			
Signatories_Hldg	β_1	0.38***	0.34***	0.34***	0.26***
		(11.63)	(10.83)	(10.51)	(6.66)
OtherInst_Hldg	β_2	0.15***	0.11***	0.11***	0.13***
		(4.49)	(3.52)	(3.24)	(3.10)
Size		0.05***	0.09***	0.09***	0.05***
		(11.02)	(13.07)	(13.44)	(4.74)
Log(BM)		−0.04***	−0.03***	−0.04***	−0.01***
		(−8.60)	(−7.86)	(−8.68)	(−2.67)
ROA		0.17***	0.12***	0.13***	0.15***
		(4.68)	(3.32)	(3.50)	(4.48)
Leverage		−0.09***	−0.11***	−0.11***	−0.04
		(−4.17)	(−4.78)	(−4.60)	(−1.27)
Tangibility		0.07***	0.06**	0.05**	−0.00
		(3.57)	(2.51)	(2.25)	(−0.06)
Dividends		0.01***	0.01***	0.01***	−0.00
		(3.66)	(3.63)	(3.67)	(−0.95)
Return		−0.00	−0.00	−0.02***	−0.01***
		(−0.79)	(−1.10)	(−5.42)	(−3.90)
Log(Sales)		0.08***	0.08***	0.08***	0.03***
		(13.25)	(9.97)	(9.71)	(3.12)
Log(CO2)		0.01**	−0.01***	−0.01***	−0.01
		(2.23)	(−4.71)	(−4.90)	(−1.29)
Country FE		YES	YES	YES	n.a.
Industry FE		NO	YES	YES	n.a.
Year FE		NO	NO	YES	YES
Firm FE		NO	NO	NO	YES
R²		0.30	0.33	0.34	0.67
# Obs.		56,431	56,431	56,431	55,979
H0: $\beta_1 = \beta_2$ (p-value)		<0.001	<0.001	<0.001	0.002

Panel B. Indicator for significant holdings

	(1)	(2)	(3)	(4)
	Dependent Variable: *CDP_Disclosure*			
I(Signatories_Hldg>5%)	0.11***	0.10***	0.10***	0.03***
	(13.27)	(11.94)	(11.67)	(3.61)
OtherInst_Hldg	0.09***	0.06**	0.06*	0.03
	(2.92)	(2.06)	(1.80)	(0.90)
Size	0.05***	0.09***	0.09***	0.05***
	(11.06)	(13.02)	(13.39)	(5.19)
Log(BM)	−0.03***	−0.03***	−0.04***	−0.01***
	(−8.40)	(−7.76)	(−8.57)	(−3.22)
ROA	0.15***	0.11***	0.12***	0.15***

Table OD.4 (*continued*)

Panel B. Indicator for significant holdings

	Dependent Variable: *CDP_Disclosure*			
	(1)	(2)	(3)	(4)
	(4.18)	(2.98)	(3.15)	(4.70)
Leverage	−0.08***	−0.09***	−0.09***	−0.05
	(−3.56)	(−4.09)	(−3.92)	(−1.57)
Tangibility	0.07***	0.06**	0.05**	0.01
	(3.32)	(2.45)	(2.18)	(0.16)
Dividends	0.01***	0.01***	0.01***	−0.00
	(3.13)	(3.22)	(3.27)	(−0.98)
Return	−0.00	−0.00	−0.02***	−0.01***
	(−0.57)	(−0.95)	(−5.21)	(−3.92)
Log(Sales)	0.08***	0.08***	0.08***	0.03***
	(13.15)	(10.07)	(9.81)	(3.12)
Log(CO2)	0.01**	−0.01***	−0.01***	−0.01
	(2.46)	(−4.63)	(−4.84)	(−1.35)
Country FE	YES	YES	YES	n.a.
Industry FE	NO	YES	YES	n.a.
Year FE	NO	NO	YES	YES
Firm FE	NO	NO	NO	YES
R^2	0.30	0.33	0.34	0.67
# Obs.	56,431	56,431	56,431	55,979

This table presents an analysis of the association between CDP disclosure and ownership by CDP signatories. The dependent variable, *CDP_Disclosure*, is an indicator variable that equals one if a company submits the CDP questionnaire in that year, and zero otherwise. In Panel A, the experimental variable, *Signatories_Hldg,* is the fraction of the firm's equity owned by mutual funds that are CDP signatories in that year. *OtherInst_Hldg* is the fraction of the firms' equity owned by funds managed by institutions that are not CDP signatories. In Panel B, the experimental variable, *I(Signatories_Hldg>5%),* is an indicator variable that equals one if CDP signatories own more than 5% of the firm's equity. The control variables are defined in Appendix A. The results correspond to the subsample of 56,431 firm-years from 2006 to 2020 with non-missing carbon emissions data from Trucost. Independent variables are measured at the end of the prior year. See Appendix A for variable definitions. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

OD.II. Signatory holdings and CDP disclosure:

Additional tests based on the MSCI Index

To further sharpen identification, we conduct an instrumental variables (IV) analysis using the firm's membership in the MSCI All Country World Index (MSCI ACWI) as an instrument for the ownership of CDP signatories (i.e., *Signatories_Hldg*) regressions. To the extent that a large percentage of the investments of CDP signatories are based on this index, the inclusion (exclusion) of a firm in the MSCI ACWI is likely to increase (decrease) the position of these investors in the company (i.e., the relevance assumption of the IV analysis is likely to hold). The resulting variation in *Signatories_Hldg* is plausibly exogenous because the inclusion of a firm in the index is determined by a mechanical rule based on market capitalization. That is, MSCI ACWI membership status is likely to satisfy the exclusion restriction of the IV analysis.

