Decarbonizing Institutional Investor Portfolios: Helping to Green the Planet or Just Greening Your Portfolio?

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Abstract

We study whether and how climate-conscious institutional investors, i.e., institutions that join climate related investor initiatives, are decarbonizing their equity portfolios. Decarbonization could be achieved by re-weighting portfolios towards lower carbon emitting firms or targeted engagements with portfolio companies to reduce emissions. Our analysis suggests that portfolio re-weighting is the predominant strategy used by climate-conscious institutions to green their portfolios, in particular by investors based in countries with carbon emissions pricing schemes. Institutions also rely on engagement, particularly following the 2015 Paris Agreement. Furthermore, we find no evidence that climate conscious investors allocate capital towards firms developing climate patents, but they do re-weight towards firms generating more green revenues. Overall, our analysis raises doubts about the effectiveness of investor-led initiatives in reducing corporate carbon emissions and helping take necessary action to tackle climate change for an all-economy transition to "green the planet".

JEL: G15, G23, G30, M14

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1. Introduction

Tackling climate change is one of the biggest challenges of our time. However, political economy constraints and informational frictions have prevented the creation of a global carbon pricing scheme (Tirole, 2012). In the absence of an international first-best policy, the two major tools that have been deployed are (i) regional or national carbon emission pricing schemes and (ii) voluntary initiatives by the financial sector to increase transparency on corporate emissions and channel capital away from high emissions-intensive investments and towards green solutions. Consistent with this idea, a recent survey on climate finance topics by Stroebel and Wurgler (2021) also finds that carbon taxes and pressure from institutional investors are identified as the most influential forces for change.

We focus our attention on the role of climate related initiatives by institutional investors. We select two initiatives based on their longevity, popularity among investors, and the relevance of their goals to tackle climate change. The main one, the CDP, was started in 2000 as the Carbon Disclosure Project, with the objective to get companies worldwide to disclose their greenhouse gas (GHG) emissions and set reduction targets.[1] Following the 2015 Paris Agreement Paris, a second initiative, the Climate Action 100+, was launched to more directly engage firms to curb their contribution to climate change. In this paper we examine both but focus more on CDP members, since that initiative runs throughout our analysis period.

We refer to investors that join these initiatives as "climate-conscious" institutions and explore whether they are actively decarbonizing their equity portfolios and, if so, whether they are just "greening their portfolios", or whether they are actually contributing to "greening the planet". A coalition of climate-conscious investors could help address the climate challenge by collectively taking the role of a large socially responsible fund that tilts the equilibrium towards lower industrial emissions as theorized by Oehmke and Opp (2022) and Biais and Landier (2022). These models assume that socially

[1] We use the terms "GHG emissions" and "carbon emissions" interchangeably in the paper for simplicity of exposition. While CO2 is the largest contributor and most-commonly mentioned as the cause of the global rise in temperature, several gases, collectively known as greenhouse gases (GHG), are responsible for the "greenhouse effect." Climate scientists have concluded that continued growth in GHG emissions can lead to the earth's warming of 1.5°C, relative to pre-industrial levels, sometime between 2030 and 2050 (IPCC, 2018). According to Climate Action Tracker (2022), even if governments achieved their pledges agreed upon in the 2015 Paris Agreement, the world is likely to warm well above the 2°C limit by 2100 compared to pre-industrial levels.

responsible investors at least partly internalize carbon emission externalities. On the other hand, if investors care more about their own portfolios, they might only take actions that reduce the exposure to climate change on their specific investments. Krueger, Sautner, and Starks (2020) provide survey evidence that regulatory, reputational and financial considerations are indeed important drivers as to why investors care about climate risks.

Guided by this debate, our study compares portfolio-level carbon metrics of climate-conscious investors to those of institutional investors that have not committed to climate initiatives. We conjecture that climate-conscious investors divest faster from companies with high emissions but could also engage more with companies on carbon issues than their institutional peers. Importantly, we also study how institutional investor climate initiatives interact with the national or regional carbon emission pricing schemes. These schemes are increasingly used to price the externality costs of GHG emissions with the largest scope one being the EU ETS "cap and trade" system. Climate-conscious investors based in countries with carbon emission schemes should have stronger incentives to decarbonize their portfolios given that these institutions face greater reputational concerns and stand a higher likelihood of future climate regulation.

To answer these research questions, we combine corporate GHG emissions data with global institutional equity holdings from FactSet Ownership to calculate portfolio-level carbon metrics related to Scope 1 emissions (the direct GHG emissions stemming from operations that are owned or controlled by the portfolio firms). We conduct tests on the year-on-year changes in GHG emissions to investigate if climate-conscious institutional investors (which we define by being CDP members) are decarbonizing their portfolios faster than institutional investors that are not supporting CDP. We find that some evidence but the effects are weak. The average effect, however, masks substantial heterogeneity: CDP investors domiciled in jurisdictions with carbon emission schemes decarbonize portfolios at a sizable rate of 3 to 4 percentage points faster than other non-CDP institutional investors. In contrast, CDP investors outside an emissions scheme do not actively decarbonize relative to their other institutional peers. These patterns are economically meaningful as UNEP (2019) estimated a required annualized fall of -7.6% in GHG emissions between 2020 and 2030 for the Paris Agreement goal of limiting global

warming to +1.5°C compared to pre-industrial levels. Our results suggest that there is an important interaction between public carbon pricing policies and voluntary market-based initiatives to reduce GHG emissions, consistent with our hypothesis that lowering GHG emissions is a more salient issue in countries that increasingly price the external costs of GHG emissions.

Next, we test the different strategies that institutional investors can take to achieve portfolio decarbonization. Decarbonization can be achieved either by reducing their portfolio stakes in the top GHG emitters and rebalancing towards lower GHG emitters (*Portfolio Re-weighting*) or through targeted engagement by investors with the portfolio companies to reduce their GHG emissions and greening their business models (*Corporate Changes*). We therefore decompose the total change in portfolio carbon emissions into (1) a component that comes from investors changing their portfolio weights and (2) a component coming from portfolio firms improving their emissions over time. Reductions in portfolio emissions due to changes in investor weights imply a portfolio re-weighting strategy, whereby investors reduce emissions by tilting away from the highest emitters. In contrast, improvements in portfolio emissions that result from portfolio firms becoming less polluting over time (corporate changes) suggest that investors may, at least to some extent, be engaging with firms to lower their emissions. Our results show that portfolio re-weighting and not corporate changes explains most of the faster decarbonization by CDP investors domiciled in an emissions scheme jurisdiction.

Our failure to uncover large-scale evidence on corporate changes by CDP signatory portfolio firms, and thus to some extent the lack of systematic investor engagement on carbon emissions, may be due to these strategies needing to be more targeted and taking time to materialize. Consistent with this idea, when we isolate the top 100 Scope 1 emitting firms in each year, we find some evidence that portfolio carbon metrics that are more likely to capture engagement by investors improve, specifically among the portfolios of CDP investors based outside an emissions scheme. We also find similar evidence when looking at changes in portfolio carbon measures over two years instead of a one-year horizon, suggesting that institutions may be relying on engagement strategies. We conclude that there appears to be an interaction between government action on climate change and private investor actions, whereby less government action could be partially substituted by private sector engagements.

Recognizing that a CDP-led disclosure push may not be sufficient to drive down emissions, a more recent investor initiative, Climate Action 100+ (CA100+), was launched in 2017 following the Paris Agreement at the 2015 UN Climate Change Conference. CA100+ targets the world's largest corporate GHG emitters with the objective to get these to take necessary action on climate change. Consistent with this mandate, we document that the investee companies curb their emissions, and thus CA100+ investors decrease their portfolio footprints (in addition to portfolio re-weightings away from high-emission companies).

In the last part of the paper, we look beyond the current snapshot of portfolio GHG emissions to examine more forward-looking measures of how investee companies are developing green technologies (Cohen, Gurun, and Nguyen, 2021, Hege, Pouget, and Zhang, 2022 and Bolton, Kacperczyk and Wiedemann, 2022) and generating revenues associated with green products or services (such as renewable energy or electric vehicles). Climate-related patents and green revenues have the potential to generate the technological breakthroughs and transformation of business models that can help achieve net-zero carbon emissions. We find that CDP (and CA100+) investors re-weight their portfolios towards firms with higher green revenues, but not to firms that are generating more climate-related patents. One caveat to this analysis is the limited data which might be a consequence of still being in the early stages of a global transition to a green economy.

How important is the scale of decarbonization of institutional investors' equity portfolios in aggregate? Our analysis shows that between 2005 and 2019 the direct carbon emissions of publicly listed firms grew from 30% to 41% of total global CO2-equivalent emissions (Panel A Figure 1).[3] Part of the growth comes from the increased emission coverage by the corporate GHG data provider Trucost but it is important to note that the majority of industrial GHG emissions still come from non-publicly listed entities (The Economist, 2020) beyond the reach of public equity investors. However, we then split out the GHG emissions by public firms into the fractions attributable to institutional investors, closely held shares, and other minority shareholders based on the ownership stake held by each group in their

[3] The total global CO2 equivalent yearly emission estimate for fossil fuel use, industrial processes and product comes from EDGAR (the Emissions Database for Global Atmospheric Research) produced by European Commission, Joint Research Centre (2021).

portfolio firms. The aggregate GHG emissions that can be apportioned to institutional investor portfolios based on their share ownership are essentially flat at 9% of total global emissions over the period (Panel A of Figure 1). This occurs despite the growth in total institutional investors' equity holdings from 43% to 53% of market capitalization (Panel B of Figure 1). If institutions were to finance the same amount of CO2e emissions per dollar invested, a crude approximation would suggest that institutional investors' portfolio GHG footprints should have grown proportionately from 9% to 15% {= 9%*[(53%/43%)*(41%/30%)]} of total global emissions over the period instead of staying flat at 9%. This indicates that institutional investors are decarbonizing their portfolios relative to other investor groups. In aggregate, our tests suggest that this is achieved primarily by tilting away from high-carbon emission companies. The predominant use of reweighting strategies to reduce portfolio carbon exposure shows the limits of trusting portfolio incentives of institutional investors to lead to an all-economy green transition.

Our paper contributes to the growing climate finance literature (see Hong, Karolyi, and Scheinkmann, 2020, Giglio, Kelly, and Stroebel, 2021, Pastor, Stambaugh, and Taylor, 2021, 2022) and how investors incorporate firms' exposure to climate risks into security prices. For instance, Bolton and Kacperczyk (2021, 2022a) and Hsu, Li and Tsou (2022) focus on the cross-section of stock returns and find that firms that are more exposed to climate transition risk due to high GHG emissions earn higher risk-adjusted returns. In follow-up studies, Bolton and Kacperczyk (2021b) examine the positive effects of disclosure of carbon emissions on stock returns and document that one cost of disclosing emissions is increased divestment by institutional investors, Bolton and Kacperczyk (2022) also study whether climate-related firm commitments via CDP and the science-based target initiative lead to a reduction in carbon emissions but the effect is small and tend to be in companies that already have lower carbon emissions (and not to those that need to reduce their emissions the most). Our results on the interaction between institutional investor initiatives and public carbon pricing policies also contributes to understanding the impact of carbon pricing tools (Burke et al., 2016).

Another stream of the literature focuses on how institutional investors as a group are approaching climate risk. For instance, Krueger, Sautner, and Starks (2020) show that institutional

investors increasingly account for climate risk in their investment decision making. Ilhan et al. (2022) show that there is a positive association between institutional ownership and firm-level carbon disclosure. Flammer, Toffel, and Viswanathan (2021) examine the role of shareholder activism campaigns in eliciting greater voluntary disclosure of firms' exposure to climate risks. Azar et al. (2021) find that the "Big Three" institutional investors have focused their climate engagement effort on large firms with high emissions and have been successful in influencing firms towards lower carbon emissions. Finally, in a contemporaneous study to ours, Cohen, Kadach and Ormazabal (2022) find that CDP signatories positively influence firms to disclose emissions and show evidence of engagement again by the "Big Three". Our study takes a broader prospective. We go beyond the "Big Three"[4] and study how investor signatories to global climate initiative such as the CDP and later CA100+ decarbonize their portfolios. Our split of portfolio decarbonization changes into those caused by "portfolio re-weights" vs "corporate changes" attempts to disentangle how the responses of climate conscious investors map on the existing literature's "voice" vs "exit" framework (see also Broccardo, Hart, and Zingales, 2022) and the broader implications of their actions for the climate challenge. Furthermore, we examine how these group of investors behave under different public policy regimes, one where their home countries are working to combat climate change via a carbon emissions pricing scheme, and one which is lacking such government actions. Our empirical results also speak to the debate whether a coalition of investors (acting as a large socially responsible fund with a mandate to tackle climate change) can make a green equilibrium more likely (Oehmke and Opp, 2022; Biais and Landier, 2022).[5]

While some of the papers mentioned above examine investor engagement, other researchers have focused more extensively on the issue of portfolio divestment.[6] Heinkel, Krauss, and Zechner (2001) examine the effects of exclusionary ethical investing on corporate behavior and Davies and van

[4] The results are robust to removing the Big Three (BlackRock, State Street, and Vanguard) from our sample.
[5] By studying investor-led climate change initiatives, our paper is also related more broadly to the literature on ESG (see Pedersen, Fitzgibbons, and Pomorski, 2021; Goldstein et al. 2021), responsible investing (see, for instance, Dyck et al. 2019; Matos, 2020; Gibson Brandon et al. 2022) and divestment versus engagement on ESG issues (Dimson et al. 2015, 2022; Edmans, Levit and Schneemeier, 2022).
[6] Divestment is sometimes used to refer to reducing just holdings in coal or oil & gas companies with the focus being on stopping future emissions if their fossil fuel reserves were burned (Bessembinder, 2016). Our paper takes a wider lens on portfolio decarbonization across all industries and focuses on tilting, engagement, and shifting assets to companies developing clean technology solutions.

Wesep (2018) document unintended consequences of divestment. Related to ethical divestment, Hong and Kacperczyk (2009) empirically examine the returns of sin stocks. More focused on climate issues, Choi et al. (2022), for instance, propose that divestment by financial institutions pushes public firms to adopt climate-friendly policies and decrease carbon footprints. In contrast to this finding, Berk and van Binsbergen (2022) evaluate the quantitative impact of ESG divestitures more generally and conclude that current ESG divesture strategies have had little impact. Atta-Darkua (2020) examines implications for firm equity value and ownership structure when a large and well-known institutional investor publicly excludes a firm from its portfolio due to unethical behavior. Finally, Bolton, Kacperczyk, and Samama (2022) propose a methodology of decarbonization such that investor portfolios are aligned with a science-based carbon budget consistent with maintaining the global temperature rise within what is set out in the Paris Agreement. We provide empirical evidence that the re-weighting actions of global institutional climate initiatives are likely too small to have a meaningful impact on greening the economy.

2. Data on Climate-Conscious Investors and Portfolio Green Metrics

2.1. Investor-Led Climate Change Initiatives and Carbon Emission Pricing Schemes

Our main proxy for "climate-conscious" institutional investors is an indicator that identifies institutional investors who participate in CDP, the earliest and most prominent investor-led initiative to tackle climate change. CDP is a non-profit organization founded as the Carbon Disclosure Project in 2000 with funding from grants and investor membership fees to collect and distribute information on firm-level exposure to, and management of climate risks. To achieve this aim in 2002, CDP started sending an annual questionnaire to request firms to self-report their greenhouse gas emissions as well as their climate risks, strategies, and actions. By 2021, CDP collected environmental disclosures on over 13,000 companies on behalf of over 680 investor signatories.[7]

In the later part of our analysis, we also examine membership in Climate Action 100+ (CA100+), a more recent initiative focused on investor engagement.[8] Launched in 2017, this initiative

[7] For background see https://www.cdp.net/en/info/about-us/20th-anniversary.
[8] For more details on CA100+ see https://www.climateaction100.org/.

engages with the global top 100 (subsequently expanded to the top 166) publicly listed companies with the largest GHG emissions. The objective of CA100+ is to accelerate the decarbonization of the highest emitting companies through engagement. Priorities for engagement are net zero goals (how the businesses of highly emitting companies are compatible with the 2050 carbon neutral world envisaged by the 2015 Paris Agreement) and other commitments regarding climate reporting and lobbying. To identify this list of target companies, CA100+ used CDP data focusing on the top emitting firms with aggregate GHG emissions that accounted for over 80% of the total CDP corporate GHG emissions data.

We match the list of institutions that are part of CDP and CA100+ to FactSet Ownership, which provides global equity holdings – see Ferreira and Matos (2008) for details on this data.[9] We use portfolio data at the end of each calendar year from 2005 to 2019 for institutional investors with at least US$ 100 million in equity holdings, owning at least five equity securities in their portfolio. As of the end of 2019, our sample of institutional investors included 623 CDP signatories and 268 CA100+ members.

Panel B of Figure 1 shows the growth of the CDP initiative. At the end of the sample period, the equity assets under management (AUM) of CDP signatories comprised over half of the US$ 37 trillion total institutional investor equity holdings. Table 1 reveals that about half of CDP signatories are based in Europe, and about a third in North America. Furthermore, the percentage of investment managers in CDP increased over time, whereas asset owners accounted for a larger proportion of the early cohort of signatories.[10] The investor base of CA100+ is substantially smaller than that of CDP representing only 14% of total institutional ownership in 2019, reflecting the fact that it is a more recent (and also more focused) initiative.

To study the interaction between public policies and private initiatives to reduce GHG emissions, we split investors depending on whether they are headquartered in a country with or without

[9] The match of CDP and CA100+ members to FactSet Ownership was done by exact name matching and then a fuzzy algorithm complemented with manual checks. We considered both parent or subsidiary entity names in FactSet and we used the closest match. For example, for Fidelity we found that FIL Investment Advisors (UK) Ltd. is a CDP signatory, but Fidelity Management & Research Co. LLC (US) is not.

[10] Note that for an asset owner to be covered by FactSet Ownership, the institution needs to have considerable direct equity holdings. Asset owners that outsource the management of their equity investments do not show up in our sample as a separate institution as their assets will be part of their respective investment managers' portfolio filings.

an active carbon emission pricing scheme in a given year. We use data from the World Bank Carbon Pricing Dashboard to identify countries with carbon pricing instruments, including taxes and emission trading schemes.[11] The largest regional scheme is the EU Emissions Trading Scheme (ETS) which was launched in 2005 and covers power generation and large industry emissions representing 40% of total GHG emissions in the EU.[12] It consists of a "cap and trade" scheme where a cap is set on the total amount of GHG emissions, with companies being allocated allowances and trading emission rights within the EU area (including the UK until 2020 plus also Iceland, Liechtenstein and Norway). In many EU member states there are additionally national energy taxes based partly on carbon content (e.g., France, Germany, Sweden, etc.). Other notable jurisdictions include Japan, where a carbon tax was instituted from 2012, and South Korea which launched an ETS in 2015.

Table IA.1 in the Internet Appendix provides a list of the top institutional investors (by Equity AUM as of 2019), showing that all the top 10 institutions located in a country with a carbon emissions pricing scheme were CDP signatories by the end of sample period while this was the case for only 5 of the top 10 domiciled outside an emission scheme country. Logit regressions in Table IA.2 show that the strongest factors associated with the decision to join CDP and CA100+ are larger equity AUM (*Portfolio Size*), being located outside of *North America*, and a more value-oriented portfolio (lower *Average Market-to-Book*).

2.2. Carbon Emissions

We access global corporate carbon emissions data from Trucost in order to calculate the GHG emissions profile of institutional investors' equity portfolios.[13] Trucost standardizes and validates the firm-level emission data. Our sample spans from 2005 to 2019 and by the end of the period covers over 15,000 publicly listed firms representing over 95% of global market capitalization. We focus our analysis on

[11] Source: https://carbonpricingdashboard.worldbank.org/map_data. Over the 2005 to 2019 sample period, the share of global GHG emissions covered by carbon pricing instruments went from 5% in 2005 to 15% in 2019 (The World Bank. 2022. "State and Trends of Carbon Pricing 2022"). Many carbon pricing schemes including the EU ETS (below EUR 30/tCO2e during the 2005-2019 sample period) were considered well below the EUR 50-100/tCO2e range the 2017 Report of the High-Level Commission on Carbon Prices indicated was needed to keep global heating to 2°C by 2030.

[12] For details see https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en.

[13] Trucost is part of S&P Global (https://www.spglobal.com/esg/trucost) covers "core plus" listed equity securities that are part of the S&P Broad Market Index (BMI) (11,500 large-, mid-, small- and micro-cap companies) and some additional indices (S&P China A SmallCap 300 Index, S&P 500 Index, S&P Global 1200 Index, S&P/TOPIX 150 Index, S&P/TSX Composite Index, S&P/ASX 200 Index, S&P/ASX 300Index) as well as other large listed companies added per client request.