We estimate a two-stage least squares (2SLS) model. In the first stage we instrument ownership of CDP signatories using the following specification:

$$Signatories\_Hldg_{it-1} = \alpha + \beta * MSCI_{it-1} + \gamma * Controls_{it-1} + \tau_t + \delta_s + \mu_k + \varepsilon_{it} \tag{OD.1}$$

where $MSCI_{it}$, the instrumental variable, defined as an indicator equal to one if stock *i* is assigned to the MSCI ACWI Index in year *t*, and zero otherwise. In the second stage, we estimate the following model:

$$CDP\_Disclosure_{it} = \alpha + \beta * \widehat{Signatories\_Hldg}_{it-1} + \gamma * Controls_{it-1} + \tau_t + \delta_s + \mu_k + \varepsilon_{it} \tag{OD.2}$$

$\widehat{Signatories\_Hldg}_{it-1}$ is the fitted value from the first stage (i.e., equation (OD.1)). In both models (i.e., equations (OD.1) and (OD.2)), the vector of control variables, *Controls* is defined as in equation (1) in the paper.

We first estimate the 2SLS model in the vicinity around the bottom of the MSCI index, as in section 4.2 in the paper (i.e., the regression discontinuity design). The results are presented in Table OD.5. To further check the robustness of our inferences, we re-estimate specifications from columns (3) and (4) of Table 2 using all sample observations (i.e., we do not restrict the analysis to the vicinity around the bottom of the MSCI index) and using MSCI to instrument *Signatories_Hldg*. The results are presented in Table OD.6.

As shown in Tables OD.5 and OD.6, the coefficient on $Signatories\_Hldg_{it-1}$ is positive and statistically significant, suggesting that the increase in signatory holdings induced by the inclusion in the MSCI index (i.e., the plausibly exogenous variation in $Signatories\_Hldg$) is associated with an increase in firms' CDP disclosure.

Table OD.5
Analysis around the Lower Threshold of the MSCI ACWI: Using the inclusion in the index as an IV

	First Stage			Second Stage		
	Dep. var.: *Signatories_Hldg*			Dep. var.: *CDP_Disclosure*		
	Bandwidth [-100; +100] (1)	Bandwidth [-200; +200] (2)	Bandwidth [-300; +300] (3)	Bandwidth [-100; +100] (4)	Bandwidth [-200; +200] (5)	Bandwidth [-300; +300] (6)
MSCI	0.02*** (7.90)	0.03*** (8.75)	0.02*** (8.15)			
$\widehat{Signatories}\_Hldg$				1.42** (2.46)	1.75*** (3.36)	1.74*** (3.27)
Rank	−0.00 (−0.88)	−0.00 (−0.32)	−0.00* (−1.70)	0.00 (0.31)	−0.00 (−0.22)	−0.00 (−0.94)
*Rank*MSCI*	0.00 (0.36)	0.00 (0.24)	0.00 (0.86)	0.00 (1.49)	0.00 (0.43)	−0.00 (−0.26)
Controls	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R^2	0.29	0.28	0.28	0.05	0.02	0.02
# Obs.	18,962	24,239	27,285	18,962	24,239	27,285

This table presents a variant of the analysis in Table 3 that uses the inclusion in the index as IV (instrumental variable). *Signatories_Hldg* is the fraction of the firm's equity owned by institutional investors that are CDP signatories in that year. *CDP_Disclosure*, is an indicator variable that equals one if the firm submits the CDP questionnaire in that year, and zero otherwise. *MSCI* equals one if the firm is included in the MSCI ACWI in that year, and zero otherwise. *Rank* is the position of the company in the ranking of sample firms based on market capitalization. *Controls* includes the same control variables as in Table 2. $\widehat{Signatories}\_Hldg$ is the fitted value of *Signatories_Hldg* from the first stage estimation. "Bandwidth" indicates the number of ranking positions (based on market capitalization) above and below the threshold. See Appendix A for other variable definitions. Independent variables are measured at the end of the prior year. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.6
Using the inclusion in the MSCI as an IV: Analysis using all sample observations

	First Stage		Second Stage	
	Dep. var.: *Signatories_Hldg*		Dep. var.: *CDP_Disclosure*	
	(1)	(2)	(3)	(4)
MSCI	0.02*** (6.71)	0.01*** (4.44)		
$\widehat{Signatories}\_Hldg$			7.91*** (6.45)	1.86* (1.84)
Controls	YES	YES	YES	YES
Country FE	YES	n.a.	YES	n.a.
Industry FE	YES	n.a.	YES	n.a.
Year FE	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES
Kleibergen-Paap F-stat.	45.0	19.7	—	—
R^2	0.29	0.78	−2.71	−0.09
# Obs.	76,284	75,755	76,284	75,755