Scope 1 emissions, which are the direct GHG emissions stemming from operations that are owned or controlled by firms. Emissions are measured in "carbon dioxide equivalents [CO2e]", a term used to describe all greenhouse gases in a common unit.[14] Examples of Scope 1 emissions include those from fossil fuels burned on site or emissions from vehicles. Trucost obtains emission data directly from companies' disclosure (in annual reports, regulatory filings, corporate social responsibility reports, etc.) and from third parties such as the CDP. When reported data is not available, Trucost uses its proprietary carbon estimation model (EEIO, Environmentally-Extended Input-Output Model) to impute emissions.

Figure 1, Panel A shows that the total Scope 1 emissions of firms in Trucost grew from about 9 gigatons (billion tons) of CO2e in 2005 to close to 16 gigatons of CO2e in 2019.[15] We further split public firm emissions into those attributable to CDP investors, non-CDP investors, closely held shares, and other minority shareholders, by allocating firm emissions to each group based on their percentage ownership levels.[16] In aggregate, corporate emissions by publicly listed firms rose from 30% to 41% of total global CO2e emissions estimated by EDGAR[17] for fossil fuel use, industrial processes and product use which grew from 30 to 38 gigatons of CO2e over that time period. Panels A and B of Figure IA.2 show that there has been an increase in the rates of corporate GHG disclosures, either full or partial. The small dip in 2016 is due to the coverage expansion of the Trucost proprietary carbon estimation model that year.

We calculate two main portfolio GHG emission metrics which are commonly used by institutional investors in reporting their portfolio carbon exposures to end investors or beneficiaries. We focus on absolute rather than relative GHG emission portfolio measures because such measures better reflect an investor's contribution to climate change (Bolton and Kacperczyk, 2021a). The first measure

[14] Each GHG has its own global warming potential (GWP), which measures how much heat the specific GHG can trap within the atmosphere. CO2e puts all GHG emissions in relation to carbon dioxide, which has a GWP standardized to one.
[15] Trucost coverage of public listed companies is higher than other leading data providers. For example, the total GHG emissions of MSCI ACWI Investable Market Index (which covers over 9,200 listed companies) were estimated at 11.3 gigatons of CO2e in 2019 (see MSCI "The MSCI Net-Zero Tracker", October 2021).
[16] We calculate the percentage of firm shares which are closely held using data in the Factset database and estimate minority ownership levels as the remaining percentage of firm equity which isn't owned by either institutional investors or is closely held.
[17] The Emissions Database for Global Atmospheric Research (EDGAR) is an independent report of global GHG emissions that contributes to the Paris Agreement process. The data considers carbon dioxide emissions from all anthropogenic activities such as the burning of fossil fuels and cement manufacture, but not emissions from land use and forestry (which are hard to account for in terms of carbon emissions and removals).

is *Scope 1* which consists of the weighted average of the direct GHG emissions (in metric tons of CO2e) from operations by the firms held in an investor's portfolio. The weighted average carbon emissions of investor *i* at time *t* is defined as:

$$Scope\ 1_{it} = \sum_{j=1}^{N_{jt}} \left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}} \right) * Scope\ 1\ GHG\ Emissions_{jt}$$

where *$ Shares Held*$_{ijt}$ is the dollar amount of firm *j* stock which investor *i* holds at time *t*, *$ Portfolio Size*$_{it}$ is the dollar size of the investor's equity portfolio, N_{jt} is the number of stocks in the investor's portfolio at time *t*, and *Scope 1 GHG Emissions*$_{jt}$ are the Scope 1 emissions of firm *j* in year *t*.

The second portfolio measure, *Scope 1 Footprint*, quantifies how much of a firm's carbon emissions can be apportioned to that institutional investor based on its ownership share in the investee firms. To illustrate it with an example: if an investor's position in a company is equal to 1% of the company's market capitalization, then the investor "owns" 1% of the company's direct Scope 1 GHG emissions. Calculating the "owned" GHG emissions from each position in the equity portfolio and summing those emissions yields the total GHG emissions of an investor's portfolio. It is an estimate of an investor's total contribution to climate change based on its ownership stakes in the emitting firms. The *Scope 1 Footprint* for an investor *i* at time *t* is defined as:

$$Scope\ 1\ Footprint_{it} = \sum_{j=1}^{N_{jt}} \left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}} \right) * Scope\ 1\ GHG\ Emissions_{jt}$$

where *$ Shares Held*$_{ijt}$ is the dollar amount of firm *j* stock which investor *i* holds at time *t*, *$ Market Cap*$_{jt}$ is the dollar size of firm *j* at date *t,* N_{jt} the number of stocks in the investor's portfolio at time *t*, and *Scope 1 GHG Emissions*$_{jt}$ are the Scope 1 emissions of firm *j* in year *t*. Using this measure, Panel A of Figure 1 shows that institutional investors "owned" collectively a total of 2.8 gigatons of CO2e in 2005 (9% of the global total in EDGAR, 31% of public firms in Trucost) and 3.4 gigatons of CO2e in 2019 (still 9% of the global total, 21% of public firms). By comparison, the emissions apportioned to the ownership stakes held by other non-institutional blockholders (and minority investors) in public firms grew faster from 2.0 to 4.8 (and 4.1 to 7.4) gigatons of CO2e from 2005 to 2019. .

We choose these two measures to provide both an internal measure of investor portfolios' exposures to climate change factors, and an external measure of how portfolios can impact global climate change. *Scope 1* is calculated as the average emissions of a portfolio and thus can proxy for a portfolio's exposure to climate change regulation measures or other factors which could lead to re-pricings of firms due to their carbon emissions. In contrast, *Scope 1 Footprint* captures the level of Scope 1 emissions an investor can be considered responsible for based on their ownership in polluting firms, and therefore their indirect impact on global emissions. While our focus in this paper is on absolute carbon emissions, we also examined relative exposure metrics sometimes reported by asset managers: (i) the weighted average carbon intensity of the portfolio (*Scope 1 / Revenue*) which captures the efficiency for the level of output of firms held by an investor; (ii) the *Scope 1 Footprint / Portfolio Size* which normalizes the carbon emissions for every $1 million of market value of an investor's equity portfolio. Appendix Figure IA.1 illustrates that similar patterns of portfolio decarbonization is observed using these alternative measures.

To provide some examples, Figure IA.3 in the Internet Appendix shows the GHG emissions metrics for four prominent institutional investors: the "Big Three" investment management companies (Blackrock, State Street, Vanguard) and the world's largest sovereign wealth fund (Norges GPFG). Panel A shows that all four institutions have gradually reduced their portfolio *Scope 1* average emissions. However, since the aggregate sized of their equity portfolios have been rising (Panel C), so has their total portfolio *Scope 1 Footprint* (Panel B) .

2.3. Summary Statistics

Table 2 provides summary statistics for our sample consisting of 56,981 investor-year observations between 2005 and 2019 used in subsequent regression analysis. Besides the carbon metric and green business variables, we account for investor characteristics and portfolio investment styles in our analysis. Our set of investor controls comprises an investor's equity AUM (*Portfolio Size*), region of domicile (*Europe*, *North America*, or *Rest of the World*), and investor type (*Asset Owner* or *Investment Manager*). Our set of portfolio holdings controls includes the number of companies and industries held (*# Companies*, *# Industries*), the type of stocks (*Average Market Cap* and *Average Market-to-Book*) and

portfolio geographic exposure (*Own Region %*, *Developed Markets %*). Appendix A provides detailed definitions and the data sources for each of these variables.

3. Portfolio Decarbonization by Climate-Conscious Institutional Investors

We study whether investor-led climate change initiatives – the CDP and Climate Action 100+ – help mitigating carbon emissions. In the absence of first-best solutions such as a Pigouvian global carbon tax, investor-led climate change initiatives may be a powerful way of addressing climate change. These initiatives could collectively take the role of a large responsible fund that impacts companies to reduce their emissions. Oehmke and Opp (2022) theorize that a large responsible fund can reduce inefficiencies resulting from negative externalities arising from dirty production and financing constraints related to clean production if the collective fund follows a broad social mandate. Alternatively, Biais and Landier (2022) show that a large responsible fund can shift the equilibrium toward emission caps if the fund is environmentally responsible or if the adverse consequences of global warming on firm profits are larger than the investment costs in green technologies.

We begin our analysis by examining the time trends in portfolio carbon emission metrics by plotting time series averages. Figure 2 shows a downward trend in the *Scope 1* portfolio emissions measure for institutional investors (Panel A). It also shows that decarbonization is a common feature for large cap companies that are part of the MSCI ACWI index (a benchmark that is commonly tracked by major institutional investors around the world). As a first indication that public policies matters, we see that portfolio decarbonization is concentrated among those investors based in countries with carbon emission pricing schemes (Panel B), with it is less pronounced for investors located in countries without such policies (Panel C).

We next study portfolio decarbonization by institutional investors in a multivariate regression model. We compute investor portfolio decarbonization as the annual changes by calculating log differences between periods $t + 1$ and t. Proceeding this way has the advantage of being able to interpret the log-differenced dependent variable as percentage changes. For each portfolio carbon metric, we run

two specifications that first includes only investor controls and a second one where we also add portfolio controls (see Section 2.3 above). We also forward the changes by one period since emissions data are typically reported with a significant time lag (Zhang, 2022). We also winsorize all continuous variables at the 1% and 99% cutoff levels each year. We include year fixed effects to absorb the overall rates of decarbonization of companies in the stock market. The main variable of interest is *CDP*, a dummy that identifies climate-conscious investors, and captures the incremental decarbonization rate of climate-conscious investors relative to the comparison group of institutional investors that did not join the initiative.

Table 3 shows some evidence that CDP investors decarbonize faster than their peers. For instance, CDP investors' *Scope 1 Footprints* (see columns 3 and 4) decrease by about 3 percentage points more per annum compared to other institutional investors. However, the effect is not overly strong from a statistical point of view. Depending on the specification, the coefficient estimate is significant only at the 10% and 5% levels. The evidence of stronger decarbonization by CDP investors is even weaker when focusing on annual percentage changes in *Scope1* (see columns 1 and 2), with the effect becoming insignificant once portfolio controls are included.[20] While our paper focuses on actual portfolio carbon emission reductions, we conduct some validation tests to check whether CDP investors are indeed associated with higher portfolio carbon disclosure and emissions targets (as shown in Ilhan et al. (2022) and Bolton and Kacperczyk (2022)). Panel D of Appendix Table IA.3 shows that portfolios of investors that join the CDP tend to have between 3 and 7 percentage points higher levels of portfolio disclosures (both in terms of *Carbon Disclosure %* and *Full Carbon Disclosure % (95%+)*) and 2 to 7 percentage points higher prevalence of emissions targets (*Emissions Target %*) but not consistently higher *Science-based Emissions Target %.*[21] However, the regression results with investor fixed effects do not show

[20] In unreported results, we find little evidence that CDP investors significantly reduce their Scope 2 + 3 emissions measures. Scope 2 emissions comprise companies' indirect GHG emissions from the purchased energy. Scope 3 emissions are indirect greenhouse gas emissions from upstream supply chain and purchased materials and also downstream emissions inherent in the use of its products and services and constitute a large part of GHG emissions for many industries These definitions follow the Greenhouse Gas Protocol (https://ghgprotocol.org/). Though Scope 2 and 3 emissions are a growing focus for investors, an important caveat is that these are often not consistently disclosed as these occur from sources not controlled by companies, and the boundaries to measure Scope 3 emissions are not well-defined. At the portfolio-level there are also methodological complexities, such as the treatment of double counting.

[21] *Emissions Target %* captures the percentage of firms in the investor portfolio that have an emissions reduction target and *Science-based Emissions Target %* captures the percentage of firms in the investor portfolio that have a verified Science-based Targets Initiative (SBTi) plan. We obtain emissions target data from firm disclosures to the CDP (available 2010-2018). In

significant improvement in either disclosure or emissions targets after an investor joins the CDP initiative.

3.1. Portfolio Decarbonization Strategies: Portfolio Re-weighting versus Corporate Changes

One of the objectives of our paper is to test the different strategies that institutional investors can employ to achieve portfolio decarbonization. The first strategy, which we refer to as *Portfolio Re-weighting*, is visualized in the illustrative example of Panel B of Figure 3 and consists of investors reducing their ownership of brown (high emitting) firms and substituting towards green (lower-emitting) firms. Panel C of Figure 3 illustrates the alternative decarbonization strategy, which we label *Corporate Changes*, in which the investor is more proactively influencing its portfolio firms to reduce their GHG emissions, rather than just tilting away from owning them. Both strategies combined reflect how institutional investors reduced their exposure to emissions from high-emission firms over time. Specifically, in Panel A of Figure 3 we plot the actual total carbon footprint of aggregate institutional holdings in the top 100 Scope 1 emitting publicly-listed firms each year. Splitting the top 100 emitters into quintiles, we can see that over time institutional investors reduced their exposure to emissions from the top 20 emitting firms. But this offers only suggestive evidence, and we perform more formal tests below to better tease out the two portfolio decarbonization strategies.

While both portfolio re-weighting and corporate changes could help an investor decarbonize its portfolio it is important to understand their implications to address the climate change challenge. With the portfolio re-weighting strategy, portfolio firms are not encouraged to improve emissions over time and therefore investors may be simply shielding their portfolios but not addressing climate change from a societal perspective – in other words, through re-weighting, an investor is primarily greening its portfolio but not actually helping with the efforts to green the planet. This is, of course, a simplification which does not account for second-order effects such as a potential higher cost of capital for firms adversely impacted by re-weighting. However, Berk and van Binsbergen (2022) have argued that the impact of ESG fund divestment on firm cost of capital is likely to be too small to affect firm behavior.

addition to the firm's internal targets, CDP disclosures also identify after 2016 which firms have plans aligned with the emission reduction objectives of the Paris Agreement and verified by the SBTi.[22] They have a weak reduction in *Scope 1 Footprints* from firms outside the three material sectors, but this is only significant at the 10% level.

At the end of this section, we calibrate their methodology to our setting and arrive at a similar conclusion for the potential of divestment on climate change grounds to impact firm emissions strategies. The Corporate changes strategy has the benefit of improving both an investor's exposure to climate change (i.e., by reducing the investors carbon footprint) and helping address the negative environmental externality, because firms effectively reduce their emissions. In contrast, portfolio re-weighting may simply be pushing the problem of carbon emissions on to other investor groups, making the negative externality "someone else's problem". Such behavior would be similar to firm-level plant divestments documented by Duchin et al (2022).Another recent paper Broccardo, Hart, and Zingales (2022) show theoretically that engagement strategies can achieve the socially desirable outcome if the majority of investors are socially responsible. Divestment strategies, by contrast, are less effective in their model given that the effects of divestment strategies are partially offset by profit-seeking investors that buy the stocks shunned by responsible investors (see also Heinkel et al. 2001). In fact, their model predicts that a socially optimal divesting equilibrium can exist only if most responsible investors are willing to pay for most of the cost of greening the economy themselves.

To test for portfolio re-weighting vs. corporate changes, we decompose the total change in portfolio carbon emissions into: (1) the component that comes from investors changing their portfolio weights in different firms; as well as (2) the component of the effect of portfolio firms' emissions improving over time. To separate the two components, we allow only one of them to change at a time. In the portfolio re-weighting regressions, we calculate the portfolio emissions metrics in period $t + 1$ using updated portfolio weights, but keep firm emissions the same as they were at time t. We then subtract this measure from the portfolio emissions at time t. These change variables, which we label Δ *weights-only* capture the extent to which investors are tilting their equity portfolio allocations away from high emissions firms and towards firms with lower emissions. In contrast, in the corporate change regressions, we only permit firm emissions to change in $t + 1$, but keep firm portfolio weights the same as they were in period t. We subtract this measure from the portfolio emissions in period t. The resulting variables, Δ *emissions-only* capture the change in portfolio emissions which is due to improving emissions in firms owned at time t. Such improvements should be, at least to some extent, a result of

investors successfully engaging with their portfolio firms to reduce their emissions. In both cases, we again calculate log-changes and describe the formulas behind these measures in more detail in Appendix B of the paper.

Columns 5 to 8 of Table 3 present the portfolio decarbonization strategy results. The decomposition analysis shows that CDP investors reduce their average *Scope 1* emissions 2 percentage points faster via portfolio re-weighting. Their *Scope 1 Footprint* is also decreasing faster by roughly the same percentage once we account for investor portfolio characteristics. In contrast, the corporate changes results (see columns 5-8) are statistically insignificant, suggesting that portfolio re-weighting is the primary method that CDP investors employ to decarbonize their portfolios. This however masks considerable investor heterogeneity depending on regulatory environment, which we study in the next section.

3.2. The Interaction Between Private and Public Decarbonization Policies

A key focus of our paper is how private investor initiatives by institutional investors such as the CDP interact with government policies to reduce GHG emissions. Climate investor initiatives co-exist with carbon emission trading schemes in many jurisdictions, absent a first-best global carbon cap or tax scheme. We conjecture that climate-conscious investors located in regions with carbon caps have higher incentives to decarbonize their portfolios as suggested by two arguments. First, institutions affected by carbon emission schemes may be more concerned about future regulation of investee companies in their portfolios. Biais and Landier (2022) and Ramadorai and Zeni (2021) model how companies are more likely to decarbonize when they expect future regulation. Second, there could also be reputational concerns. Institutions located in regions with carbon taxes or emission caps might face stronger reputational concerns to decarbonize their portfolios. Survey evidence from institutional investors confirms that the protection of the investors' reputation and legal duties are two important motivations for considering climate risks (Krueger, Sautner, and Starks 2020).

To explore how climate initiatives interact with national or regional carbon trading schemes, we split the investor sample into those institutions located in countries with active carbon emissions pricing

schemes, and those located elsewhere (see Section 2.1 for details). In Panel A of Table 4, we show that decarbonization is concentrated primarily among CDP investors based in countries with emissions schemes. Those CDP investors significantly reduce their portfolio emissions across both the *Scope 1* and the *Scope 1 Footprint* measure relative to their non-CDP counterparts in a given year (see columns 1-4). In contrast, there is no evidence that CDP investors outside an emissions scheme country reduce their carbon performance (see columns 5-7), apart from a marginally significant coefficient for the CDP dummy when using *Scope 1 Footprint* and once we include investor portfolio controls (at the 10% significance level).

Next, we decompose the total changes into those stemming from portfolio re-weighting vs. corporate changes. The results indicate that portfolio re-weighting explains most of the decarbonization of CDP signatories and that this result is driven by those based in countries with a carbon pricing emissions scheme (Table 4, Panel B). These are mostly European-based CDP signatories since the world's first emissions trading system (EU ETS) started in 2005 and remains the biggest one, making the social cost of GHG emissions more salient to these institutional investors. In comparison, CDP investors outside an emissions scheme do not decarbonize via portfolio re-weighting and there is some evidence that they may be decarbonizing their *Scope 1 Footprint* via corporate changes. After accounting for both portfolio and investor characteristics the *CDP* coefficient for that investor group is significant at the 10% level (Panel C). While the effect is not strongly statistically significant, it could indicate a substitution effect between government and investor actions on climate change. In Appendix Table IA.4 we run the change regressions using two relative portfolio emissions measures, Scope 1 / Revenue and Scope 1 / Portfolio size (described in Appendix A), and achieve similar results to when we use the absolute measures in Table 4.

We can also comment on the economic magnitude of these effects. Across the two portfolio carbon metrics, CDP investors inside an emissions scheme decarbonize 3 to 4 percentage points more than non-CDP institutional investors via portfolio re-weighting. Using the sample averages, we estimate a decarbonization rate of around -7% to -8% per year for CDP investors (which compares to -5% for non-CDP investors as shown in Panel B of Table 2). To put these magnitudes into context, UNEP (2019)

warned that emissions need to fall by an annualized -7.6% between 2020 and 2030 for the Paris agreement goal of limiting global warming to +1.5°C to be met. Thus, while this rate of portfolio decarbonization is economically meaningful, portfolio re-weighting implies that this is achieved primarily by tilting away from and selling shares of carbon intensive firms to other investor groups, rather than pushing companies to improve emissions, somewhat making the GHG emissions to be "someone else's problem". Part of the emissions are being traded from CDP to non-CDP institutions, but Figure 1 suggest that an even larger fraction become owned by non-institutional blockholders and minority shareholders that may be even less motivated to tackle corporate GHG emissions. Overall, the evidence casts doubt on whether the decarbonization efforts of institutional investors have a meaningful real impact on the level of carbon emissions of firms.

In further tests, we also test if re-weighting is stronger for portfolio holdings in the sectors where emissions are more material but report these in Internet Appendix to conserve space. In Table IA.5, we run regressions using the subset of carbon emissions that stem from portfolio firms in three sectors that have the largest total GHG emissions (materials, utilities, and energy). These results are consistent with our main findings, with portfolio re-weighting being the primary decarbonization strategy of investors based in an emissions scheme country. In Table IA.6, we also examine the reductions in allocations (weights) and footprints in investor portfolios which stem from the 100 most polluting firms in the three material sectors (Panel A), other firms in those sectors outside the worst polluting ones (Panel B), and firms outside the three material sectors (Panel C). We find that CDP investors inside an emissions scheme focus on reducing weights and footprints from the top 100 emitting firms in the three material sectors. CDP investors outside an emissions scheme do not appear to meaningfully reduce allocations or footprints from either group[22]. In Table IA.7, we investigate if climate conscious investors reward brown firms which are leaders in reducing their emissions, a strategy suggested by Edmans et al. (2022). In each year, we split the top 100 emitting firms in our sample into three groups, based on the changes in Scope 1 emissions that they have experienced over the past 3-years. We then test if CDP investors reweight their portfolios towards those that have achieved the largest reductions in emissions (Panel C,

[22] They have a weak reduction in *Scope 1 Footprints* from firms outside the three material sectors, but this is only significant at the 10% level.

bottom tercile in 3-year Scope 1 emissions changes). We find that CDP investors do not reweight their portfolios towards those firms, relative to non-CDP investors. So our results suggest there is more "tilting away" than "tilting in".

The focus of our analysis has been Scope 1 corporate emissions since these are the most commonly reported by institutional investors to their end clients or beneficiaries and also those examined in the extant academic literature. However, a recent paper by Dai et al. (2021) document that firms outsource their direct Scope 1 emissions to their suppliers, converting them to Scope 3 emissions. We investigate if there is any evidence of similar re-composition of investor portfolios over time. In Table 5, we examine changes across investors' full portfolio emissions (Scope 1 + 2 + 3). The results again mirror our main findings in Table 4, with portfolio re-weighting among CDP investors based in a country inside an emissions scheme and some weak evidence for corporate changes by CDP investors located in a country outside a scheme. Therefore, our main results are not due to emissions outsourcing. However, climate conscious investors may still end up holding more firms with lower direct emissions, relative to their broader emissions profile. We examine this in Appendix Table IA.8 where we expand the scope of portfolio firm emissions associated with a portfolio and test whether climate-conscious investors are reducing their exposure to Scope 1 as a proportion to total Scope 1 + 2 + 3 emissions. CDP investors reduce the ratio of their portfolio Scope 1 to total emissions, particularly those based in a country with an active emissions scheme (Panel A). When we decompose the total changes, we find evidence that CDP investor portfolios re-weight towards firms with lower direct to indirect emissions ratios that may be less salient (Panel B). The corporate changes results are insignificant for all investor groups (Panel C). CDP investors seem to have a preference towards firms that are light in direct emissions or may be curbing their emissions by "outsourcing" it to others in their supply chains (Dai et al., 2021). Taken together, the results in these two tables suggest that CDP investors are decarbonizing their total portfolio emissions, despite the fact that there may be some portfolio emissions "outsourcing".

We conclude that CDP signatories appear to decarbonize their portfolios via re-weighting but not via corporate changes. This raises the question whether portfolio re-weighting alone may have real effects by imposing higher cost of capital on firms that are being divested by CDP investors. To provide

an upper bound of the impact of re-weighting, we calculate an estimate based on the formula of Berk and van Binsbergen (2022, page 2). If we assume all CDP investors were to divest all firms in the three material sectors (materials, energy, and utilities), the change in the cost of capital for those firms would be 15 basis points.[23] We believe that this is economically modest to incentivize large-scale corporate decarbonization trough re-weighting. Notably, Hartzmark and Shue (2023) document that increased financing costs for brown firms have unintended consequences leading such brown firms to increase their greenhouse emissions. This finding casts further doubt on the effectiveness of divestment to discipline brown firms to reduce emissions. Nevertheless, divestment could have effects, which take longer to materialize. For example, Becht et al (2023) argue that divestment can change social preferences and increase company stranded asset risk.

3.3. Evidence of Corporate Changes: Does it Take Time and Need to be Targeted?

While our tests show evidence of decarbonization mostly via portfolio re-weighting (instead of corporate changes), engagement by climate-conscious investors may need to be more targeted and also such efforts might take time to materialize in corporate changes. As we discussed when describing Figure 3, aggregate carbon emissions are particularly concentrated in the top 100 emitting firms (and this is also why the CA100+ initiative started with 100 focus companies that were deemed most important to tackle climate change). In 2005, over two thirds (68%) of the overall institutional investor carbon footprint can be attributed to those top 100 emitting firms, falling to just under half of total emissions in 2019 (46%). Figure IA.4 in the Internet Appendix also shows that other investors decarbonized less and the proportion of their carbon footprint coming from top 100 emitting firms fell from 63% to 54% over the same time period. The results in Table 6 show that CDP investors, and particularly those based in countries with emissions schemes, reduce their footprints stemming from the top 100 Scope 1 emitters via portfolio re-weighting, by about 1.1 to 4 percentage points more than non-CDP investors (Panel B).

[23] We adapt the Berk and van Binsbergen (2022, page 2) cost of capital charge formula as follows: $Market\ Risk\ Premium \times \left(\frac{\$\ Held\ by\ CDP\ Investors}{\$\ Rest\ of\ Total\ Market\ Cap}\right) \times \%\ Material\ Sectors\ \times (1 - correlation^2)$. For the calculation, we assume a 6% market risk premium and, use data from 2019 where CDP investors make up 29% of equity market capitalization (=53%*55% of institutional investor holdings, see Panel B of Figure 1 and Panel A of Table 1), that the weight of firms in the material sectors is 20% of the MSCI ACWI index in December 2019, and the return correlation with the rest of the market we estimated at 83% using 2006-2019 data.

There is some evidence of corporate changes for those investors based outside a scheme, who achieve 0.9 percentage points faster footprint decarbonization (Panel C). While portfolio re-weighting can be implemented within a year via stock rebalancing, engaging with portfolio firms to reduce corporate emissions and achieve corporate changes can be a more involved process taking multiple years to deliver tangible results. To test this hypothesis, we run regressions with two-year portfolio changes in Table 7. This analysis shows that total decarbonization is higher for CDP investors in general and those based in a country with an emission scheme, relative to non-CDP signatories (Panel A) but the results are not clear on portfolio re-weighting vs. corporate changes. Similarly to the results we found for the top 100 emitting firms, here there is again some evidence of corporate changes in the portfolios of climate conscious investors for those investors outside an emissions scheme (Panel C).

We next turn our attention to the more targeted engagements via the CA100+ investor initiative. The pressure to engage on climate change issues rose following the Paris Agreement of December 2015 with the finance sector (and institutional investors in particular) being asked to contribute to the global effort. As a result, in 2017, the CA100+ initiative was created with the specific mandate to engage with the 100 top emitting firms (later increasing the number to 166). We examine how investors that signed up to the CA100+ initiative decarbonize their portfolios. There is a high overlap in the memberships of CDP and CA 100+, with over three-fourths of CA100+ signatories being also signatories of CDP. Therefore, we create two new dummies, one for investors who are only members of CDP (but not CA100+), and one for investors who are signatories of CA100+, and are also CDP members. Because CA100+ did not have investor members prior to 2017, an investor can only fall in the second category (CA100+) from 2017 onwards.

Table 8 shows that members of CA100+ decarbonize their portfolios at faster rates than institutional investors who are not signatories to either organization (Panel A). This result is independent of whether the investors are based in a country with emissions scheme (columns 3 and 4) or without (columns 5 and 6). Similarly, both groups also use portfolio re-weighting to achieve decarbonization, which is also broadly independent of the emissions scheme membership of their host countries (Panel B). When we examine decarbonization via corporate changes, we find that it tends to result in

deteriorating average Scope 1 emissions for CA100+ investors, and this result seems to be driven by CA100+ signatories located outside a carbon emissions scheme country. In contrast, signatories of CA100+ achieve reduced Scope 1 Footprints via corporate changes if they are located in a country with an emissions scheme (Panel C). Therefore, we conclude that following the Paris Agreement, there is some evidence consistent with climate-conscious investors also increasingly engaging with portfolio firms to reduce their footprints. However, the impact on their portfolios from such potential actions is smaller in magnitude than that achieved by portfolio re-weighting.

Overall, we document that climate conscious investors based in countries with emission schemes re-weight their portfolios towards lower emitting firms. However, we also find evidence of corporate changes in some circumstances, particularly with the top 100 emitting firms and from investors that committed to the CA100+ initiative following the Paris Agreement.

4. Greening of Business Activities by Climate-Conscious Investors

In this section, we study the role of institutional investors in increasing green business activities, both in terms of the successful development of low carbon technologies and ultimately selling more green products or services. Although green business activities do not necessarily have an immediate effect on reducing carbon emissions, these have the potential to do so over the long-term and help with the transition to a carbon-neutral economy. Without technological breakthroughs and transformation of business models of corporations, it may become increasingly hard with each passing year to achieve the required reductions to reach net-zero emissions in their portfolios in alignment with the Paris Agreement.

4.1. Green patents

We construct a metric capturing an investor portfolio's exposure to firms developing technologies related to climate change mitigation and adaptation. We collect firm patent data from the Global

Corporate Patent Dataset (GCPD) developed by Bena, Ferreira, Matos, and Pires (2017).[24] Then we identify which patents are climate-related using the OECD environmental-related mapping developed by Hascic and Migotto (2015) and used in other recent finance papers such as Cohen, Gurun and Nguyen (2021) and Hege, Pouget, and Zhang (2022).[25] Once we classify the set of climate patents by each publicly listed firm, we create the variable *Climate Patent %* at the portfolio level as the ratio of climate patents to total patents granted to the firms held by an institutional investor. Missing firm data is filled in with zeros. We use granted patents, and since there is a lag in approving filed patents, this measure is available only from 2005 to 2012.

In Table 9, we examine the relation between climate-conscious investors and climate patents, capturing the invention of climate-related technologies such as renewable energy, electric vehicles, and broader environmental technologies like waste management and pollution control. We have data on climate patents between 2005 and 2012 in the GCPD data (see Section 2.2.). We focus on the quantity of climate patents (relative to overall level of patenting) given that the value of patents is difficult to assess. The results for all investors (Panel A), and those located inside (Panel B) and outside (Panel C) an emissions scheme country are weak and rarely significant. We conclude that CDP investors do not seek companies with higher levels of climate patenting or successfully encourage existing companies to shift innovation activities towards green products or services. In Internet Appendix Table IA.9 we conduct the same analysis with two-year changes instead of yearly changes and find similar results. One caveat is that these green patent measures capture inventions and not necessarily the diffusion or adoption of new green technologies. Also our data ends in 2012, so we are unable to test how investors behave in the post-Paris Agreement period.

4.2. Green revenues

Next, we examine climate conscious institutions' exposure to firms generating green revenues. Our green revenue measure captures an investor portfolio's exposure to the fraction of firm-level revenues that come from green business activities. Examples include revenues from clean technologies such as,

[24] The GCPD data is available at https://patents.darden.virginia.edu.
[25] Source: http://stats.oecd.org/wbos/fileview2.aspx?IDFile=0befc58e-d72f-4ff9-b27e-84e446240e34

for instance, selling electrified cars or solar panels or providing data-driven monitoring solutions for carbon emission reductions.

To construct the portfolio measure, we access data from FTSE Russell on revenue exposure to green business activities for over 16,000 stocks starting from 2017 and classified using the EU Taxonomy on sustainable activities.[26] This green revenue data is available from FTSE Russell based on a bottom-up assessment of companies' revenues generated from products and services with climate and environmental benefits using the EU Taxonomy Regulation on what constitutes sustainable economic activities. While green revenues only accounted for 6% of total revenues of FTSE All-World companies, these were growing at a faster rate than the market.[27] Unfortunately, it is only available from 2017 onwards (see Section 2.2) so one caveat in that this analysis is again the short sample period over which we can observe the green revenue data which allows us to run just one cross section. We use this firm-level data to calculate a weighted average measure of the *Green Revenue %* of an investor's portfolio. Firms that are not covered in the FTSE Russell dataset are assumed to have zero green revenues.

Table 10 reports the results from the analysis of whether climate-conscious investors consider measures of green revenue in their portfolios based on the proportion of firm revenue coming from green business activities in their investee firms. In Panel A, we find that CDP investors have a significantly higher exposure to firms generating higher green revenues (e.g., those of wind turbine or solar panel makers). However, this effect is economically moderate given that the average firm in the portfolios of climate-conscious investors have about 0.3-0.5 percentage points more green revenues (which translates to 14-20 percent higher green revenues relative to the sample standard deviation). Columns 7 to 9 show some evidence that climate-conscious investors attempt to increase their exposure to green revenue via portfolio re-weighting. However, there is little evidence of corporate changes (see columns 10 to 12). We again split the sample into investors based in countries with (Panel B) or without (Panel C) emissions trading schemes. Both groups of CDP investors appear to have higher portfolio green revenues.

[26] For more information, see FTSE Russell "Sizing the green economy: Green Revenues and the EU taxonomy" https://content.ftserussell.com/sites/default/files/sizing_the_green_economy_green_revenues_and_the_eu_taxonomy_final_4.pdf and European Commission "EU taxonomy for sustainable activities - What the EU is doing to create an EU-wide classification system for sustainable activities" https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[27] Source: FTSE Russell, "Green equity exposure in a 1.5°C scenario" (September 2022).

However, portfolio re-weighting towards firms with higher green revenues is a strategy predominantly employed by CDP investors outside an emissions scheme. We also run the analysis for two-year changes instead in Internet Appendix Table IA.10 and find results consistent with those of the one-year changes.

We conclude that climate-conscious investors have started to gain higher exposure to green revenue, but not to climate patents. One caveat is that this might be a consequence of being in the early stages of transition to green economy so it may still be too early to conclude.

5. Conclusions

In this paper, we study whether and how institutional investors are decarbonizing their equity portfolios to reduce their exposure to the potential risks of climate change. We combine global data on portfolio equity holdings and firm-level GHG emissions and analyze climate-conscious institutional investors that are members of the most prominent investor-led climate change initiatives: the first one being CDP (that seeks corporate disclosure on climate risk related matters) and the subsequent Climate Action 100+ (that calls for investor action on climate change).

We find that the decarbonization strategies that investors pursue are heavily dependent on the presence of an emissions scheme in the country that they are headquartered in. We conclude that CDP signatory investors located in an emissions scheme country decarbonize their portfolios mostly via portfolio re-weighting (tilting their holdings towards low-emitting firms) rather than via corporate changes (engaging with high-emitting firms to curb their emissions). In contrast, we find some evidence consistent with corporate changes for CDP investors located outside an emissions scheme, among holdings of top emitting firms, over longer periods of time (3-years), and following the Paris Agreement through the CA100+ initiative. While climate action calls for capital to spur the development of green solutions, we fail to find evidence that climate-conscious investors seek companies that are developing green technologies or encouraging their portfolio firms to generate a significant fraction of their revenues from green products or services.

Overall, our paper raises the concern that addressing the steep challenge posed by climate change and energy transition requires more than portfolio re-weighting that "greens a portfolio" but do

not help “green the planet”. Institutional investors that decarbonize their equity holdings via portfolio re-weightings may just be pushing away the problem to other investor groups that might be even less motivated to tackle corporate carbon emissions. This warrants further examination and future work should also examine institutional portfolio decarbonization more holistically to also encompass emissions financed via other asset classes such as private equity investments, debt holdings, or project finance.

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Appendix A: Variable Definitions and Data Sources

Variable	Definition and Source
CDP	dummy =1 if an institutional investor is a signatory of the CDP initiative (formerly known as the Carbon Disclosure Project), using yearly data from the list of CDP investor signatories and matching it to FactSet Ownership
Climate Action 100+	dummy =1 if an institutional investor is a participant of the Climate Action 100+ initiative, using yearly membership lists and matching it to FactSet Ownership
Scope 1, 2, or 3	Weighted average portfolio Scope 1, 2, or 3 Carbon emissions (e.g., tons of carbon dioxide equivalent [CO2e] emissions) of firms in the institutional investor's portfolio). We use firm-level yearly emission data from Trucost and end-of-year investor portfolio holdings from FactSet Ownership. *Scope 1* emissions are Greenhouse Gas (GHG) emissions from operations that are owned or controlled by the company. *Scope 2* emissions are the indirect GHG emissions from consumption of purchased electricity, heat or steam by the company. *Scope 3* are other indirect GHG emissions from upstream supply chain and purchased materials as well as downstream emissions inherent in the use of its products and services. Trucost definitions follow the Greenhouse Gas Protocol standard for corporate carbon accounting (https://ghgprotocol.org/). The weighted average *Scope 1* emissions of investor *i* at time *t* is defined as: $$Scope\ 1_{it} = \sum_{j=1}^{N_{jt}} \left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}} \right) * Scope\ 1\ GHG\ Emissions_{jt}$$ where *$ Shares Held*$_{ijt}$ is the dollar amount of firm *j* stock which investor *i* holds at time *t*, *$ Portfolio Size*$_{it}$ is the dollar size the investor's equity portfolio, N_{jt} is the number of stocks in the investor's portfolio at time *t*, and *Scope 1 GHG Emissions*$_{jt}$ are the Scope 1 emissions of firm *j*.
Scope 1, 2, or 3 Footprint	Total portfolio Scope 1, 2, or 3 Carbon emissions attributable to an institutional investor (sum of io * CO2e tons Scope 1, 2 or 3 emissions), using firm-level emission data from Trucost and investor portfolio holdings from FactSet Ownership. *io* is the percentage of shares owned by an investor in a firm / total outstanding shares of the firm, using data from FactSet Ownership. The *Scope 1 Footprint* for an investor *i* at time *t* is defined as: $$Scope\ 1\ Footprint_{it} = \sum_{j=1}^{N_{jt}} \left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}} \right) * Scope\ 1\ GHG\ Emissions_{jt}$$ where *$ Shares Held*$_{ijt}$ is the dollar amount of firm *j* stock which investor *i* holds at time *t*, *$ Market Cap*$_{jt}$ is the dollar size of firm *j*, N_{jt} the number of stocks in the investor's portfolio at time *t*, and *Scope 1 GHG Emissions*$_{jt}$ are the Scope 1 emissions of firm *j*.
Scope 1, 2, or 3 /Revenue	Value-weighted portfolio Scope 1 ,2 or 3 Carbon Intensity (CO2e tons / revenue in $ million) of firms in an institutional investor's portfolio, using firm-level emission data from Trucost and investor portfolio holdings from FactSet Ownership. The *Scope 1 / Revenue* for an investor *i* at time *t* is:

	$$Scope\ 1/\ Revenue_{it} = \sum_{j=1}^{N_{jt}} \left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}} \right) * \frac{Scope\ 1\ GHG\ Emissions_{jt}}{Revenue_{jt}}$$ where *$ Shares Held$*$_{ijt}$ is the dollar amount of firm *j* stock which investor *i* holds at time *t*, *$ Portfolio Size*$_{it}$ is the dollar size the investor's equity portfolio, N_{jt} the number of stocks in the investor's portfolio, Scope 1 GHG Emissions$_{jt}$ are the Scope 1 emissions of firm *j*, and *Revenue*$_{jt}$ is firm *j*'s revenue.
Scope 1, 2, or 3/Portfolio Size	Total portfolio Scope 1, 2 or 3 Carbon Footprint per million $ invested (*Scope 1, 2, or 3 Footprint /Portfolio Size*), using firm-level emission data from Trucost and institutional investor equity portfolio holdings from FactSet Ownership. The *Scope 1/Portfolio Size* for an investor *i* at time *t* is defined as: $$\text{Scope } 1/Portfolio\ Size_{it} = \frac{\sum_{j=1}^{N_{jt}} \left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}} \right) * Scope\ 1\ GHG\ Emissions_{jt}}{Portfolio\ Size_{it}}$$
Carbon Disclosure %	Value-weighted percentage of disclosed emissions by the firms' in an institutional investor's portfolio, using firm-level emission disclosure data from Trucost and portfolio holdings from FactSet Ownership.
Full Carbon Disclosure % (95%+)	Value-weighted percentage of firms in an institutional investor's portfolio which disclose over 95% of their emissions, using firm-level emission disclosure data from Trucost and portfolio holdings from FactSet Ownership.
Trucost Data Coverage in Portfolios %	Value-weighted percentage of an institutional investor's portfolio equity assets covered by the Trucost emissions data, using firm-level emission disclosure data from Trucost and portfolio holdings from FactSet Ownership.
Emissions Target %	Value-weighted percentage of firms in an institutional investor's portfolio that have an emissions reduction target (available 2010-2018), using firm-level data from CDP and portfolio holdings from FactSet Ownership.
Science-based Emissions Target %	Value-weighted percentage of firms in an institutional investor's portfolio that have a verified Science Based Targets initiative emission reduction target plan (available 2016-2018), using firm-level data from CDP and portfolio holdings from FactSet Ownership.
Climate Patent %	Value-weighted portfolio ratio of climate patents to total patents, for an institutional investor's portfolio (calculated for 2005-2012). Firm-level patent data is from the Global Corporate Patent Dataset (https://patents.darden.virginia.edu/). Climate Patents are classified using the OECD Environmental-related technology mapping of developed by Hascic and Migotto (2015) and updated in 2020. Portfolio holdings from FactSet Ownership.
Green Revenue %	Value-weighted portfolio ratio of green revenues for an institutional investor's portfolio (available for 2016-2019, missing values filled in as zeros). Data on the percentage of green revenues are defined using the EU Taxonomy for Sustainable Activities classification in firm level data from FTSE Russell. Portfolio holdings from FactSet Ownership.
Portfolio Size	Portfolio equity assets under management in $ million, from FactSet Ownership. In regressions we take the log of this variable.
Europe	dummy = 1 if the institutional investor is domiciled in Europe, from FactSet Ownership.
North America	dummy = 1 if the institutional investor is domiciled in North America, from FactSet Ownership.
Rest of World	dummy = 1 if the institutional investor is domiciled in a region outside of Europe and North America, from FactSet. Ownership

Asset Owner	dummy = 1, if the institutional investor is classified as a Corporate, Foundation/Endowment Manager, Insurance Company, Pension Fund Manager, or Sovereign Wealth Manager in FactSet Ownership.
# Companies	Number of equity securities in the institutional investor portfolio, using FactSet Ownership data. In regressions we take the log of this variable.
# Industries	Number of SIC2 industries represented in the institutional investor portfolio, using FactSet Fundamentals and Ownership data.
Average Market Cap	Value-weighted average market capitalization of portfolio firms in $ million, using FactSet Fundamentals and Ownership data. In regressions we take the log of this variable.
Average Market-to-Book	Value-weighted average market-to-book of an institutional investor's equity portfolio, using FactSet Fundamentals and Ownership data. In regressions we take the log of this variable.
Own Region %	Percentage of the institutional investor's equity portfolio which is invested in companies listed in the same region where the investor is domiciled in (Europe, North America, Rest of World), using data from FactSet Fundamentals and Ownership.
Developed Markets %	Percentage of the institutional investor's equity portfolio which is invested in firms listed in MSCI developed markets, using data from FactSet Fundamentals and Ownership.