This table reports estimates from an instrumental variable (IV) 2SLS analysis exploiting the composition of the MSCI ACWI index to instrument ownership by CDP signatories. *MSCI*, the instrument, equals one if stock *i* is a member of the MSCI ACWI Index in year *t*, and zero otherwise; $\widehat{Signatories}\_Hldg$ is the fitted value of *Signatories_Hldg* from the first stage estimation. The experimental variable, *Signatories_Hldg*, is the fraction of the firm's equity owned by institutional investors that were CDP signatories in year *t*. The dependent variable, *CDP_Disclosure*, is an indicator variable that equals one if the firm submits CDP questionnaire in year *t*, and zero otherwise. The rest of the variables are defined in Appendix A. Independent variables are measured at the end of the prior year. The sample spans from 2003 to 2020, and includes 76,621 firm-year observations. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted. Finally, we report R^2 for completeness, however it has no statistical meaning in the context of 2SLS/IV.

Table OD.7
Analysis around the Lower Threshold of the MSCI ACWI. Robustness to the degree of polynomial specification

Dep. Var: *CDP_Disclosure*	Bandwidth [−100; +100]			Bandwidth [−200; +200]			Bandwidth [−300; +300]		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MSCI	0.04**	0.03**	0.03**	0.04***	0.05***	0.05***	0.04***	0.05***	0.05***
	(2.46)	(2.41)	(2.40)	(3.36)	(3.57)	(3.53)	(3.40)	(3.70)	(3.70)
Rank	0.00	−0.00	−0.00	−0.00	0.00**	0.00**	−0.00	0.00	0.00
	(0.20)	(−0.14)	(−0.35)	(−0.34)	(1.97)	(2.30)	(−1.38)	(1.32)	(1.17)
Rank*MSCI	0.00	0.00	0.00	0.00	0.00	0.00	−0.00	−0.00	−0.00
	(1.49)	(1.51)	(1.58)	(0.53)	(0.23)	(0.16)	(−0.23)	(−0.27)	(−0.19)
Rank^2	−0.00	−0.00	0.00	0.00	0.00	−0.00*	−0.00	−0.00	0.00
	(−0.67)	(−0.75)	(1.12)	(0.06)	(0.84)	(−1.72)	(−1.30)	(−0.66)	(0.35)
Rank^3		0.00	0.00		−0.00***	−0.00***		−0.00***	−0.00***
		(0.46)	(0.73)		(−3.83)	(−4.32)		(−3.92)	(−3.77)
Rank^4			−0.00			0.00**			−0.00
			(−1.49)			(2.45)			(−0.59)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.34
# Obs.	18,962	18,962	18,962	24,239	24,239	24,239	27,285	27,285	27,285

This table presents an analysis of variation in CDP disclosure in the vicinity of the lower threshold of the MSCI ACWI. Dependent variable: *CDP_Disclosure* is an indicator variable that equals one if the firm submits the CDP questionnaire in that year, and zero otherwise. *MSCI* equals one if the firm is included in the MSCI ACWI in that year, and zero otherwise. *Rank* is the position of the company in the ranking of sample firms based on market capitalization. *Controls* includes the same control variables as in Table 2. See Appendix A for variable definitions. "Bandwidth" indicates the number of ranking positions (based on market capitalization) above and below the threshold. Independent variables are measured at the end of the prior year. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.8
Additions to the MSCI index: Descriptive statistics of the matched treatment and control groups

Variable	Mean values		Difference	
	Treatment	*Control*	*t*-stat.	*p*-value
Inst_Hldg	0.29	0.30	−0.68	0.496
Size	8.66	8.79	−1.47	0.141
Log(BM)	−0.91	−0.99	1.38	0.169
ROA	0.06	0.06	−0.50	0.615
Leverage	0.26	0.25	0.72	0.472
Tangibility	0.29	0.28	0.63	0.531
Dividends	0.40	0.42	−0.64	0.523
Return	0.36	0.30	1.86	0.062
Log(Sales)	8.00	8.17	−1.94	0.052

This table provides descriptive statistics of the covariates for the propensity score matching test in Table 4, Panel B of the paper. The statistics are presented separately for the treatment and control groups obtained from the matching exercise. Variables are defined in Appendix A.

OD.III. CDP Disclosure and CO2 Emissions: Additional tests

This section of the online appendix includes the following additional tests:
Table OD.9. CDP Disclosure and CO2 Emissions: Scope 2 and Scope 3.
Table OD.10. CDP Disclosure and CO2 Emissions: Alternative fixed effect structures.
Table OD.11. CDP Disclosure and Subsequent Sales and Total Assets.
Table OD.12. First-Time Disclosure to the CDP: Descriptive statistics of the matched treatment and control groups.
Table OD.13. First-Time Disclosure to the CDP: Coarsened Exact Matching.

Table OD.9
CDP disclosure and CO2 emissions: Scope 2 and Scope 3

Indep. variables:	Dependent variable: Log [CO2 (t + s)]					
	Scope 2			Scope 3		
	s = 0	s = 1	s = 2	s = 0	s = 1	s = 2
	(1)	(2)	(3)	(4)	(5)	(6)
CDP_Disclosure	0.01	−0.02	−0.04**	0.01**	−0.01	−0.02**
	(0.70)	(−1.10)	(−2.44)	(2.10)	(−1.19)	(−2.21)
Inst_Hldg	−0.09	−0.06	−0.03	0.19***	0.21***	0.19***
	(−1.16)	(−0.74)	(−0.38)	(5.89)	(5.04)	(3.99)
Size	0.28***	0.30***	0.27***	0.25***	0.29***	0.28***
	(10.72)	(11.48)	(9.74)	(13.88)	(15.35)	(13.49)
Log(BM)	−0.03**	−0.05***	−0.06***	−0.05***	−0.07***	−0.08***
	(−2.55)	(−4.48)	(−4.82)	(−8.22)	(−9.88)	(−9.64)
ROA	0.30***	0.45***	0.52***	0.28***	0.38***	0.43***
	(3.46)	(4.40)	(5.14)	(5.28)	(5.60)	(5.96)
Leverage	−0.13*	−0.14*	−0.10	−0.15***	−0.16***	−0.12***
	(−1.84)	(−1.93)	(−1.30)	(−4.41)	(−3.95)	(−2.59)
Tangibility	−0.01	0.01	−0.07	0.19***	0.24***	0.15**
	(−0.13)	(0.14)	(−0.65)	(3.14)	(3.48)	(2.23)
Dividends	−0.00	0.00	0.01	0.00	0.01	0.01*
	(−0.37)	(0.49)	(1.43)	(0.89)	(1.52)	(1.89)
Return	0.06***	0.07***	0.06***	0.06***	0.07***	0.06***
	(9.39)	(9.93)	(9.21)	(14.48)	(13.30)	(12.27)
Log(Sales)	0.48***	0.27***	0.16***	0.57***	0.33***	0.19***
	(16.49)	(9.47)	(5.35)	(25.57)	(16.03)	(8.61)
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
R^2	0.91	0.91	0.91	0.98	0.97	0.97
# Obs.	66,831	64,988	62,976	66,878	65,033	63,022

This table repeats the analysis in Table 5 for firms' indirect CO_2 emissions. In columns (1)–(3) the dependent variable is the logarithm of the emissions due to purchased electricity (Scope 2). In columns (4)–(6) the dependent variable is the logarithm of the firm's other supply chain emissions (Scope 3). The rest of the specification is as in Table 5. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.10
CDP Disclosure and CO2 Emissions: Alternative Fixed Effects Structures

Indep. variables:	Dependent variable: Log [CO_2 (t + s)]					
	s = 0	s = 1	s = 2	s = 0	s = 1	s = 2
	(1)	(2)	(3)	(4)	(5)	(6)
CDP_Disclosure	−0.06***	−0.07***	−0.07***	−0.06***	−0.07***	−0.09***
	(−3.87)	(−4.05)	(−4.66)	(−3.79)	(−4.71)	(−6.01)
Inst_Hldg	0.26***	0.27***	0.22**	0.14*	0.16*	0.13
	(3.25)	(3.19)	(2.50)	(1.74)	(1.93)	(1.57)
Size	0.22***	0.27***	0.26***	0.24***	0.28***	0.27***
	(6.81)	(8.61)	(8.37)	(7.15)	(8.88)	(8.62)
Log(BM)	−0.01	−0.04***	−0.04***	−0.02**	−0.05***	−0.05***
	(−1.06)	(−2.74)	(−3.39)	(−2.08)	(−3.59)	(−4.21)
ROA	0.14	0.27***	0.28***	0.21**	0.33***	0.36***
	(1.53)	(2.58)	(2.66)	(2.33)	(3.30)	(3.52)
Leverage	−0.03	−0.04	−0.06	−0.01	−0.02	−0.06
	(−0.39)	(−0.50)	(−0.86)	(−0.14)	(−0.34)	(−0.74)
Tangibility	0.48***	0.47***	0.36***	0.41***	0.39***	0.30**
	(3.45)	(3.40)	(2.78)	(2.86)	(2.73)	(2.17)
Dividends	0.01	0.00	0.01	0.01*	0.01	0.01*
	(1.18)	(0.36)	(1.27)	(1.79)	(1.35)	(1.80)
Return	0.06***	0.06***	0.06***	0.04***	0.05***	0.05***
	(7.80)	(7.71)	(7.84)	(6.42)	(6.40)	(6.74)
Log(Sales)	0.54***	0.30***	0.17***	0.53***	0.31***	0.17***
	(14.40)	(9.10)	(5.12)	(14.69)	(9.52)	(5.52)
Firm FE	YES	YES	YES	YES	YES	YES