Appendix B: Measuring Portfolio Carbon Emission Changes

In this appendix we describe the portfolio carbon change measures we analyze in Section 3.2 where we test decarbonization strategies.

1. Total Changes

The Scope 1 Δtotal change variables for investor *i* at time *t* are defined as:

$$\Delta Total \log Scope\ 1_{it}$$

$$= \log\left(\sum_{j=1}^{N_{jt+1}}\left(\frac{\$\ Shares\ Held_{ijt+1}}{\$\ Portfolio\ Size_{it+1}}\right) * Scope\ 1\ GHG\ Emissions_{jt+1}\right)$$

$$- \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

, where \$ Shares $Held_{ijt}$ is the dollar amount of firm j stock which investor i holds, \$ Portfolio $Size_{it}$ is the dollar size the investor's equity portfolio, N_{jt} the number of stocks in the investor's portfolio, and Scope 1 GHG $Emissions_{jt}$ are the Scope 1 emissions of firm j.

$$\Delta Total \log Scope\ 1\ Footprint_{it}$$

$$= \log\left(\sum_{j=1}^{N_{jt+1}}\left(\frac{\$\ Shares\ Held_{ijt+1}}{\$\ Market\ Cap_{jt+1}}\right) * Scope\ 1\ GHG\ Emissions_{jt+1}\right)$$

$$- \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

, where \$ Market Cap_{jt} is the dollar size of firm j at time t.

2. Portfolio Re-weighting Changes

The Scope 1 Δweights-only change variables for investor *i* at time *t* are defined as:

$$\Delta weights - only \log Scope\ 1_{it}$$

$$= \log\left(\sum_{j=1}^{N_{jt+1}}\left(\frac{\$\ Shares\ Held_{ijt+1}}{\$\ Portfolio\ Size_{it+1}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

$$- \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

$$\Delta weights - only \log Scope\ 1\ Footprint_{it}$$

$$= \log\left(\sum_{j=1}^{N_{jt+1}}\left(\frac{\$\ Shares\ Held_{ijt+1}}{\$\ Market\ Cap_{jt+1}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

$$- \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

3. Corporate Changes

The Scope 1 Δemissions-only change variables for investor *i* at time *t* are defined as:

$$\Delta emissions - only \log Scope\ 1_{it}$$

$$= \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}}\right) * Scope\ 1\ GHG\ Emissions_{jt+1}\right)$$

$$- \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Portfolio\ Size_{it}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

$$\Delta emissions - only \log Scope\ 1\ Footprint_{it}$$

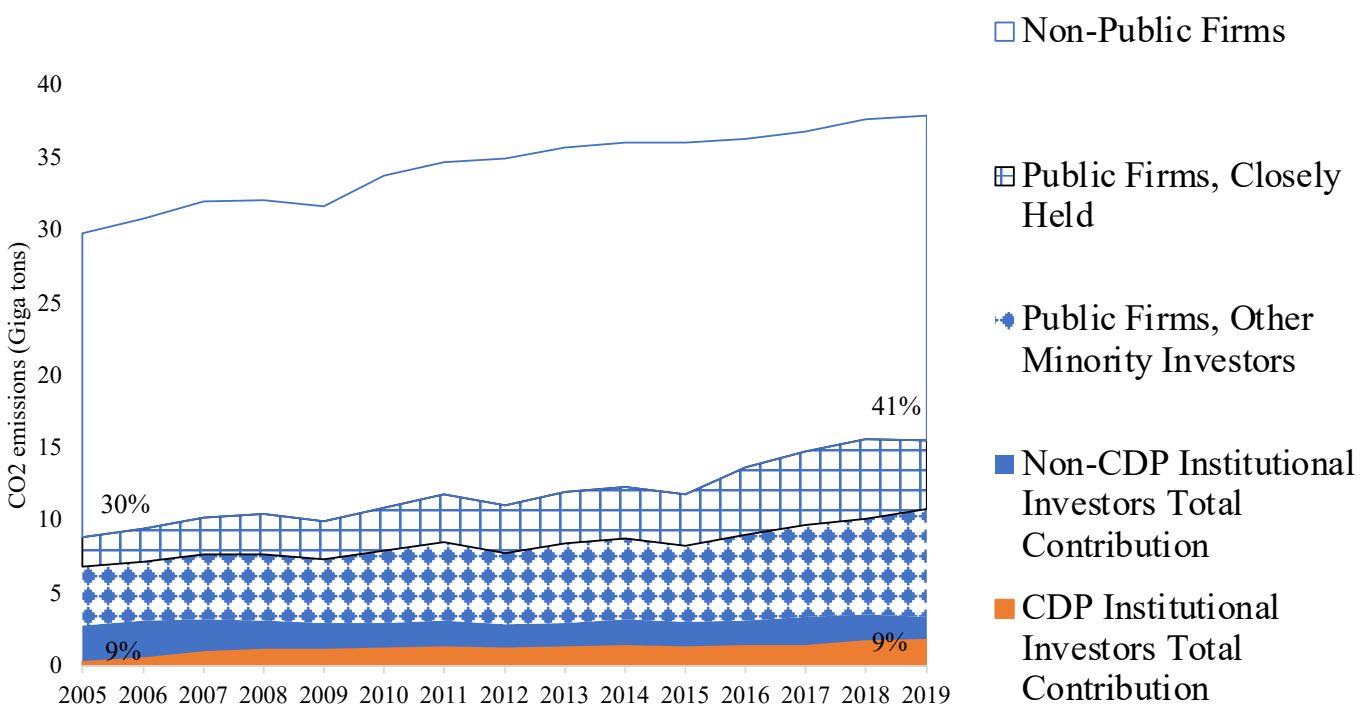
$$= \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}}\right) * Scope\ 1\ GHG\ Emissions_{jt+1}\right)$$

$$- \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}}\right) * Scope\ 1\ GHG\ Emissions_{jt}\right)$$

Figure 1: Institutional Share of Global Carbon Emissions and Market Capitalization

This figure plots the share of total carbon (GHG) emissions apportioned to the equity holdings of institutional investors and also the fraction of outstanding shares held in publicly listed firms for the 2005-2019 sample period. In Panel A we plot the total direct (Scope 1) GHG (CO2-equivalent) emissions by public firms compared to the total global emissions from fossil fuel use, industrial processes and product use estimated by the EDGAR v6.0 data from the European Commission, Joint Research Centre (2021). We then split out the GHG emissions by public firms into the fractions attributable to closely held shares, other minority investor shareholders, and institutional investors based on the ownership stake of each group. We split the Institutional Investor Group into CDP and Non-CDP signatory institutions. In Panel B we show the total equity market capitalization of all public firms and the total equity holdings of institutional investors.

Panel A: Total Carbon (GHG) Emissions



Panel B: Total Equity Market Values

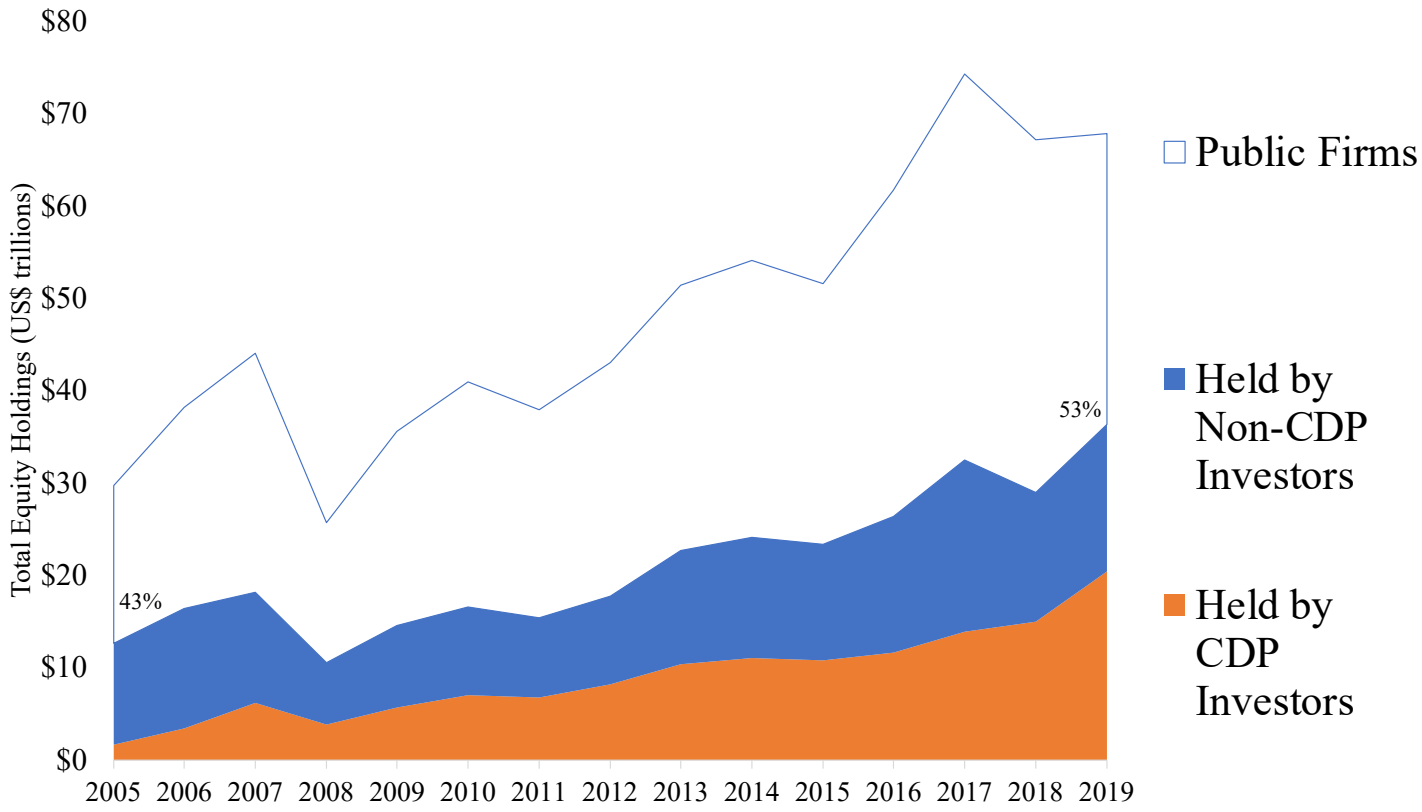
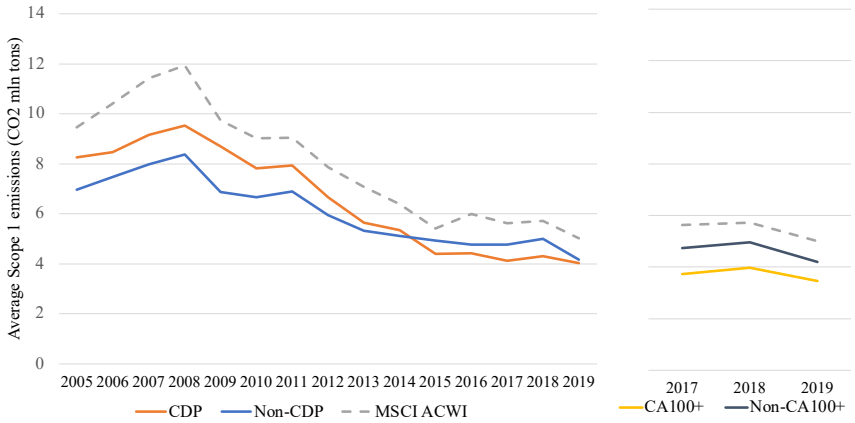


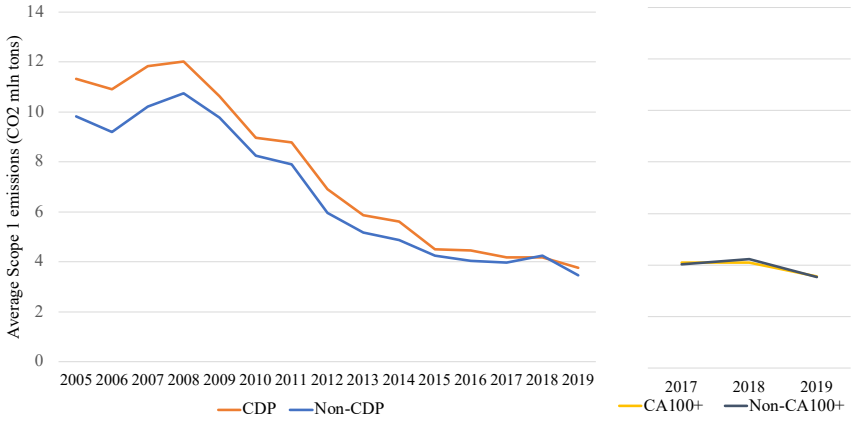
Figure 2: Portfolio Decarbonization by Climate-Conscious Institutional Investors

This figure shows the average portfolio direct (Scope 1) carbon (GHG) emission metrics of climate-conscious investors. We define as climate-conscious those investors that are signatories of the CDP or Climate Action 100+(CA100+) initiatives. We also add portfolio GHG metrics for Non-CDP and Non-CA100+ institutional investors, as well as for a representative investor holding the MSCI ACWI index. Panel A displays mean Scope 1 carbon emissions over time, Panel B shows the same measure for investors located in a country with a carbon emissions scheme in the given year, and Panel C plots the measure for investors based in a country without a carbon emissions scheme.

Panel A: All Institutional Investors



Panel B: Institutional Investors based in an Emissions Scheme country



Panel C: All Institutional Investors based outside an Emissions Scheme country

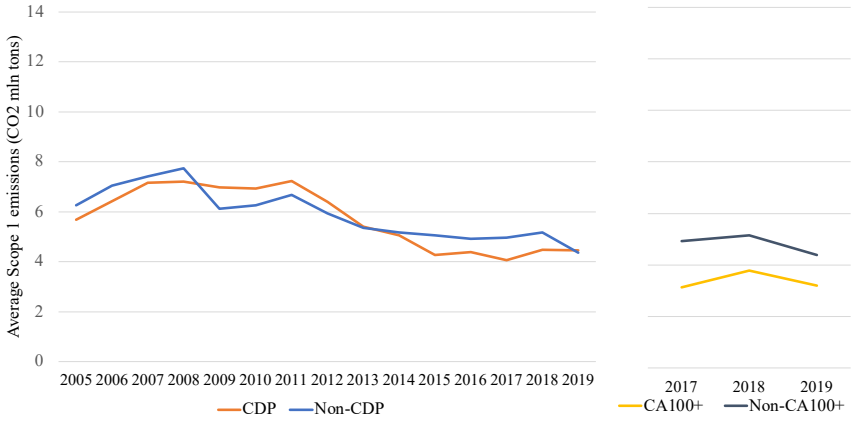
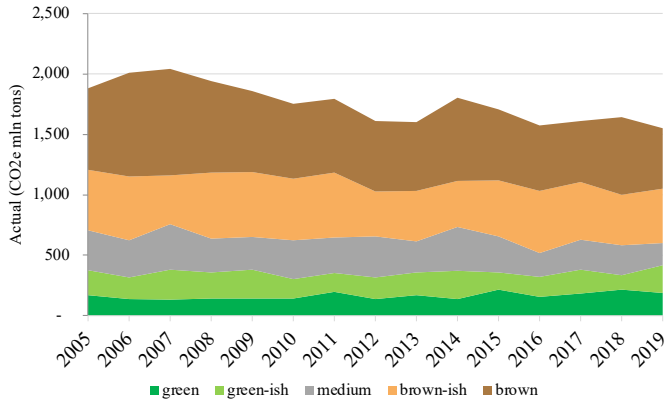


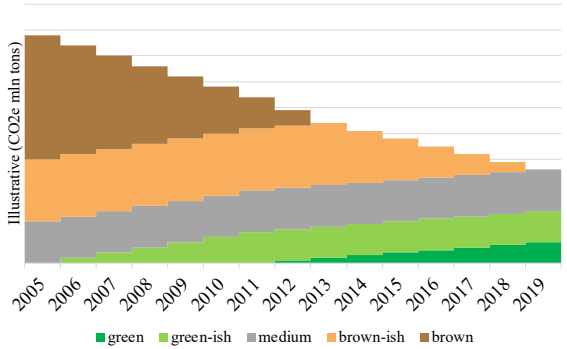
Figure 3: Portfolio Decarbonization Strategies

This figure shows the actual portfolio decarbonization of institutional investors in Panel A as well as illustrations two approaches that investors may employ (Panels B and C). In Panel A we show the total Scope 1 emissions footprint of the institutional investors' portfolio, using their aggregate holdings in the top 100 emitting firms in Trucost each year (by Scope 1 emissions). The graph decomposes the aggregate Scope 1 emissions into those stemming from firms in different emission quintiles ("brown" = sum of apportioned emissions by institutional holdings of the top 20 polluter firms; "brown-ish" = sum of apportioned emissions from holdings of firms ranked 21-40 in emission levels; etc.). Panel B provides an illustrative example of a "portfolio re-weighting" strategy where investors reduce only their portfolio weights in high emitting firms, with firms not improving their Scope 1 emissions. Panel C exemplifies a "corporate changes" strategy where firm emissions actively improve, but investor portfolio weights remain unchanged.

Panel A: Institutional Investor Total Scope 1 Footprint (in the Top 100 Emitting Firms)



Panel B: Example of a Portfolio Re-weighting Strategy



Panel C: Example of a Corporate Changes Strategy

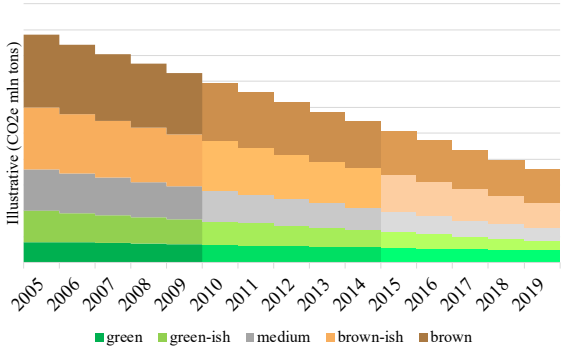


Table 1: Descriptive Statistics for Climate-Conscious Institutional Investors

This table describes the portfolio characteristics of climate-conscious investors (institutions that are CDP and Climate Action 100+ signatories) versus other institutional investors across different sample years from 2005 to 2019. *Number of Investors* and *Equity Holdings (AuM)* display the total number of institutional investors and their total equity assets under management in each category and year. The number of investors is then decomposed by region, type and portfolio size. It then displays the mean portfolio carbon metrics, disclosure and green metrics for climate-conscious versus other institutional investors. Definitions of these variables are provided in Appendix A.