Table OD.10 (*continued*)

Indep. variables:	Dependent variable: Log [CO_2 (t + s)]					
	s = 0	s = 1	s = 2	s = 0	s = 1	s = 2
	(1)	(2)	(3)	(4)	(5)	(6)
Country-Year FE	YES	YES	YES	NO	NO	NO
Industry-Year FE	NO	NO	NO	YES	YES	YES
R^2	0.95	0.95	0.95	0.95	0.95	0.95
# Obs.	66,804	64,963	62,950	66,812	64,973	62,960

This table assesses the sensitivity of the results in Table 5 (i.e., the association between CDP disclosure and subsequent carbon emissions) to alternative fixed-effect structures. Except for the fixed effects, the rest of the specification is as in Table 5 t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.11
CDP Disclosure and Subsequent Sales and Total Assets

	Log [Sales (t + s)]			Log [Assets (t + s)]	
	s = 1	s = 2		s = 1	s = 2
	(1)	(2)		(3)	(4)
CDP_Disclosure	0.02***	0.02***		0.02***	0.01**
	(3.61)	(2.86)		(3.66)	(2.13)
Inst_Hldg	0.26***	0.24***		0.21***	0.20***
	(5.56)	(4.46)		(6.12)	(4.93)
Size	0.30***	0.29***		0.61***	0.44***
	(15.05)	(13.03)		(37.53)	(25.69)
Log(BM)	−0.05***	−0.06***		−0.05***	−0.07***
	(−6.06)	(−6.84)		(−9.36)	(−9.56)
ROA	0.39***	0.37***		0.48***	0.57***
	(6.87)	(5.29)		(11.24)	(11.39)
Leverage	−0.11***	−0.14***		−0.23***	−0.28***
	(−2.66)	(−2.98)		(−6.53)	(−6.27)
Tangibility	0.22***	0.21***		0.12***	0.12**
	(4.38)	(3.75)		(2.94)	(2.43)
Dividends	0.01**	0.01		0.01***	0.01**
	(2.47)	(1.61)		(4.15)	(2.44)
Return	0.07***	0.07***		0.05***	0.05***
	(14.58)	(12.27)		(13.48)	(13.37)
Log(Sales)	0.34***	0.17***		0.05***	0.05***
	(15.17)	(6.64)		(3.65)	(3.30)
Year FE	YES	YES		YES	YES
Firm FE	YES	YES		YES	YES
R^2	0.97	0.97		0.98	0.98
# Obs.	66,177	58,580		66,284	58,685

This table presents an analysis of the association between CDP disclosure and subsequent sales and total assets. Log[Sales (t + s)] is the logarithm of the firm's sales measured in t + s where t is the year of the CDP disclosure and s = 1, 2 in columns (1) and (2), respectively. Log[Assets (t + s)] is the logarithm of the total assets measured in t + s where t is the year of the CDP disclosure and s = 1, 2 in columns (3) and (4), respectively. CDP_Disclosure, is an indicator variable that equals one if the company submits the CDP questionnaire in that year, and zero otherwise. See Appendix A for other variable definitions. The analysis includes firm-year observations from 2003 to 2019. Independent variables are measured at the end of the prior year. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.12

First-Time Disclosure to the CDP: Descriptive statistics of the matched treatment and control groups

Variable	Treatment		Control		Difference	
	Mean	Std. Dev.	Mean	Std. Dev.	t-stat	p-value
Size	8.38	1.42	8.34	1.39	1.32	0.19
Log(BM)	−0.81	0.86	−0.79	0.92	−1.14	0.26
ROA	0.05	0.07	0.05	0.08	−0.39	0.70
Leverage	0.26	0.19	0.24	0.19	2.64	0.00
Tangibility	0.30	0.26	0.30	0.25	0.61	0.54
Dividends	0.39	0.64	0.37	0.60	2.07	0.04
Return	0.17	0.54	0.18	0.56	−0.98	0.33
Log(Sales)	7.75	1.24	7.75	1.21	0.00	0.99

This table provides descriptive statistics of the covariates for the propensity score matching test in Table 6, Panel B of the paper. The statistics are presented separately for the treatment and control groups obtained from the matching exercise. See Appendix A for variable definitions.

Table OD.13

First-time Disclosure to the CDP: CEM

Panel A. Descriptive statistics

Variable	Treatment		Control		Difference	
	Mean	Std. Dev.	Mean	Std. Dev.	t-stat	p-value
Size	8.58	1.63	8.56	1.63	0.80	0.42
Log(BM)	−0.56	0.59	−0.55	0.59	−0.35	0.73
ROA	0.05	0.04	0.05	0.04	0.68	0.50
Leverage	0.16	0.14	0.16	0.14	0.09	0.93
Tangibility	0.17	0.19	0.17	0.19	0.12	0.91
Dividends	0.41	0.50	0.39	0.52	1.97	0.05
Return	0.05	0.25	0.05	0.25	−0.17	0.86
Log(Sales)	7.77	1.23	7.51	1.24	11.12	0.00

Panel B. CO_2 emissions as a function of disclosure to the CDP

Indep. variables:	Dep. Var: Log [CO_2 (t)]	
	No CEM Weights (1)	CEM Weights (2)
Treatment*Post	−0.22***	−0.21***
	(−4.62)	(−4.41)
Controls	YES	YES
Country FE	n.a.	n.a.
Industry FE	n.a.	n.a.
Year FE	YES	YES
Firm FE	YES	YES
R^2	0.96	0.96
Observations	9645	9645

This table presents a variant of the analysis in Table 6 using coarsened exact matching (CEM). The treated group consists of the 4199 firms that started disclosing carbon emissions for the first time during the period 2005−2020. Panel A reports descriptive statistics on observable covariates for treatment and control observations after coarsened exact matching on Size, Log(BM), ROA, Leverage, Tangibility, and Return. Panel B analyzes CO_2 emissions after the firm's first disclosure to the CDP. The dependent variable is the logarithm of the firm's direct CO_2 emissions (Scope 1). Treatment is an indicator variable that equals one if a firm started systematically disclosing its carbon emissions for the first time during the period 2005−2020, and zero otherwise. Post is an indicator variable that equals one in the year of the first CDP questionnaire is filed and thereafter, and zero otherwise. Results in the column titled CEM Weights are computed using CEM and the results reported in the column titled No CEM Weights are computed using the same common support sample as the CEM Weights column, but without applying the CEM weights. The control variables in Panel B are the covariates in Panel A. The variables are defined in Appendix A. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

OD.IV. Engagements and Divestment: Additional tests

This section of the online appendix includes the following additional tests:

Table OD.14
Engagements: Treating the Big Three as a group

	Dependent Variable: Big3_Engagement	
	(1)	(2)
CDP_Disclosure*Top_Emitter	0.02***	0.02***
	(3.06)	(3.07)
CDP_Disclosure	0.01**	0.01**
	(2.42)	(2.39)
Top_Emitter	−0.00	−0.00
	(−1.05)	(−1.06)
Size	0.01***	0.01***
	(10.19)	(10.13)
Log(BM)	−0.01***	−0.01***
	(−9.75)	(−9.70)
ROA	−0.03***	−0.03***
	(−2.89)	(−2.94)
Leverage	−0.03***	−0.03***
	(−5.05)	(−5.04)
Tangibility	0.03***	0.03***
	(6.13)	(6.12)
Dividends	−0.00***	−0.00***
	(−2.92)	(−2.83)
Return	0.00	0.00*
	(1.53)	(1.66)
Log(Sales)	0.01***	0.01***
	(7.10)	(7.13)
Year FE	YES	NO
Fund FE	YES	NO
Fund-Year FE	NO	YES
R^2	0.04	0.05
# Obs.	52,260	52,260

This table presents a variant of the analysis in Table 8, Panel B treating the Big Three as a group in fund-firm-year panel. The dependent variable, *Big3_Engagement*, is an indicator variable that equals one if BlackRock, State Street, or Vanguard engages with the firm about environmental issues, and zero otherwise. *Top_Emitter* is an indicator variable that equals one if a company is in the top industry quartile based on the amount of CO_2 emissions in that year, and zero otherwise. *CDP_Disclosure* is an indicator variable that equals one if a company submitted CDP questionnaire, and zero otherwise. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.15
Divestment: Firm-level analysis using total signatories holdings

	Dependent variable: Signatories_Hldg $(t + s)$					
	Only Signatories have access		Only Signatories have access Signatories own >5%		Only Signatories have access Signatories of both CDP and PRI own >5%	
	s = 0	s = 1	s = 0	s = 1	s = 0	s = 1
	(1)	(2)	(3)	(4)	(5)	(6)
CDP_Disclosure* Top_Emitter	−0.005	−0.005	−0.007*	−0.007	−0.009**	−0.009*
	(−1.550)	(−1.460)	(−1.796)	(−1.482)	(−2.001)	(−1.761)
CDP_Disclosure	0.010***	0.008***	0.018***	0.014***	0.023***	0.018***
	(4.713)	(3.657)	(6.943)	(5.156)	(7.983)	(5.954)
Top_Emitter	0.004*	0.005*	0.005*	0.005*	0.005*	0.005*
	(1.703)	(1.891)	(1.713)	(1.907)	(1.720)	(1.928)
Size	0.033***	0.028***	0.034***	0.029***	0.035***	0.029***
	(10.358)	(8.283)	(10.386)	(8.381)	(10.303)	(8.299)
Log(BM)	−0.009***	−0.011***	−0.010***	−0.011***	−0.009***	−0.011***
	(−5.102)	(−5.894)	(−4.923)	(−5.764)	(−4.658)	(−5.509)
ROA	0.066***	0.073***	0.064***	0.074***	0.064***	0.074***

Table OD.15 (*continued*)