	CDP				Non-CDP				CA100+		Non-CA100+		ALL
	2005	2012	2017	2019	2005	2012	2017	2019	2017	2019	2017	2019	Pooled Avg.
Number of Investors	149	550	598	623	3,109	3,281	4,226	4,420	182	268	4,642	4,775	
Equity Hodings (AuM) in US$ Trillion	2.0	8.2	13.9	20.4	14.0	11.0	19.1	16.4	3.1	5.3	29.9	31.5	22.6
% Equity AuM Coverage	13%	43%	42%	55%	87%	57%	58%	45%	9%	14%	91%	86%	
by Region:													
Europe	51%	45%	47%	48%	22%	18%	17%	16%	57%	54%	19%	18%	22%
North America	30%	33%	31%	32%	71%	71%	73%	74%	24%	26%	69%	71%	67%
Rest of World	19%	22%	22%	21%	7%	11%	11%	10%	19%	20%	12%	11%	11%
by Type:													
Asset Owner	12%	7%	6%	5%	5%	3%	3%	2%	13%	10%	3%	2%	4%
Investment Manager	88%	93%	94%	95%	95%	97%	97%	98%	87%	90%	97%	98%	96%
By Equity Portfolio Size:													
<1bn	38.9%	40.5%	34.9%	32.3%	64.4%	67.5%	68.3%	69.6%	28.6%	24.6%	65.5%	67.2%	63.9%
1-10bn	29.5%	34.2%	36.6%	36.0%	28.3%	26.8%	25.6%	24.7%	38.5%	38.1%	26.5%	25.4%	27.5%
10-100bn	30.2%	22.7%	23.9%	26.5%	6.8%	5.4%	5.6%	5.2%	30.2%	32.8%	7.0%	6.4%	7.9%
>100bn	1.3%	2.5%	4.5%	5.3%	0.5%	0.3%	0.5%	0.5%	2.7%	4.5%	1.0%	0.9%	0.7%
Carbon Metrics:													
Scope 1 (CO2 mln tons)	8.3	6.7	4.1	4.0	6.9	5.9	4.8	4.2	3.7	3.4	4.7	4.2	6.1
Scope 1 Footprint (CO2 giga tons)	0.4	1.3	1.4	1.8	2.4	1.6	2.0	1.5	0.3	0.5	3.1	2.9	3.1
Scope 1/ Revenue (CO2e tons / $ Rev mlns)	326	220	171	170	305	225	177	146	162	139	177	150	228
Scope 1 / Portfolio Size (CO2e tons / $Mkt Cap mlns)	260	184	128	123	179	150	114	100	123	103	116	103	153
% Total Scope 1 Footprint	14%	45%	41%	55%	86%	55%	59%	45%	9%	14%	91%	86%	
Scope 2 + 3 (CO2 mln tons)	11.8	10.0	7.3	6.8	10.3	9.4	7.5	7.1	7.3	6.4	7.5	7.1	8.7
Scope 2 + 3 Footprint (CO2 giga tons)	0.4	1.4	1.8	2.2	2.4	1.8	2.3	1.7	0.4	0.6	3.7	3.2	3.3
Scope 2 + 3/Revenue (CO2e tons / $ Rev mlns)	252	203	210	182	253	196	199	166	210	179	200	168	206
Scope 2 + 3/ Portfolio Size (CO2e tons / $Mkt Cap mlns)	201	194	144	125	156	157	126	109	141	121	127	110	150
% Total Scope 2 + 3 Footprint	14%	44%	43%	57%	86%	56%	57%	43%	10%	16%	90%	84%	
Disclosure:													
% Trucost Data Coverage in Portfolios %	81%	88%	96%	96%	70%	77%	93%	93%	95%	96%	93%	93%	82%
Carbon Disclosure %	41%	74%	73%	77%	33%	67%	63%	68%	73%	76%	64%	69%	60%
Full Carbon Disclosure % (95%+)	25%	66%	68%	72%	21%	60%	59%	65%	66%	70%	60%	66%	52%
Green Business Activities													
Climate Patent %	5.2%	8.8%			5.8%	8.1%							6.8%
Green Revenue %			4.1%	4.5%			3.4%	3.6%	4.6%	4.9%	3.4%	3.7%	3.5%
Emissions Targets													
% Any Reduction Target		48%	50%	.		40%	43%	.	50%		43%		43%
% Science-Based (verified) Target			7.3%				6.5%		7.1%		6.6%		6.6%
Allocations (weights)													
Top 100 in Material Sectors %	9%	6%	3%	4%	8%	5%	3%	3%	3%	3%	3%	3%	6%
Non-Top 100 in Material Sector %	12%	16%	12%	11%	13%	15%	12%	9%	12%	10%	12%	9%	14%

Table 2: Summary Statistics

This table provides summary statistics for the variables used in our analysis. After displaying the summary statistics for the total sample, we show the average measures for climate-conscious (CDP, CA100+) and non-climate-conscious institutional investors (non-CDP, non-CA100+). Definitions of the variables are provided in Appendix A and Appendix Tables B.1. The sample comprises investor-year observations where there is emission data for portfolio holdings, the investor has at least 100$ mln in equity assets under management, it has at least five equity holdings. We also remove outliers where average portfolio Scope 1 emissions are larger than 100 million CO2e tons. The sample period ranges from 2005 to 2019 except for the following variables: (i) the *Climate Action 100+* dummy variable is only available from 2017 onwards (when the initiative begins); (ii) Climate Patent % data from GCPD is populated only up till 2012; (iii) *Green Revenue %* data from FTSE Russell commences in 2016; (iv) *Emissions Target %* data from CDP starts in 2010 and is populated until 2018; (v) *Science-based Emissions Target %* data from CDP is available for 2016-2018. We adjust the sample for the table statistics to reflect that in the regressions we forward all dependent variables so we also lose the last year of the sample for the control variables. Panel A shows the statistics for the main variables in our analysis, and Panel B tabulates the data for the emissions change variables. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Main Variables

Variable	Mean	SD	Min	p10	p50	p90	Max	N	CDP	Non-CDP	CA100+	Non-CA100+
CDP	0.12	0.32	0	0	0	1	1	56,981	1	0	0.81	0.11
Climate Action 100+	0.01	0.08	0	0	0	0	1	56,981	0.05	0	1	0
Scope 1 (CO2e mln)	5.89	5.60	0	0.29	4.62	12.83	41.45	56,981	6.00	5.88	3.67	5.91
Scope 1/ Revenue (CO2e / $ Rev mln)	208.87	237.35	1.02	29.09	149.89	416.08	2,296.33	56,981	213.61	208.24	143.84	209.31
Scope 1 Footprint (CO2e mln)	0.53	1.42	0	0.00	0.05	1.25	10.28	56,981	1.47	0.40	1.49	0.52
Scope 1/ Portfolio Size (CO2e / $ Mkt Cap mln)	145.09	177.64	0	13.09	96.12	311.29	1,755.13	56,981	176.18	140.95	123.25	145.23
Scope 2+3 (CO2e mln)	8.48	6.57	0	1.23	7.37	16.88	42.70	56,981	8.56	8.47	7.17	8.49
Scope 2+3 Footprint (CO2e mln)	0.56	1.47	0	0.01	0.07	1.27	9.99	56,981	1.60	0.42	1.85	0.55
Carbon Disclosure %	61	25	0	22	67	89	100	56,981	71	59	76	61
Full Carbon Disclosure % (95%+)	54	26	0	16	58	84	100	56,981	64	52	70	54
Emissions Target %	43	24	0	6	48	71	100	36,180	50	42	51	43
Science-based Emissions Target %	7	6	0	0	6	15	38	13,360	8	6	11	7
Climate Patent %	7	5	0	2	6	10	52	26,505	8	7		7
Green Revenue %	3	2	0	1	3	6	19	17,872	4	3	5	3
Portfolio Size ($bln)	3.66	9.58	0.10	0.14	0.53	8.20	70.97	56,981	10.25	2.79	14.33	3.59
Europe	0.22	0.41	0	0	0	1	1	56,981	0.47	0.19	0.57	0.22
North America	0.67	0.47	0	0	1	1	1	56,981	0.32	0.72	0.24	0.67
Rest of World	0.11	0.31	0	0	0	1	1	56,981	0.21	0.10	0.19	0.11
Asset Owner	0.04	0.20	0	0	0	0	1	56,981	0.07	0.04	0.12	0.04
# Companies	364	618	5	26	128	966	3,336	56,981	901	293	988	360
# Industries	36	18	1	12	35	62	71	56,981	49	34	51	36
Average Market Cap ($ bln)	66	55	0.12	8	55	138	437	56,981	65	66	90	66
Average Market-to-Book	5.15	4.38	0.58	2.27	3.91	8.98	51.11	56,963	4.43	5.25	5.56	5.15
Own Region %	83	24	0	45	93	100	100	56,981	72	84	64	83
Developed Markets %	90	24	0	67	99	100	100	56,981	83	91	85	90

Panel B: Portfolio Emission and Greening of Business Activities Metrics - Change Variables

Variable	Mean	SD	Min	p10	p50	p90	Max	N	CDP	Non-CDP	CA100+	Non-CA100+
Δ Total log Scope 1	-0.05	0.73	-4.13	-0.63	-0.04	0.54	3.85	50,997	-0.08	-0.05	-0.21	-0.05
Δ Total log Scope 1/Revenue	-0.06	0.62	-3.42	-0.59	-0.05	0.50	3.05	50,997	-0.07	-0.05	-0.07	-0.06
Δ Total log Scope 1 Footprint	-0.06	0.91	-5.30	-0.83	-0.02	0.70	4.67	50,997	-0.08	-0.05	-0.18	-0.06
Δ Total log Scope 1/Portfolio Size	-0.04	0.77	-4.02	-0.70	-0.07	0.69	4.13	50,997	-0.07	-0.04	-0.32	-0.04
Δ weights-only log Scope 1	-0.05	0.71	-3.97	-0.61	-0.04	0.50	3.73	50,971	-0.08	-0.05	-0.16	-0.05
Δ weights-only log Scope 1/Revenue	-0.03	0.60	-3.22	-0.54	-0.02	0.48	3.10	50,971	-0.05	-0.03	-0.04	-0.03
Δ weights-only log Scope 1 Footprint	-0.10	0.89	-5.40	-0.86	-0.03	0.61	4.49	50,971	-0.10	-0.10	-0.15	-0.10
Δ weights-only log Scope 1/Portfolio Size	-0.08	0.75	-3.76	-0.73	-0.09	0.61	3.80	50,971	-0.09	-0.08	-0.29	-0.08
Δ emissions-only log Scope 1	0.00	0.18	-1.72	-0.12	0.00	0.14	1.56	52,442	0.00	0.00	-0.02	0.00
Δ emissions-only log Scope 1/Revenue	-0.03	0.19	-1.16	-0.18	-0.03	0.15	1.65	52,442	-0.02	-0.03	-0.01	-0.03
Δ emissions-only log Scope 1 Footprint	0.03	0.24	-1.24	-0.12	0.00	0.19	3.52	52,442	0.01	0.03	-0.04	0.03
Δ emissions-only log Scope 1/Portfolio Size	0.03	0.24	-1.24	-0.12	0.00	0.19	3.52	52,442	0.01	0.03	-0.04	0.03
Δ Total Climate Patent %	0.29	4.13	-28.95	-2.18	0.27	2.73	31.84	22,230	0.24	0.29		0.29
Δ Total Green Revenue %	0.18	1.55	-7.18	-1.15	0.16	1.48	8.79	12,944	0.23	0.17	0.37	0.18

Table 3: Portfolio Decarbonization by Institutional Investors

This table presents regressions of yearly changes in portfolio Scope 1 carbon metrics of institutional investors. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. Control variables include investor characteristics (size, geography and type) and, portfolio characteristics (*# Companies*, *# Industries*, *Average Market Cap*, *Average Market-to-Book*, *Own Region %*, and *Developed Markets %*).The first two dependent variables are the yearly changes in log Scope 1 emission metrics. The next four are decompositions of two decarbonization strategies as illustrated in Figure 3. The first one is "portfolio re-weighting", where we calculate the portfolio Scope 1 emission variables by changing only the portfolio weights of the investor in t+1, keeping the firm Scope 1 emissions unchanged from period t. The second is "corporate changes", where we calculate the portfolio Scope 1 emission variables by changing only the firm Scope 1 emissions of portfolio firms in period t+1, leaving the investor portfolio weights the same as in period t. We calculate the changes from period t + 1 to t. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

	All				Portfolio re-weighting		Corporate Changes	
	Δ Total log Scope 1 (t+1)		Δ Total log Scope 1 Footprint (t+1)		Δ weights-only log Scope 1 (t+1)	Δ weights-only log Scope 1 Footprint (t+1)	Δ emissions-only log Scope 1 (t+1)	Δ emissions-only log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	-0.018*	-0.012	-0.027*	-0.030**	-0.021***	-0.023**	0.007	-0.008
	[0.010]	[0.010]	[0.014]	[0.011]	[0.006]	[0.010]	[0.006]	[0.005]
Portfolio Size	0.003	0.006	-0.002	-0.007*	0.000	-0.012***	0.005***	0.003***
	[0.003]	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.002]	[0.001]
Europe	-0.022	-0.018	-0.025	-0.022	-0.013	0.000	-0.012	-0.026**
	[0.025]	[0.018]	[0.038]	[0.024]	[0.012]	[0.024]	[0.008]	[0.009]
North America	-0.006	-0.005	-0.021	-0.027	-0.006	-0.021	-0.003	-0.010
	[0.029]	[0.025]	[0.037]	[0.028]	[0.019]	[0.027]	[0.012]	[0.012]
Asset Owner	-0.023**	-0.019*	-0.051**	-0.042*	-0.014***	-0.035*	-0.004	-0.006
	[0.009]	[0.010]	[0.022]	[0.021]	[0.004]	[0.018]	[0.005]	[0.004]
# Companies		0.004		0.061***	0.022	0.054***	-0.016*	0.010
		[0.016]		[0.017]	[0.015]	[0.015]	[0.008]	[0.006]
# Industries		-0.001		-0.004***	-0.001	-0.002**	0.000	-0.001**
		[0.001]		[0.001]	[0.001]	[0.001]	[0.000]	[0.001]
Average Market Cap		-0.012		-0.018	-0.016**	0.015**	0.002	-0.031*
		[0.014]		[0.020]	[0.007]	[0.006]	[0.011]	[0.017]
Average Market-to-Book		0.012		0.033	-0.004	0.014	0.015***	0.019**
		[0.017]		[0.021]	[0.013]	[0.018]	[0.005]	[0.006]
Own Region %		-0.000		0.000	0.000	0.000	-0.000	-0.000
		[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Developed Markets %		0.000		0.000	0.000	0.001*	-0.000**	-0.001***
		[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50997	50983	50997	50983	50957	50957	52426	52426
Adjusted R^2	0.012	0.012	0.009	0.010	0.010	0.006	0.075	0.107

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Portfolio Decarbonization Strategies

This table presents regressions of yearly Scope 1 emission changes and our two portfolio rebalancing approaches, described in Table 3. We show results for investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 Emissions Yearly Changes (Δ Total)

	Emissions Scheme				No Emissions Scheme			
	Δ Total log Scope 1 (t+1)		Δ Total log Scope 1 Footprint (t+1)		Δ Total log Scope 1 (t+1)		Δ Total log Scope 1 Footprint (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	-0.030***	-0.027***	-0.039***	-0.035**	-0.004	0.003	-0.016	-0.023*
	[0.008]	[0.008]	[0.013]	[0.013]	[0.015]	[0.015]	[0.014]	[0.011]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11109	11109	11109	11109	39888	39874	39888	39874
Adjusted R^2	0.024	0.026	0.008	0.012	0.011	0.012	0.010	0.011

Panel B: Portfolio Re-weighting

	Emissions Scheme				No Emissions Scheme			
	Δ weights-only log Scope 1 (t+1)		Δ weights-only log Scope 1 Footprint (t+1)		Δ weights-only log Scope 1 (t+1)		Δ weights-only log Scope 1 Footprint (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	-0.037***	-0.032***	-0.044***	-0.040**	-0.004	-0.006	0.022*	-0.007
	[0.006]	[0.006]	[0.012]	[0.014]	[0.006]	[0.009]	[0.010]	[0.012]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11106	11106	11106	11106	39865	39851	39865	39851
Adjusted R^2	0.026	0.028	0.006	0.008	0.008	0.008	0.004	0.007

Panel C: Corporate Changes

	Emissions Scheme				No Emissions Scheme			
	Δ emissions-only log Scope 1 (t+1)		Δ emissions-only log Scope 1 Footprint (t+1)		Δ emissions-only log Scope 1 (t+1)		Δ emissions-only log Scope 1 Footprint (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	0.006	0.006	-0.001	0.001	-0.002	0.007	-0.032**	-0.013*
	[0.004]	[0.004]	[0.003]	[0.002]	[0.009]	[0.007]	[0.014]	[0.007]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11365	11365	11365	11365	41077	41061	41077	41061
Adjusted R^2	0.070	0.079	0.066	0.084	0.074	0.082	0.086	0.120

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Portfolio Decarbonization Strategies: Sum of Scope 1 + 2 + 3 Emissions

This table presents regressions for total yearly changes in portfolio sum of Scope 1 + 2 + 3 emissions metrics of institutional investors. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. We show results for all investors, and investors headquartered in countries with an emission scheme and without one in a given year. The regressions include Investor and Portfolio Characteristics as in Table IA.3. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1+2+3 Emission Yearly Changes (Δ Total)

	All		Emissions Scheme		No Emissions Scheme	
	Δ Total log Scope 1+2+3 (t+1)	Δ Total log Scope 1+2+3 Footprint (t+1)	Δ Total log Scope 1+2+3 (t+1)	Δ Total log Scope 1+2+3 Footprint (t+1)	Δ Total log Scope 1+2+3 (t+1)	Δ Total log Scope 1+2+3 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.005	-0.022**	-0.011	-0.023*	0.004	-0.019*
	[0.008]	[0.009]	[0.007]	[0.012]	[0.009]	[0.010]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50983	50983	11109	11109	39874	39874
Adjusted R^2	0.026	0.020	0.063	0.025	0.023	0.022

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1+2+3 (t+1)	Δ weights-only log Scope 1+2+3 Footprint (t+1)	Δ weights-only log Scope 1+2+3 (t+1)	Δ weights-only log Scope 1+2+3 Footprint (t+1)	Δ weights-only log Scope 1+2+3 (t+1)	Δ weights-only log Scope 1+2+3 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.011**	-0.014*	-0.016**	-0.028**	-0.003	-0.004
	[0.005]	[0.008]	[0.006]	[0.012]	[0.005]	[0.010]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50957	50957	11106	11106	39851	39851
Adjusted R^2	0.014	0.007	0.036	0.010	0.011	0.009

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only log Scope 1+2+3 (t+1)	Δ emissions-only log Scope 1+2+3 Footprint (t+1)	Δ emissions-only log Scope 1+2+3 (t+1)	Δ emissions-only log Scope 1+2+3 Footprint (t+1)	Δ emissions-only log Scope 1+2+3 (t+1)	Δ emissions-only log Scope 1+2+3 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.004	-0.010*	0.004	0.000	0.005	-0.013*
	[0.005]	[0.005]	[0.002]	[0.002]	[0.007]	[0.006]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52426	52426	11365	11365	41061	41061
Adjusted R^2	0.156	0.216	0.300	0.259	0.147	0.225

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Portfolio Decarbonization Strategies: Top 100 emitting firms

This table presents regressions for total yearly changes in portfolio carbon metrics related to their holdings of the top 100 Scope 1 emitting firms in each year. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). We show results for all investors, as well as investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Top 100 firms Scope 1 Emissions Yearly Changes (Δ Total)

	All		Emissions Scheme		No Emissions Scheme	
	Δ Total log Scope 1 Top 100 (t+1)	Δ Total log Scope 1 Footprint Top 100 (t+1)	Δ Total log Scope 1 Top 100 (t+1)	Δ Total log Scope 1 Footprint Top 100 (t+1)	Δ Total log Scope 1 Top 100 (t+1)	Δ Total log Scope 1 Footprint Top 100 (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.005	-0.038**	-0.007	-0.045***	-0.001	-0.027
	[0.005]	[0.016]	[0.005]	[0.008]	[0.006]	[0.022]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39580	39580	9329	9329	30251	30251
Adjusted R^2	0.029	0.007	0.019	0.014	0.035	0.007

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 Top 100 (t+1)	Δ weights-only log Scope 1 Footprint Top 100 (t+1)	Δ weights-only log Scope 1 Top 100 (t+1)	Δ weights-only log Scope 1 Footprint Top 100 (t+1)	Δ weights-only log Scope 1 Top 100 (t+1)	Δ weights-only log Scope 1 Footprint Top 100 (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.006*	-0.023**	-0.011**	-0.040***	-0.001	-0.008
	[0.003]	[0.010]	[0.004]	[0.007]	[0.004]	[0.015]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39697	39697	9352	9352	30345	30345
Adjusted R^2	0.009	0.005	0.010	0.008	0.013	0.005

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only log Scope 1 Top 100 (t+1)	Δ emissions-only log Scope 1 Footprint Top 100 (t+1)	Δ emissions-only log Scope 1 Top 100 (t+1)	Δ emissions-only log Scope 1 Footprint Top 100 (t+1)	Δ emissions-only log Scope 1 Top 100 (t+1)	Δ emissions-only log Scope 1 Footprint Top 100 (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.005*	-0.006**	-0.001	0.002	-0.005	-0.009**
	[0.003]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42141	42141	9807	9807	32334	32334
Adjusted R^2	0.113	0.130	0.124	0.157	0.126	0.138

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Portfolio Decarbonization Strategies: 2-Year Changes

This table presents regressions for two-year changes in portfolio Scope 1 carbon metrics of institutional investors. The variable of interest is a dummy indicating if the investor is a member of the CDP initiative. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. We show results for all investors, and investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 Emissions 2-Year Changes (Δ2-year Total)

	All		Emissions Scheme		No Emissions Scheme	
	Δ2 Total log Scope 1 (t+1)	Δ2 Total log Scope 1 Footprint (t+1)	Δ2 Total log Scope 1 (t+1)	Δ2 Total log Scope 1 Footprint (t+1)	Δ2 Total log Scope 1 (t+1)	Δ2 Total log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.026*	-0.059***	-0.042**	-0.056**	-0.003	-0.058**
	[0.012]	[0.019]	[0.017]	[0.024]	[0.017]	[0.024]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	45063	45063	9826	9826	35237	35237
Adjusted R^2	0.018	0.013	0.037	0.017	0.017	0.015

Panel B: Portfolio Re-weighting, 2-Year Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ2 weights-only log Scope 1 (t+1)	Δ2 weights-only log Scope 1 Footprint (t+1)	Δ2 weights-only log Scope 1 (t+1)	Δ2 weights-only log Scope 1 Footprint (t+1)	Δ2 weights-only log Scope 1 (t+1)	Δ2 weights-only log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.038***	-0.040*	-0.057***	-0.061**	-0.012	-0.025
	[0.011]	[0.019]	[0.016]	[0.025]	[0.015]	[0.026]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44991	44991	9824	9824	35167	35167
Adjusted R^2	0.015	0.009	0.037	0.011	0.012	0.011

Panel C: Corporate Changes, 2-Year Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ2 emissions-only log Scope 1 (t+1)	Δ2 emissions-only log Scope 1 Footprint (t+1)	Δ2 emissions-only log Scope 1 (t+1)	Δ2 emissions-only log Scope 1 Footprint (t+1)	Δ2 emissions-only log Scope 1 (t+1)	Δ2 emissions-only log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.008	-0.020**	0.008	-0.001	0.007	-0.029**
	[0.006]	[0.007]	[0.005]	[0.005]	[0.007]	[0.010]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47728	47728	10286	10286	37442	37442
Adjusted R^2	0.064	0.118	0.081	0.086	0.066	0.129

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Portfolio Decarbonization Strategies: Climate Action 100+

This table presents regressions for yearly changes in portfolio carbon metrics of institutional investors. The variables of interest are dummies indicating if the investor is only a member of the CDP initiative, or (also/only) a member the Climate Action 100+ initiative. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). We show results for all investors, and investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 Emissions 1-Year Changes (Δ Total)

	All		Emissions Scheme		No Emissions Scheme	
	Δ Total log Scope 1 (t+1)	Δ Total log Scope 1 Footprint (t+1)	Δ Total log Scope 1 (t+1)	Δ Total log Scope 1 Footprint (t+1)	Δ Total log Scope 1 (t+1)	Δ Total log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
only CDP	-0.012	-0.030**	-0.026***	-0.036**	0.002	-0.022*
	[0.011]	[0.011]	[0.008]	[0.013]	[0.015]	[0.011]
Climate Action 100+	-0.063***	-0.072***	-0.085***	-0.081***	-0.091***	-0.066**
	[0.011]	[0.018]	[0.008]	[0.017]	[0.013]	[0.025]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50983	50983	11109	11109	39874	39874
Adjusted R^2	0.012	0.010	0.026	0.012	0.012	0.011

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 (t+1)	Δ weights-only log Scope 1 Footprint (t+1)	Δ weights-only log Scope 1 (t+1)	Δ weights-only log Scope 1 Footprint (t+1)	Δ weights-only log Scope 1 (t+1)	Δ weights-only log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
only CDP	-0.021***	-0.022**	-0.032***	-0.041***	-0.006	-0.006
	[0.007]	[0.010]	[0.007]	[0.013]	[0.009]	[0.012]
Climate Action 100+	-0.059***	-0.093***	-0.072***	-0.075***	-0.070***	-0.105***
	[0.008]	[0.015]	[0.014]	[0.016]	[0.012]	[0.024]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50957	50957	11106	11106	39851	39851
Adjusted R^2	0.010	0.006	0.028	0.008	0.008	0.007

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only log Scope 1 (t+1)	Δ emissions-only log Scope 1 Footprint (t+1)	Δ emissions-only log Scope 1 (t+1)	Δ emissions-only log Scope 1 Footprint (t+1)	Δ emissions-only log Scope 1 (t+1)	Δ emissions-only log Scope 1 Footprint (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
only CDP	0.007	-0.008	0.006	0.001	0.006	-0.013*
	[0.006]	[0.005]	[0.004]	[0.002]	[0.007]	[0.007]
Climate Action 100+	0.018**	0.002	0.001	-0.010**	0.027***	0.011
	[0.007]	[0.011]	[0.002]	[0.005]	[0.006]	[0.012]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52426	52426	11365	11365	41061	41061
Adjusted R^2	0.075	0.107	0.079	0.084	0.082	0.120

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Greening of Business Activities: Climate Patents

This table presents regressions of the levels and yearly changes of portfolio climate patent metrics for institutional investors. Regressions include investor and portfolio characteristics as in Table 3 (coefficients shown). We also add two additional controls in specifications (3), (6) and (9). These are log *Scope 1/Revenue*, and *Carbon Disclosure %*. The dependent variable *Climate Patent %* is available for 2005-2012. Further, we regress yearly changes in the measures as well as decomposing those into "portfolio re-weighting" and "corporate changes" as in Table 3. The main variables of interest are dummies indicating if the institution is a member of the CDP initiative. Panel A shows the regressions for all institutional investors, Panel B for those headquartered in a country with a carbon pricing emission scheme in a given year, and Panel C for those who are not headquartered in a country with an emissions scheme. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the investor and year level. The Dependent variables are all forwarded by one period. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: All Institutional Investors

	Climate Patent % (t+1)			Δ Total Climate Patent % (t+1)			Δ weights-only Climate Patent % (t+1)			Δ patent-only Climate Patent % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.364*	0.242	0.151	-0.111*	-0.113	-0.138*	-0.077**	-0.048	-0.059	0.063	0.017	0.020
	[0.179]	[0.180]	[0.166]	[0.047]	[0.063]	[0.061]	[0.025]	[0.035]	[0.037]	[0.062]	[0.066]	[0.066]
log Scope 1/Revenue			0.582***			0.036			-0.041			0.070
			[0.093]			[0.059]			[0.033]			[0.041]
Carbon Disclosure %			0.058***			0.001			0.001			0.001
			[0.008]			[0.005]			[0.003]			[0.004]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26505	26505	23465	22230	22230	19286	25701	25701	22746	22894	22894	19875
Adjusted R^2	0.059	0.073	0.111	0.003	0.004	0.004	0.008	0.009	0.009	0.016	0.017	0.018

Panel B: Institutional Investors based in an Emissions Scheme Country

	Climate Patent % (t+1)			Δ Total Climate Patent % (t+1)			Δ weights-only Climate Patent % (t+1)			Δ patent-only Climate Patent % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.320	0.280	0.288	-0.130	-0.112	-0.107	-0.119	-0.092	-0.090	0.081	0.057	0.057
	[0.225]	[0.207]	[0.202]	[0.130]	[0.151]	[0.154]	[0.076]	[0.093]	[0.106]	[0.059]	[0.059]	[0.061]
log Scope 1/Revenue			0.994***			0.103			-0.012			0.080
			[0.216]			[0.209]			[0.133]			[0.081]
Carbon Disclosure %			0.042**			-0.006			-0.005			-0.003
			[0.014]			[0.011]			[0.009]			[0.008]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5293	5293	5195	4380	4380	4284	5139	5139	5042	4503	4503	4406
Adjusted R^2	0.043	0.084	0.110	0.007	0.008	0.008	0.009	0.009	0.010	0.078	0.081	0.083

Panel C: Institutional Investors based outside an Emissions Scheme Country

	Climate Patent % (t+1)			Δ Total Climate Patent % (t+1)			Δ weights-only Climate Patent % (t+1)			Δ patent-only Climate Patent % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.303	0.160	0.013	-0.050	-0.062	-0.123	-0.013	0.016	-0.006	0.063	0.002	-0.011
	[0.292]	[0.297]	[0.272]	[0.071]	[0.090]	[0.102]	[0.066]	[0.070]	[0.074]	[0.113]	[0.113]	[0.120]
log Scope 1/Revenue			0.532***			0.028			-0.046*			0.073*
			[0.086]			[0.054]			[0.022]			[0.034]
Carbon Disclosure %			0.061***			0.001			0.002			0.000
			[0.007]			[0.006]			[0.002]			[0.004]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21212	21212	18270	17850	17850	15002	20562	20562	17704	18391	18391	15469
Adjusted R^2	0.063	0.079	0.121	0.005	0.005	0.005	0.008	0.009	0.010	0.012	0.013	0.012

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Greening of Business Activities: Green Revenues

This table presents regressions of the levels and yearly changes of portfolio green revenue metrics for institutional investors. Regressions include investor and portfolio characteristics as in Table 3 (coefficients shown). We also add two additional controls in specifications (3), (6) and (9). These are log *Scope 1/Revenue*, and *Carbon Disclosure %*. The dependent variable *Climate Revenue %* is available for 2016-2019. Further, we regress yearly changes in the measures as well as decomposing those into "portfolio re-weighting" and "corporate changes" as in Table 3.The main variables of interest are dummies indicating if the institution is a member of the CDP initiative. Panel A shows the regressions for all institutional investors, Panel B for those headquartered in a country with an emissions scheme in a given year, and Panel C for those who are not headquartered in a country with a carbon pricing emission scheme. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the investor level. The Dependent variables are all forwarded by one period. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: All Institutional Investors

	Green Revenue % (t+1)			Δ Total Green Revenue % (t+1)			Δ weights-only Green Revenue % (t+1)			Δ revenue-only Green Revenue % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.483***	0.337***	0.344***	0.082**	0.080**	0.079**	0.079**	0.090***	0.092***	0.024**	0.014	0.009
	[0.099]	[0.099]	[0.098]	[0.034]	[0.034]	[0.034]	[0.032]	[0.033]	[0.033]	[0.011]	[0.012]	[0.012]
log Scope 1/Revenue			0.376***			-0.006			-0.011			-0.003
			[0.040]			[0.018]			[0.017]			[0.005]
Carbon Disclosure %			-0.001			0.001			-0.000			0.001***
			[0.002]			[0.001]			[0.001]			[0.000]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17889	17876	17827	12944	12935	12888	12944	12935	12888	13373	13362	13314
Adjusted R^2	0.034	0.063	0.083	0.001	0.002	0.001	0.002	0.002	0.002	0.019	0.041	0.042

Panel B: Institutional Investors based in an Emissions Scheme Country

	Green Revenue % (t+1)			Δ Total Green Revenue % (t+1)			Δ weights-only Green Revenue % (t+1)			Δ revenue-only Green Revenue % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.526***	0.481***	0.457***	0.018	0.007	0.010	0.024	0.013	0.019	0.004	0.008	0.006
	[0.158]	[0.155]	[0.152]	[0.051]	[0.051]	[0.051]	[0.050]	[0.050]	[0.049]	[0.016]	[0.016]	[0.017]
log Scope 1/Revenue			0.485***			-0.003			-0.039			0.012
			[0.104]			[0.044]			[0.043]			[0.014]
Carbon Disclosure %			0.012**			-0.003			-0.004			0.001
			[0.006]			[0.003]			[0.003]			[0.001]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4080	4080	4076	2977	2977	2974	2977	2977	2974	3060	3060	3057
Adjusted R^2	0.042	0.113	0.142	0.002	0.002	0.002	0.006	0.005	0.007	0.028	0.031	0.031

Panel C: Institutional Investors based outside an Emissions Scheme Country

	Green Revenue % (t+1)			Δ Total Green Revenue % (t+1)			Δ weights-only Green Revenue % (t+1)			Δ revenue-only Green Revenue % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.457***	0.277**	0.303**	0.124***	0.130***	0.127***	0.125***	0.144***	0.146***	0.026	0.017	0.010
	[0.129]	[0.132]	[0.130]	[0.047]	[0.048]	[0.048]	[0.044]	[0.046]	[0.046]	[0.017]	[0.017]	[0.017]
log Scope 1/Revenue			0.399***			-0.005			-0.005			-0.004
			[0.042]			[0.020]			[0.018]			[0.005]
Carbon Disclosure %			-0.006***			0.001			0.000			0.001***
			[0.002]			[0.001]			[0.001]			[0.000]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13809	13796	13751	9967	9958	9914	9967	9958	9914	10313	10302	10257
Adjusted R^2	0.013	0.037	0.060	0.002	0.003	0.003	0.001	0.001	0.001	0.022	0.049	0.051

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Internet Appendix

Figure IA.1: Portfolio Decarbonization: Alternative Metrics

This figure shows the portfolio carbon (GHG) emission metrics of climate-conscious investors over time using alternative emission measures. We define as climate-conscious those investors that are signatories of the CDP or Climate Action 100+(CA100+) initiatives. We also add portfolio GHG metrics for Non-CDP and Non-CA100+ investors, as well as for a representative investor holding the MSCI ACWI index. Panel A presents median Scope 1/ Revenue over time, and Panel B shows median Scope 1 / Portfolio Size. In Panel B we assume that the MSCI ACWI investor holds all the free-floating shares of MSCI ACWI firms.

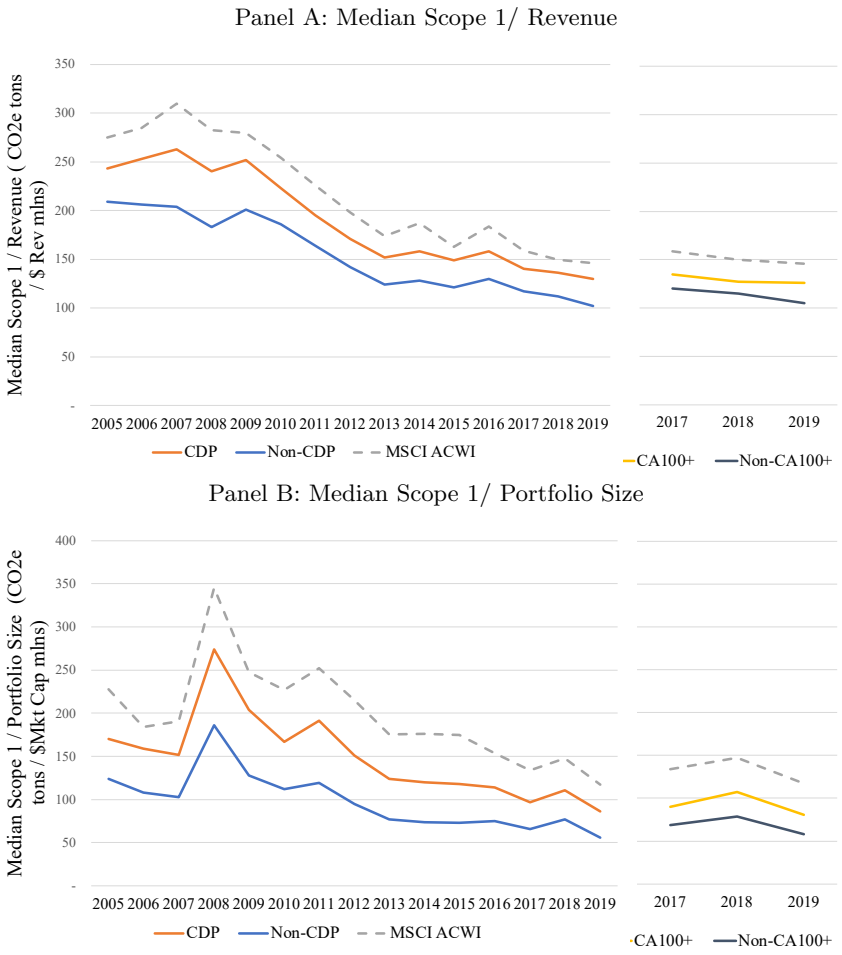
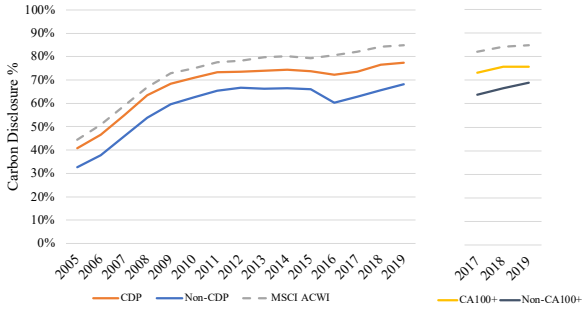


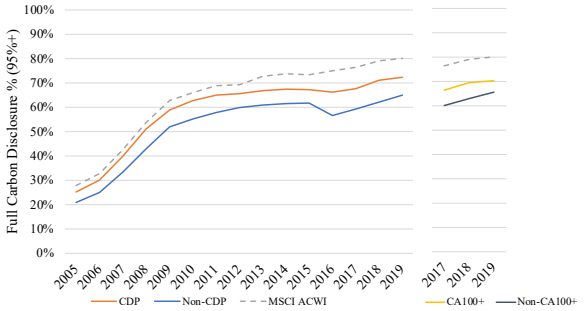
Figure IA.2: Portfolio Carbon Emissions : Corporate Disclosures and Targets

This figure shows the fraction of firms in investor portfolios which have disclosed carbon emissions or emission reduction targets. We define as climate-conscious those investors that are signatories of the CDP or Climate Action 100+ initiatives. We also add other mean disclosure and target variables for Non-CDP and Non-Climate Action 100+ investors, as well as for a representative MSCI ACWI investor. Panel A displays the weighted average percentage of disclosed Scope 1 carbon emissions by firms in investor portfolios. Panel B displays the mean percentage of firms in the investor portfolios which disclose over 95% of their Scope 1 carbon emissions. Panel C displays the mean percentage of firms in the investor portfolios that have an emissions reduction target. Panel D shows the mean percentage of firms in investor portfolios that have a verified Science-based Target initiative (SBTi) emissions reduction target program. Definitions of the variables are provided in Appendix A.