	Dependent variable: *Signatories_Hldg* ($t + s$)					
	Only Signatories have access		Only Signatories have access Signatories own >5%		Only Signatories have access Signatories of both CDP and PRI own >5%	
	s = 0	s = 1	s = 0	s = 1	s = 0	s = 1
	(1)	(2)	(3)	(4)	(5)	(6)
	(6.047)	(6.232)	(5.837)	(6.138)	(5.805)	(6.164)
Leverage	−0.050***	−0.037***	−0.051***	−0.038***	−0.051***	−0.040***
	(−5.548)	(−3.657)	(−5.460)	(−3.634)	(−5.459)	(−3.737)
Tangibility	0.018*	0.024**	0.018*	0.023**	0.017*	0.023**
	(1.892)	(2.226)	(1.756)	(2.073)	(1.651)	(2.044)
Dividends	0.001	0.000	0.001	0.001	0.001	0.000
	(1.566)	(0.660)	(1.557)	(0.740)	(1.412)	(0.465)
Return	0.005***	0.006***	0.005***	0.006***	0.005***	0.006***
	(5.328)	(6.924)	(5.140)	(6.618)	(5.026)	(6.539)
Log(Sales)	0.000	−0.000	0.000	−0.000	0.001	−0.000
	(0.146)	(−0.040)	(0.132)	(−0.181)	(0.205)	(−0.128)
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
R^2	0.77	0.77	0.77	0.77	0.77	0.77
# Obs.	47,243	42,532	44,947	40,323	43,575	38,965

This table presents a variant of the analysis in Table 9 using total signatories holdings. *Signatories_Hldg* is the fraction of shares owned by CDP signatories. The sample and the rest of the specification are as in Table 9. Standard errors are clustered at the firm level. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

Table OD.16
Institutional Holdings: Fund-level analysis

		Dependent Variable: Δ_Fund_Ownership	
		CDP signatories	Other funds
		(1)	(2)
*CDP_Disclosure*Top_Emitter*	β	−0.012***	−0.003
		(−4.92)	(−1.04)
CDP_Disclosure		−0.002	−0.011***
		(−1.14)	(−6.12)
Top_Emitter		0.002	0.005***
		(0.94)	(2.77)
Size		−0.003	0.013***
		(−0.95)	(4.18)
Log(BM)		−0.013***	−0.012***
		(−7.01)	(−6.04)
ROA		−0.110***	−0.060***
		(−8.70)	(−4.35)
Leverage		0.092***	0.054***
		(11.23)	(7.06)
Tangibility		−0.023***	0.016*
		(−2.88)	(1.74)
Dividends		−0.003***	−0.000
		(−3.97)	(−0.23)
Return		−0.001	−0.040***
		(−0.42)	(−13.31)
Log(Sales)		−0.006***	−0.016***
		(−3.03)	(−7.10)
Firm FE		YES	YES
Fund-Year FE		YES	YES

Table OD.16 (*continued*)

	Dependent Variable: Δ_Fund_Ownership	
	CDP signatories	Other funds
	(1)	(2)
R^2	0.33	0.33
# Obs.	8,328,323	8,001,296
H0: β(1) = β(2)	p-value = 0.011	

This table presents a fund-level analysis of the association between CDP disclosures and institutional holdings. The unit of observation is fund-firm-year. Δ_Fund_Ownership is the fractional change in the number of firm's shares owned by a particular institutional investor. CDP_Disclosure is an indicator variable that equals one if the company submits the CDP questionnaire in that year, and zero otherwise. Top_Emitter is an indicator variable that equals one if the company is in the top industry quartile based on the amount of CO_2 emissions in that year, and zero otherwise. See Appendix A for other variable definitions. Column (1) includes the funds that are CDP signatories. Column (2) includes the funds that are not CDP signatories. Included portfolio firms either disclose to the CDP but restrict access to signatories or do not disclose to the CDP. Independent variables are measured at the end of the prior year. Standard errors are clustered at the fund level. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels (two-tail) respectively. Intercepts are omitted.

References

Aggarwal, R., Erel, I., Ferreira, M., Matos, P., 2011. Does governance travel around the world? Evidence from institutional investors. J. Financ. Econ. 100 (1), 154−181. https://doi.org/10.1016/j.jfineco.2010.10.018.

Azar, J., Duro, M., Kadach, I., Ormazabal, G., 2021. The Big Three and corporate carbon emissions around the world. J. Financ. Econ. 142 (2), 674−696. https://doi.org/10.1016/j.jfineco.2021.05.007.

Barko, T., Cremers, M., Renneboog, L., 2022. Shareholder engagement on environmental, social, and governance performance. J. Bus. Ethics 180, 777−812. https://doi.org/10.1007/s10551-021-04850-z.

Barzuza, M., Curtis, Q., Webber, D.H., 2020. Shareholder value (s): index fund ESG activism and the new millennial corporate governance. South. Calif. Law Rev. 93, 1243−1321. https://doi.org/10.2139/ssrn.3439516.

Bena, J., Ferreira, M., Matos, P., Pires, P., 2017. Are foreign investors locusts? The long-term effects of foreign institutional ownership. J. Financ. Econ. 126, 122−146. https://doi.org/10.1016/j.jfineco.2017.07.005.