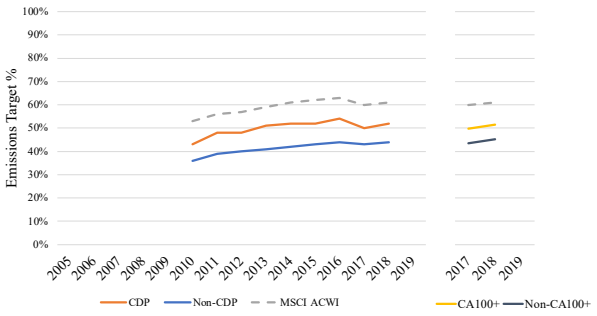
Panel A: Carbon Disclosure %



Panel B: Full Carbon Disclosure % (95%+)



Panel C: Emissions Target %



Panel D: Science-based Emissions Target %

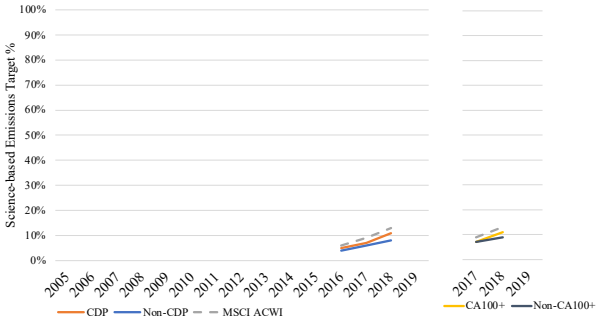
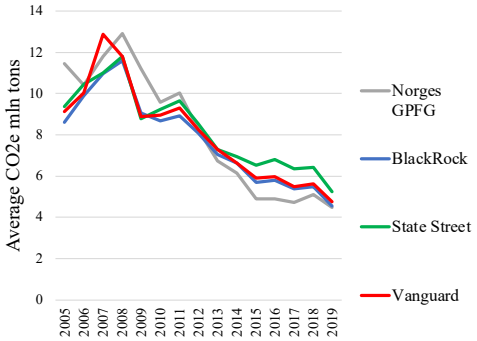


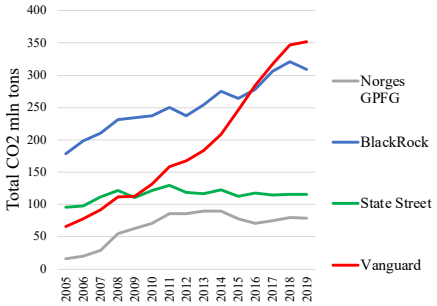
Figure IA.3: Portfolio Carbon Emissions and Equity Holdings for the Big 3 and Norges GPFG

This figure displays portfolio carbon emissions and equity holdings data for prominent institutional investors, as described in Section 2.2. The first one is Norges GPFG (the Government Pension Fund Global), commonly known as the Norwegian sovereign Wealth Fund. The next three are the "Big 3": Blackrock, State Street and Vanguard. Definitions of the variables are provided in Appendix A.

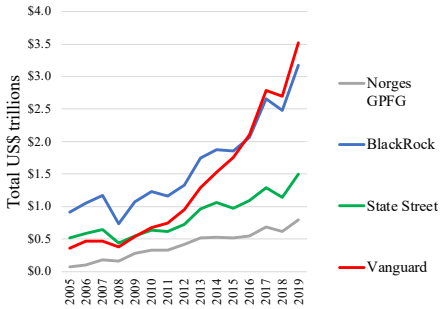
Panel A: Scope 1



Panel B: Scope 1 Footprint



Panel C: Total Equity Holdings



Panel D: Scope 1/Revenue

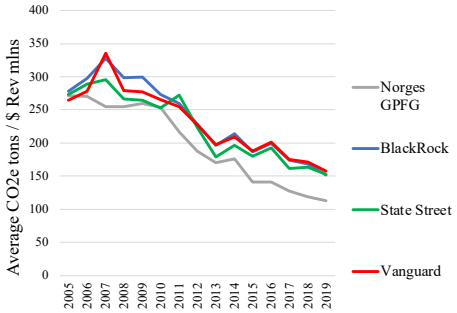


Figure IA.4: Institutional Share of Global Carbon Emissions: Top 100 Emitting Firms

This figure shows the share of total carbon (GHG) emissions apportioned to the equity holdings of institutional investors, other public investors, and to non-public firms for the 2005-2019 sample period. We plot the total Scope 1 GHG (CO2-equivalent) emissions by public firms compared to the total global emissions from fossil fuel use, industrial processes and product use estimated by the EDGAR v6.0 data from European Commission, Joint Research Centre (2021). We then split out the Scope 1 GHG emissions by public firms into the fractions attributable to institutional and non-institutional investors based on the ownership stake of each group. Finally, we split the two groups further into the GHG emissions coming from the top 100 emitters in each year (brown and brown-checkered) and the remaining non-top 100 emitting firms (green and green-checkered).

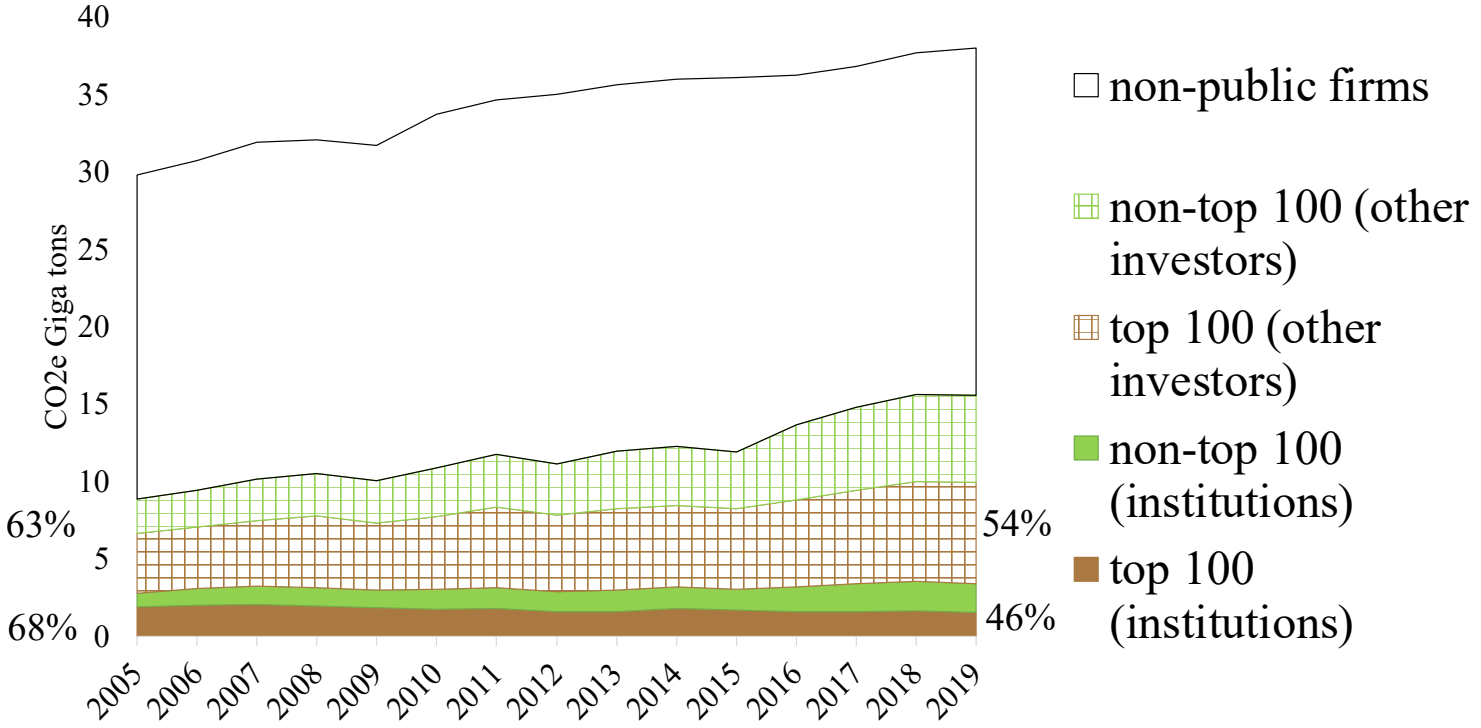


Table IA.1: Top Institutional Investors

This table displays the top ten institutional investors by Portfolio Size (Equity AuM) domiciled both in a country with a carbon price emissions scheme, and outside one, as of 2019. Definitions of the variables are provided in Appendix A.

Emissions Scheme	Investor Name	Equity AuM in 2019 (in US $ blns)	Country of Domicile	Year joined CDP	Year joined CA100+	*Scope 1 (Average CO2e million tons)*	*Scope 1/ Revenue (Average CO2e tons/ $ Rev millions)*	*Scope 1 Footprint (Total CO2e million tons)*	*Scope 1/ Portfolio Size (Total CO2e tons/ $ Mkt Cap millions)*
No Emissions Scheme	The Vanguard Group, Inc.	$ 3,363	US	2018		4.72	158	337	100
	BlackRock Fund Advisors	$ 2,084	US	2007		4.52	160	208	100
	SSgA Funds Management, Inc.	$ 1,403	US	2004		5.20	153	104	74
	Fidelity Management & Research Co. LLC	$ 916	US			3.40	96	56	61
	T. Rowe Price Associates, Inc. (Investment Management)	$ 785	US	2011		2.60	121	38	49
	Capital Research & Management Co. (World Investors)	$ 702	US			4.63	113	55	78
	Geode Capital Management LLC	$ 530	US			4.79	140	43	81
	Wellington Management Co. LLP	$ 509	US	2019		3.66	106	27	53
	Capital Research & Management Co. (Global Investors)	$ 505	US			5.25	131	35	70
	Dimensional Fund Advisors LP	$ 417	US			4.28	174	82	197
Emissions Scheme	Norges Bank Investment Management	$ 794	NO	2009		4.48	113	79	99
	BlackRock Investment Management (UK) Ltd.	$ 341	GB	2007		4.87	131	28	82
	BlackRock Advisors (UK) Ltd.	$ 274	GB	2007		5.30	156	34	124
	Nikko Asset Management Co., Ltd.	$ 205	JP	2005	2018	3.22	105	19	91
	Baillie Gifford & Co.	$ 195	GB	2003		1.51	46	6	29
	Nomura Asset Management Co., Ltd.	$ 194	JP	2015	2019	1.43	64	27	138
	APG Asset Management NV	$ 166	NL	2004	2017	3.92	148	18	105
	DWS Investment GmbH	$ 155	DE	2005	2017	4.84	175	13	81
	Legal & General Investment Management Ltd.	$ 144	GB	2003	2017	5.43	185	13	92
	Canada Pension Plan Investment Board	$ 113	CA	2006		2.71	158	16	141

Table IA.2: Factors Associated with Joining the CDP and Climate Action 100+ Initiatives

This table presents regressions of the factors associated with membership of CDP and Climate Action 100+, two prominent climate-conscious investor initiatives. We show results for Logit regressions. The dependent variables dummies take the value of one if an investor is a member of CDP in a given year and zero otherwise. We show results for all institutional investors, those located in a country with a carbon pricing emission scheme in a given year, and those located in a country without an emissions scheme. Definitions of the variables are provided in Appendix A. All specifications include fixed effects and the standard errors are clustered at the investor level. We forward the dependent variables by one year. We winsorise all continuous variables at the 1 and 99% cutoff levels.

	All				Emissions Scheme				No Emissions Scheme			
	CDP (t+1)		Climate Action 100+ (t+1)		CDP (t+1)		Climate Action 100+ (t+1)		CDP (t+1)		Climate Action 100+ (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Portfolio Size	0.495***	0.281***	0.525***	0.372***	0.487***	0.311***	0.550***	0.447***	0.505***	0.258***	0.492***	0.294***
	[0.023]	[0.027]	[0.037]	[0.047]	[0.035]	[0.044]	[0.052]	[0.065]	[0.030]	[0.034]	[0.055]	[0.067]
Europe	0.145	-0.069	0.494***	0.292	-0.317	-0.240	0.368	0.479	0.104	-0.449**		
	[0.116]	[0.148]	[0.183]	[0.238]	[0.219]	[0.232]	[0.372]	[0.383]	[0.187]	[0.215]		
North America	-1.676***	-1.692***	-1.622***	-1.505***	0.644	0.404			-1.637***	-1.831***	-1.564***	-1.763***
	[0.118]	[0.168]	[0.203]	[0.290]	[0.590]	[0.625]			[0.122]	[0.202]	[0.217]	[0.408]
Asset Owner	0.140	0.179	1.021***	1.171***	0.058	0.229	1.001***	1.232***	0.243	0.107	1.033***	1.110***
	[0.172]	[0.172]	[0.232]	[0.235]	[0.219]	[0.228]	[0.319]	[0.348]	[0.249]	[0.255]	[0.346]	[0.346]
# Companies		0.555***		0.022		0.546***		0.089		0.648***		0.070
		[0.103]		[0.180]		[0.153]		[0.250]		[0.138]		[0.264]
# Industries		-0.013*		0.023		-0.018		0.013		-0.016		0.026
		[0.008]		[0.014]		[0.012]		[0.020]		[0.011]		[0.021]
Average Market Cap		0.254***		0.142*		0.271***		0.004		0.294***		0.273**
		[0.045]		[0.080]		[0.080]		[0.111]		[0.058]		[0.115]
Average Market-to-Book		-0.411***		-0.550***		-0.122		-0.456**		-0.444***		-0.590***
		[0.074]		[0.141]		[0.118]		[0.213]		[0.093]		[0.204]
Own Region %		-0.001		-0.002		0.004*		0.000		-0.004		-0.004
		[0.002]		[0.003]		[0.002]		[0.004]		[0.002]		[0.005]
Developed Markets %		-0.001		0.004		-0.007**		-0.001		0.002		0.009*
		[0.002]		[0.003]		[0.003]		[0.005]		[0.003]		[0.005]
Fossil Fuel %		0.010***		-0.012		0.005		0.002		0.014***		-0.031
		[0.004]		[0.012]		[0.009]		[0.016]		[0.004]		[0.025]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62218	62200	13605	13594	12570	12570	3050	3050	49648	49630	10499	10488
Pseudo R^2	0.206	0.236	0.221	0.237	0.119	0.145	0.152	0.166	0.162	0.203	0.136	0.169

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.3: Portfolio Carbon Emission Levels

This table presents regressions of institutional investors' portfolio carbon metrics and whether the investor is climate-conscious. The main variable of interest is whether an institution is a member of the CDP initiative. Regressions include Investor and Portfolio Characteristics as in Table 3 (coefficients not shown). We show results for all investors, and for those headquartered in countries with a carbon pricing emission scheme and without one in a given year. In Panel A we show results for the Scope 1 and Scope 2 + 3 emissions variables for all investors. In Panel C we show results for the Scope 1 emissions variables for investors inside and outside an emissions scheme. In Panel C we show the same split of investors for the Scope 2 + 3 measures. In Panel D we run regressions of portfolio disclosure and emissions targets. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects, while specifications in (3), (6), (9), and (12) also have investor fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 and Scope 2 + 3 Emissions

	log Scope 1(t+1)			log Scope 1 Footprint (t+1)			log Scope 2 + 3 (t+1)			log Scope 2 + 3 Footprint (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.320***	-0.064**	-0.071**	0.230***	-0.009	-0.060	0.224***	-0.061***	-0.020	0.083***	-0.030	-0.051*
	[0.041]	[0.027]	[0.025]	[0.040]	[0.029]	[0.041]	[0.029]	[0.014]	[0.017]	[0.022]	[0.018]	[0.025]
Portfolio Size	0.064***	-0.154***	-0.032*	1.092***	0.905***	0.725***	0.038***	-0.084***	-0.026***	1.040***	0.963***	0.761***
	[0.012]	[0.009]	[0.018]	[0.011]	[0.011]	[0.025]	[0.009]	[0.005]	[0.008]	[0.007]	[0.009]	[0.021]
Europe	0.294***	0.376***	0.000	-0.191**	0.168**	0.000	0.559***	0.223***	0.000	0.164***	0.192***	0.000
	[0.066]	[0.042]	[0.000]	[0.068]	[0.060]	[0.000]	[0.045]	[0.030]	[0.000]	[0.051]	[0.040]	[0.000]
North America	0.022	0.212***	0.000	-0.808***	-0.144**	0.000	0.413***	0.031	0.000	-0.340***	-0.173***	0.000
	[0.057]	[0.051]	[0.000]	[0.064]	[0.063]	[0.000]	[0.038]	[0.031]	[0.000]	[0.049]	[0.041]	[0.000]
Asset Owner	0.385***	0.143**	0.000	0.067	0.019	0.000	0.307***	0.043	0.000	0.003	-0.054	0.000
	[0.065]	[0.056]	[0.000]	[0.066]	[0.053]	[0.000]	[0.052]	[0.030]	[0.000]	[0.043]	[0.033]	[0.000]
# Companies		-0.011	0.148***		-0.219***	0.104**		-0.035	0.041*		-0.293***	-0.016
		[0.058]	[0.033]		[0.062]	[0.041]		[0.029]	[0.020]		[0.037]	[0.028]
# Industries		0.032***	0.002		0.048***	0.008**		0.017***	0.003**		0.035***	0.008***
		[0.005]	[0.002]		[0.005]	[0.003]		[0.002]	[0.001]		[0.003]	[0.002]
Average Market Cap		0.823***	0.342***		0.298***	0.011		0.762***	0.403***		0.204***	0.020
		[0.021]	[0.023]		[0.039]	[0.026]		[0.017]	[0.022]		[0.038]	[0.021]
Average Market-to-Book		-0.410***	-0.082***		-0.543***	-0.159***		-0.189***	-0.043***		-0.332***	-0.110***
		[0.044]	[0.017]		[0.048]	[0.032]		[0.023]	[0.013]		[0.034]	[0.027]
Own Region %		0.005***	0.002***		0.003***	0.000		0.002***	0.000		0.001**	-0.001
		[0.001]	[0.001]		[0.001]	[0.001]		[0.000]	[0.000]		[0.000]	[0.001]
Developed Markets %		-0.011***	-0.005***		-0.012***	-0.005***		-0.000	0.001		-0.003***	-0.001
		[0.001]	[0.001]		[0.001]	[0.001]		[0.000]	[0.001]		[0.001]	[0.001]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Investor FE	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	56981	56963	56053	56981	56963	56053	56981	56963	56053	56981	56963	56053
Adjusted R^2	0.053	0.514	0.809	0.596	0.683	0.843	0.053	0.688	0.850	0.752	0.789	0.879

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Scope 1 Emissions, for investors based inside and outside an emissions scheme country

	Emissions Scheme						No Emissions Scheme					
	log Scope 1(t+1)			log Scope 1 Footprint(t+1)			log Scope 1 (t+1)			log Scope 1 Footprint (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.301***	-0.017	-0.018	0.197***	-0.024	0.005	0.359***	-0.097**	-0.022	0.296***	0.019	-0.065
	[0.065]	[0.037]	[0.035]	[0.060]	[0.038]	[0.041]	[0.047]	[0.037]	[0.032]	[0.049]	[0.041]	[0.046]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Investor FE	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	12388	12388	12210	12388	12388	12210	44593	44575	43315	44593	44575	43315
Adjusted R^2	0.125	0.574	0.823	0.646	0.750	0.859	0.037	0.502	0.806	0.577	0.663	0.836

Panel C: Scope 2+3 Emissions, for investors based inside and outside an emissions scheme country

	Emissions Scheme						No Emissions Scheme					
	log Scope 2+3 (t+1)			log Scope 2+3 Footprint(t+1)			log Scope 2+3 (t+1)			log Scope 2+3 Footprint (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.165***	-0.027	0.000	0.051*	-0.021	-0.010	0.244***	-0.107***	-0.015	0.113***	-0.031	-0.056*
	[0.043]	[0.020]	[0.018]	[0.028]	[0.023]	[0.026]	[0.036]	[0.018]	[0.022]	[0.031]	[0.025]	[0.028]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Investor FE	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	12388	12388	12210	12388	12388	12210	44593	44575	43315	44593	44575	43315
Adjusted R^2	0.094	0.707	0.856	0.814	0.842	0.901	0.044	0.687	0.848	0.731	0.774	0.871

Panel D: Emission Disclosure and Targets

	Carbon Disclosure %(t+1)			Full Carbon Disclosure % (95%+) (t+1)			Emissions Target %(t+1)			Science-based Emissions Target %(t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	7.282***	2.995***	-0.137	6.946***	3.071***	0.444	7.296***	2.449***	-0.559	1.065*	0.406	-0.066
	[0.794]	[0.598]	[0.542]	[0.747]	[0.535]	[0.426]	[0.819]	[0.663]	[0.485]	[0.311]	[0.251]	[0.588]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Investor FE	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	56981	56963	56053	56981	56963	56053	36372	36356	35504	13373	13362	12528
Adjusted R^2	0.237	0.574	0.819	0.312	0.583	0.812	0.099	0.607	0.883	0.153	0.378	0.727

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.4: Portfolio Decarbonization Strategies: Relative Scope 1 Emissions Measures

This table presents regressions of yearly Scope 1 emission changes, for the relative portfolio emissions measures, and our two portfolio rebalancing approaches, described in Table 3. We show results for investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 Emissions 1-Year Changes (Δ Total)

	Emissions Scheme				No Emissions Scheme			
	Δ Total log Scope 1/Revenue (t+1)		Δ Total log Scope 1/Portfolio Size (t+1)		Δ Total log Scope 1/Revenue (t+1)		Δ Total log Scope 1/Portfolio Size (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	-0.026**	-0.027**	-0.031*	-0.031**	-0.004	-0.005	-0.017	-0.005
	[0.012]	[0.011]	[0.015]	[0.012]	[0.011]	[0.010]	[0.019]	[0.014]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11109	11109	11109	11109	39888	39874	39888	39874
Adjusted R^2	0.025	0.026	0.143	0.146	0.012	0.012	0.065	0.067

Panel B: Portfolio Re-weighting

	Emissions Scheme				No Emissions Scheme			
	Δ weights-only log Scope 1/Revenue (t+1)		Δ weights-only log Scope 1/Portfolio Size (t+1)		Δ weights-only log Scope 1/Revenue (t+1)		Δ weights-only log Scope 1/Portfolio Size (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	-0.029**	-0.027*	-0.035**	-0.035**	-0.002	-0.007	0.021*	0.010
	[0.010]	[0.013]	[0.014]	[0.014]	[0.008]	[0.009]	[0.011]	[0.013]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11106	11106	11106	11106	39865	39851	39865	39851
Adjusted R^2	0.021	0.021	0.146	0.146	0.009	0.009	0.061	0.062

Panel C: Corporate Changes

	Emissions Scheme				No Emissions Scheme			
	Δ emissions-only log Scope 1/Revenue (t+1)		Δ emissions-only log Scope 1/Portfolio Size (t+1)		Δ emissions-only log Scope 1/Revenue (t+1)		Δ emissions-only log Scope 1/Portfolio Size (t+1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDP	0.003	0.002	-0.001	0.001	-0.002	0.002	-0.032**	-0.013*
	[0.003]	[0.003]	[0.003]	[0.002]	[0.004]	[0.003]	[0.014]	[0.007]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11365	11365	11365	11365	41077	41061	41077	41061
Adjusted R^2	0.150	0.153	0.066	0.084	0.103	0.106	0.086	0.120

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.5: Portfolio Decarbonization Strategies: Material Sectors

This table presents regressions for yearly changes in portfolio carbon metrics of institutional investors, in the part of their portfolios which is allocated to one of the three material sectors (materials, utilities, and energy).The sectors are classified using the GICs sectors in the Trucost emissions data. We limit the sample to only include European institutional investors. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. We show results for all investors and for investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded.We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 Emission Yearly Changes (Δ Total)

	All		Emissions Scheme		No Emissions Scheme	
	Δ Total log Scope 1 3MS (t+1)	Δ Total log Scope 1 Footprint 3MS (t+1)	Δ Total log Scope 1 3MS (t+1)	Δ Total log Scope 1 Footprint 3MS (t+1)	Δ Total log Scope 1 3MS (t+1)	Δ Total log Scope 1 Footprint 3MS (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.010	-0.027**	-0.017*	-0.035***	0.002	-0.016
	[0.010]	[0.011]	[0.009]	[0.011]	[0.015]	[0.010]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46700	46700	10557	10557	36143	36143
Adjusted R^2	0.009	0.008	0.011	0.011	0.011	0.008

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 3MS (t+1)	Δ weights-only log Scope 1 Footprint 3MS (t+1)	Δ weights-only log Scope 1 3MS (t+1)	Δ weights-only log Scope 1 Footprint 3MS (t+1)	Δ weights-only log Scope 1 3MS (t+1)	Δ weights-only log Scope 1 Footprint 3MS (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.019*	-0.021**	-0.019*	-0.035***	-0.012	-0.007
	[0.009]	[0.010]	[0.010]	[0.011]	[0.014]	[0.011]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46708	46708	10569	10569	36139	36139
Adjusted R^2	0.006	0.004	0.011	0.007	0.007	0.005

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only log Scope 1 3MS (t+1)	Δ emissions-only log Scope 1 Footprint 3MS (t+1)	Δ emissions-only log Scope 1 3MS (t+1)	Δ emissions-only log Scope 1 Footprint 3MS (t+1)	Δ emissions-only log Scope 1 3MS (t+1)	Δ emissions-only log Scope 1 Footprint 3MS (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.005	-0.008	0.001	-0.001	0.007	-0.009
	[0.006]	[0.005]	[0.003]	[0.003]	[0.006]	[0.006]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	48648	48648	10896	10896	37752	37752
Adjusted R^2	0.048	0.080	0.060	0.071	0.052	0.089

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.6: Portfolio Decarboniation Strategies: Allocations (weights) and Scope 1 Carbon Footprint in Material and Non-Material Sectors

This table presents regressions of the yearly changes in institutional investor portfolio allocations (weights, 0-100) and portfolio footprint in the polluting firms in three material sectors, non-top 100 polluting firms in the three material sectors, and in firms outside of the three material sectors. We rank firms based on their Scope 1 emissions each year. We define the three material sectors as materials, utilities, and energy. The sectors are classified using the GICs sectors in the Trucost emissions data.The variable of interest is a dummy showing if an investor is a member of the CDP initiative. We show results for all investors, and investors headquartered in countries with an emission scheme and without one in a given year. The regressions include Investor and Portfolio Characteristics as in Table IA.3. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Panel A shows the regressions for the Top 100 firms in the three material sectors, Panel B for non-top 100 firms in the three material sectors, and Panel C for the measures based on portfolio non-material sector firms. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Top 100 Emitters in Three Material Sectors

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights Top 100 in Material Sectors (t+1)	Δ Total log Scope 1 Footprint Top 100 in Material Sector (t+1)	Δ weights Top 100 in Material Sectors (t+1)	Δ Total log Scope 1 Footprint Top 100 in Material Sector (t+1)	Δ weights Top 100 in Material Sectors (t+1)	Δ Total log Scope 1 Footprint Top 100 in Material Sector (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.084**	-0.032*	-0.150***	-0.044***	0.018	-0.016
	[0.036]	[0.015]	[0.047]	[0.010]	[0.066]	[0.024]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50983	38179	11109	9153	39874	29026
Adjusted R^2	0.023	0.006	0.064	0.016	0.021	0.006

Panel B: Non-Top 100 Emitters in Three Material Sectors

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights Non-Top 100 in Material Sectors (t+1)	Δ Total log Scope 1 Footprint Non-Top 100 in Material Sector (t+1)	Δ weights Non-Top 100 in Material Sectors (t+1)	Δ Total log Scope 1 Footprint Non-Top 100 in Material Sector (t+1)	Δ weights Non-Top 100 in Material Sectors (t+1)	Δ Total log Scope 1 Footprint Non-Top 100 in Material Sector (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.053	-0.013	0.031	-0.011	-0.024	-0.018
	[0.077]	[0.016]	[0.090]	[0.017]	[0.130]	[0.015]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50983	46045	11109	10475	39874	35570
Adjusted R^2	0.032	0.025	0.042	0.015	0.034	0.029

Panel C: Non-Three Material Sectors

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights Non-Material Sectors (t+1)	Δ Total log Scope 1 Footprint Non-Material Sectors (t+1)	Δ weights Non-Material Sectors (t+1)	Δ Total log Scope 1 Footprint Non-Material Sectors (t+1)	Δ weights Non-Material Sectors (t+1)	Δ Total log Scope 1 Footprint Non-Material Sectors (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.028	-0.030**	0.136	-0.020	-0.013	-0.034*
	[0.077]	[0.012]	[0.083]	[0.015]	[0.132]	[0.017]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50983	50464	11109	11064	39874	39400
Adjusted R^2	0.028	0.013	0.049	0.024	0.026	0.013

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.7: Portfolio Decarbonization Strategies: Portfolio re-weightings among Top 100 Firms, split into terciles based on their past decarbonization

This table presents regressions for portfolio re-weighting changes related to their holdings of the top 100 Scope 1 emitting firms in each year. We split the top 100 firms in each year into terciles, based on their changes in Scope 1 emissions over the past three years. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. In Panel A we show results for portfolio re-weightings among the top tercile firms in the top 100 (highest 3-year increases in emissions), in Panel B we show the portfolio re-weighting results for the middle tercile, and in Panel C for the bottom tercile (highest 3-year reductions in emissions). We show results for all investors, and investors headquartered in countries with an emission scheme and without one in a given year. The regressions include Investor and Portfolio Characteristics as in Table IA.3. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Portfolio re-weightings for Top 100 Firms with top tercile 3-year changes in emissions (increases in emissions)

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 Top 100 TT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 TT (t+1)	Δ weights-only log Scope 1 Top 100 TT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 TT (t+1)	Δ weights-only log Scope 1 Top 100 TT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 TT (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.001	-0.011	-0.005	0.036	0.006	-0.045*
	[0.006]	[0.016]	[0.009]	[0.029]	[0.009]	[0.025]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21275	21275	5586	5586	15689	15689
Adjusted R^2	0.019	0.007	0.039	0.008	0.014	0.007

Panel B: Portfolio re-weightings for Top 100 Firms with middle tercile 3-year changes in emissions (median changes in emissions)

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 Top 100 MT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 MT (t+1)	Δ weights-only log Scope 1 Top 100 MT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 MT (t+1)	Δ weights-only log Scope 1 Top 100 MT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 MT (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.009***	-0.020	-0.017**	-0.052*	-0.006	0.003
	[0.003]	[0.020]	[0.007]	[0.025]	[0.004]	[0.025]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27196	27196	7116	7116	20080	20080
Adjusted R^2	0.008	0.004	0.011	0.008	0.007	0.004

Panel C: Portfolio re-weightings for Top 100 Firms with bottom tercile 3-year changes in emissions (reductions in emissions)

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 Top 100 BT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 BT (t+1)	Δ weights-only log Scope 1 Top 100 BT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 BT (t+1)	Δ weights-only log Scope 1 Top 100 BT (t+1)	Δ weights-only log Scope 1 Footprint Top 100 BT (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.005	-0.008	-0.007	-0.027	-0.004	-0.002
	[0.003]	[0.014]	[0.004]	[0.027]	[0.006]	[0.016]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26627	26627	7044	7044	19583	19583
Adjusted R^2	0.008	0.004	0.013	0.007	0.010	0.003

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.8: Portfolio Decarbonization Strategies: Ratio of Scope 1 / (1+ 2 + 3) Emissions

This table presents regressions for total yearly changes in portfolio carbon metrics of institutional investors, in particular the ratio of Scope 1 to Scope 1 + 2 + 3 emissions. The main variable of interest is a dummy indicating if the institution is a member of the CDP initiative. Panel A shows the result for total changes, Panel B for portfolio re-weighting, and Panel C for corporate changes, as illustrated in Figure 3. The specifications follow those of Table 3. Regressions include investor and portfolio characteristics also used in the same table (coefficients not shown). Definitions of the variables are provided in Appendix A. We show results for all investors, as well as investors headquartered in countries with a carbon pricing emission scheme and without one in a given year. All specifications include year fixed effects. Standard errors are clustered at the year and investor level. Dependent variables are forwarded. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Scope 1 / (1 +2+3) Emissions Yearly Changes (Δ Total)

	All		Emissions Scheme		No Emissions Scheme	
	Δ Total Scope 1 % All (t+1)	Δ Total Scope 1 Footprint % All (t+1)	Δ Total Scope 1 % All (t+1)	Δ Total Scope 1 Footprint % All (t+1)	Δ Total Scope 1 % All (t+1)	Δ Total Scope 1 Footprint % All (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.002	-0.003**	-0.005**	-0.005**	0.000	-0.001
	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50983	50983	11109	11109	39874	39874
Adjusted R^2	0.017	0.011	0.036	0.028	0.016	0.009

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only Scope 1 % All (t+1)	Δ weights-only Scope 1 Footprint % All (t+1)	Δ weights-only Scope 1 % All (t+1)	Δ weights-only Scope 1 Footprint % All (t+1)	Δ weights-only Scope 1 % All (t+1)	Δ weights-only Scope 1 Footprint % All (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.003**	-0.004***	-0.005***	-0.005***	-0.001	-0.001
	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50957	50957	11106	11106	39851	39851
Adjusted R^2	0.008	0.002	0.019	0.004	0.008	0.002

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only Scope 1 % All (t+1)	Δ emissions-only Scope 1 Footprint % All (t+1)	Δ emissions-only Scope 1 % All (t+1)	Δ emissions-only Scope 1 Footprint % All (t+1)	Δ emissions-only Scope 1 % All (t+1)	Δ emissions-only Scope 1 Footprint % All (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.001	0.001	0.000	0.000	0.001	0.000
	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52426	52426	11365	11365	41061	41061
Adjusted R^2	0.214	0.101	0.394	0.229	0.201	0.087

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.9: Greening of Business Activities: Climate Patents, 2-years

This table presents regressions of the levels and 2-yearly changes of portfolio climate patent metrics for institutional investors. Regressions include investor and portfolio characteristics as in Table 3 (coefficients shown). We also add two additional controls in specifications (3), (6) and (9). These are log *Scope 1/Revenue*, and *Carbon Disclosure %*. The dependent variable *Climate Patent %* is available for 2005-2012. Further, we regress yearly changes in the measures as well as decomposing those into "portfolio re-weighting" and "corporate changes" as in Table 3. The main variables of interest are dummies indicating if the institution is a member of the CDP initiative. Panel A shows the regressions for all institutional investors, Panel B for those headquartered in a country with a carbon pricing emission scheme in a given year, and Panel C for those who are not headquartered in a country with an emissions scheme. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the investor and year level. The Dependent variables are all forwarded by one period. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: All Institutional Investors

	Climate Patent % (t+1)			Δ2 Total Climate Patent % (t+1)			Δ2 weights-only Climate Patent % (t+1)			Δ2 patent-only Climate Patent % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.364*	0.242	0.151	-0.232*	-0.213*	-0.242	-0.153*	-0.077	-0.076	-0.071	-0.115	-0.153*
	[0.179]	[0.180]	[0.166]	[0.092]	[0.102]	[0.123]	[0.071]	[0.066]	[0.070]	[0.093]	[0.061]	[0.062]
log Scope 1/Revenue			0.582***			0.008			-0.014			0.093*
			[0.093]			[0.085]			[0.051]			[0.036]
Carbon Disclosure %			0.058***			0.001			0.005			0.002
			[0.008]			[0.008]			[0.004]			[0.008]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26505	26505	23465	18131	18131	15296	24906	24906	22048	19300	19300	16294
Adjusted R^2	0.059	0.073	0.111	0.009	0.011	0.013	0.013	0.017	0.018	0.015	0.018	0.023

Panel B: Institutional Investors based in an Emissions Scheme Country

	Climate Patent % (t+1)			Δ2 Total Climate Patent % (t+1)			Δ2 weights-only Climate Patent % (t+1)			Δ2 patent-only Climate Patent % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.320	0.280	0.288	-0.101	-0.097	-0.101	-0.122	-0.077	-0.076	0.083	0.074	0.067
	[0.225]	[0.207]	[0.202]	[0.182]	[0.172]	[0.177]	[0.100]	[0.113]	[0.113]	[0.120]	[0.141]	[0.138]
log Scope 1/Revenue			0.994***			-0.053			-0.098			0.153
			[0.216]			[0.145]			[0.128]			[0.105]
Carbon Disclosure %			0.042**			0.007			-0.000			0.005
			[0.014]			[0.016]			[0.009]			[0.008]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5293	5293	5195	3491	3491	3399	5009	5009	4916	3692	3692	3595
Adjusted R^2	0.043	0.084	0.110	0.006	0.014	0.014	0.012	0.015	0.014	0.033	0.052	0.053

Panel C: Institutional Investors based outside an Emissions Scheme Country

	Climate Patent % (t+1)			Δ2 Total Climate Patent % (t+1)			Δ2 weights-only Climate Patent % (t+1)			Δ2 patent-only Climate Patent % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.303	0.160	0.013	-0.210*	-0.204	-0.262*	-0.069	-0.027	-0.040	-0.084	-0.195	-0.240
	[0.292]	[0.297]	[0.272]	[0.099]	[0.113]	[0.120]	[0.086]	[0.066]	[0.078]	[0.133]	[0.115]	[0.138]
log Scope 1/Revenue			0.532***			0.027			-0.068			0.053
			[0.086]			[0.084]			[0.056]			[0.031]
Carbon Disclosure %			0.061***			-0.003			0.002			-0.006
			[0.007]			[0.009]			[0.003]			[0.009]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21212	21212	18270	14640	14640	11897	19897	19897	17132	15608	15608	12699
Adjusted R^2	0.063	0.079	0.121	0.011	0.013	0.015	0.016	0.018	0.019	0.011	0.018	0.023

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table IA.10: Greening of Business Activities: Green Revenues, 2-years

This table presents regressions of the levels and 2-yearly changes of portfolio green revenue metrics for institutional investors. Regressions include investor and portfolio characteristics as in Table 3 (coefficients shown). We also add two additional controls in specifications (3), (6) and (9). These are log *Scope 1/Revenue*, and *Carbon Disclosure %*. The dependent variable *Climate Revenue %* is available for 2016-2019. Further, we regress yearly changes in the measures as well as decomposing those into "portfolio re-weighting" and "corporate changes" as in Table 3.The main variables of interest are dummies indicating if the institution is a member of the CDP initiative. Panel A shows the regressions for all institutional investors, Panel B for those headquartered in a country with an emissions scheme in a given year, and Panel C for those who are not headquartered in a country with a carbon pricing emission scheme. Definitions of the variables are provided in Appendix A. All specifications include year fixed effects. Standard errors are clustered at the investor level. The Dependent variables are all forwarded by one period. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: All Institutional Investors

	Green Revenue % (t+1)			Δ2 Total Green Revenue % (t+1)			Δ2 weights-only Green Revenue % (t+1)			Δ2 revenue-only Green Revenue % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.483***	0.337***	0.344***	0.221***	0.231***	0.218***	0.165*	0.184*	0.182*	-0.114***	-0.084***	-0.084***
	[0.099]	[0.099]	[0.098]	[0.073]	[0.074]	[0.073]	[0.096]	[0.097]	[0.098]	[0.031]	[0.032]	[0.032]
log Scope 1/Revenue			0.376***			-0.022			0.013			-0.093***
			[0.040]			[0.033]			[0.047]			[0.016]
Carbon Disclosure %			-0.001			0.004**			0.001			0.001
			[0.002]			[0.002]			[0.003]			[0.001]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17889	17876	17827	8114	8109	8066	3887	3886	3846	17889	17876	17827
Adjusted R^2	0.034	0.063	0.083	0.002	0.006	0.007	-0.000	-0.001	-0.001	0.585	0.588	0.590

Panel B: Institutional Investors based in an Emissions Scheme Country

	Green Revenue % (t+1)			Δ2 Total Green Revenue % (t+1)			Δ2 weights-only Green Revenue % (t+1)			Δ2 revenue-only Green Revenue % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.526***	0.481***	0.457***	0.080	0.102	0.102	0.089	0.068	0.070	-0.126***	-0.089*	-0.082*
	[0.158]	[0.155]	[0.152]	[0.108]	[0.108]	[0.108]	[0.146]	[0.146]	[0.146]	[0.048]	[0.049]	[0.049]
log Scope 1/Revenue			0.485***			-0.010			-0.089			-0.095***
			[0.104]			[0.079]			[0.105]			[0.036]
Carbon Disclosure %			0.012**			-0.000			-0.001			-0.004*
			[0.006]			[0.005]			[0.005]			[0.002]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4080	4080	4076	1877	1877	1875	911	911	910	4080	4080	4076
Adjusted R^2	0.042	0.113	0.142	-0.001	0.006	0.005	-0.003	0.006	0.006	0.652	0.658	0.660

Panel C: Institutional Investors based outside an Emissions Scheme Country

	Green Revenue % (t+1)			Δ2 Total Green Revenue % (t+1)			Δ2 weights-only Green Revenue % (t+1)			Δ2 revenue-only Green Revenue % (t+1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CDP	0.457***	0.277**	0.303**	0.316***	0.322***	0.303***	0.224*	0.246*	0.248*	-0.126***	-0.088**	-0.095**
	[0.129]	[0.132]	[0.130]	[0.104]	[0.107]	[0.106]	[0.134]	[0.138]	[0.138]	[0.042]	[0.043]	[0.043]
log Scope 1/Revenue			0.399***			-0.019			0.034			-0.103***
			[0.042]			[0.036]			[0.053]			[0.017]
Carbon Disclosure %			-0.006***			0.004**			0.001			0.002**
			[0.002]			[0.002]			[0.003]			[0.001]
Investor Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13809	13796	13751	6237	6232	6191	2976	2975	2936	13809	13796	13751
Adjusted R^2	0.013	0.037	0.060	0.003	0.007	0.008	-0.001	-0.001	-0.001	0.566	0.568	0.570

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$