Bolton, P., Kacperczyk, M., 2021. Do investors care about carbon risk? J. Financ. Econ. 142 (2), 517−549. https://doi.org/10.1016/j.jfineco.2021.05.008.

Bolton, P., Kacperczyk, M., 2022. Global pricing of carbon-transition risk. J. Financ. https://doi.org/10.2139/ssrn.3550233. forthcoming.

Boone, A., White, J., 2015. The effect of institutional ownership on firm transparency and information production. J. Financ. Econ. 117 (3), 508−533. https://doi.org/10.1016/j.jfineco.2015.05.008.

Bushee, B., Noe, C., 2000. Corporate disclosure practices, institutional investors, and stock return volatility. J. Account. Res. 171−202. https://doi.org/10.2307/2672914.

Crane, A., Michenaud, S., Weston, J., 2016. The effect of institutional ownership on payout policy: evidence from index thresholds. Rev. Financ. Stud. 29 (6), 1377−1408. https://doi.org/10.1093/rfs/hhw012.

deHaan, E., 2021. Using and Interpreting Fixed Effects Models. https://doi.org/10.2139/ssrn.3699777. Working paper.

Dimson, E., Karakaş, O., Li, X., 2021. Coordinated Engagements. European Corporate Governance Institute − Finance. https://doi.org/10.2139/ssrn.3209072. Working Paper. 721/2021.

Downar, B., Ernstberger, J., Reichelstein, S., Schwenen, S., Zaklan, A., 2021. The impact of mandatory carbon reporting on emissions and financial operating performance. Rev. Account. Stud. 26, 1137−1175. https://doi.org/10.1007/s11142-021-09611-x.

Dyck, A., Lins, K., Roth, L., Wagner, H., 2019. Do institutional investors drive corporate social responsibilities? International evidence. J. Financ. Econ. 131, 693−714. https://doi.org/10.1016/j.jfineco.2018.08.013.

Friedman, H., Heinle, M., 2016. Taste, information, and asset prices: implications for the valuation of CSR. Rev. Account. Stud. 21, 740−767. https://doi.org/10.1007/s11142-016-9359-x.

FSB (Financial Stability Board), 2020. The Implications of Climate Change for Financial Stability. FSB, Basel, Switzerland. https://www.fsb.org/2020/11/the-implications-of-climate-change-for-financial-stability/.

Gibson, R., Glossner, S., Krueger, P., Matos, P., Steffen, T., 2022. Do responsible investors invest responsibly? Rev. Finance 26 (6), 1389−1432. https://doi.org/10.1093/rof/rfac064.

Grossman, S., Hart, O., 1980. Disclosure laws and takeover bids. J. Finance 35 (2), 323−334. https://doi.org/10.1111/j.1540-6261.1980.tb02161.x.

Ilhan, E., Krueger, P., Sautner, Z., Starks, L.T., 2023. Climate risk disclosure and institutional investors. Rev. Financ. Stud., forthcoming. https://doi.org/10.2139/ssrn.3437178.

Jouvenot, V., Krueger, P., 2019. Mandatory Corporate Carbon Disclosure: Evidence from a Natural Experiment. https://doi.org/10.2139/ssrn.3434490. Working paper.

Kim, S., Yoon, A., 2022. Assessing active managers' commitment to ESG evidence from United Nations principles for responsible investment. Manag. Sci. 69 (2), 741−758. https://doi.org/10.1287/mnsc.2022.4394.

Krueger, P., Sautner, Z., Starks, L., 2020. The importance of climate risks for institutional investors. Rev. Financ. Stud. 33 (3), 1067−1111. https://doi.org/10.1093/rfs/hhz137.

Liang, H., Sun, L., Teo, M., 2022. Responsible hedge funds. Rev. Finance 26 (6), 1585−1633. https://doi.org/10.1093/rof/rfac028.

Matsumura, E., Prakash, R., Vera-Munoz, S., 2014. Firm-value effects of carbon emissions and carbon disclosures. Account. Rev. 89, 695−724. https://doi.org/10.2139/ssrn.1921809.

Matsumura, E., Prakash, R., Vera-Munoz, S., 2017. To Disclose or not to disclose climate-change risk in form 10-K: does Materiality Lie in the Eyes of the Beholder? Working paper. https://doi.org/10.2139/ssrn.2986290.

Raghunandan, A., Rajgopal, S., 2022. Do ESG funds make stakeholder-friendly investments? Rev. Account. Stud. 27, 822−863. https://doi.org/10.1007/s11142-022-09693-1.

Tallarita, R., 2023. The limits of portfolio primacy. Vanderbilt Law Rev. 76 (2), 511−569. https://doi.org/10.2139/ssrn.3912977.

Tomar, S., 2023. Greenhouse gas disclosure and emissions benchmarking. J. Account. Res. 61 (2), 451−492. https://doi.org/10.1111/1475-679X.12473.

Yang, L., Muller, N., Liang, P., 2021. The Real Effects of Mandatory CSR Disclosure on Emissions: Evidence from the Greenhouse Gas Reporting Program. National Bureau of Economic Research, w28984. https://doi.org/10.2139/ssrn.3880217.