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

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Abstract

We study how institutional investors that join climate-related investor initiatives are actively decarbonizing their equity portfolios. Decarbonization could be achieved by re-weighting portfolios towards lower carbon emitting firms or alternatively via targeted engagements with portfolio companies to reduce their emissions. Our analysis suggests that portfolio re-weighting is the predominant strategy to green their portfolios, in particular by investors based in countries with carbon emissions pricing schemes. We do not uncover much evidence of engagement even after 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 starting to generate green revenues. Overall, our analysis raises doubts about the effectiveness of investor-led initiatives in reducing corporate emissions and helping an all-economy transition to "green the planet".

JEL: G15, G23, G30, M14

Keywords: climate change, decarbonization, GHG emissions, sustainability, institutional investors, CDP, Climate Disclosure Project, Climate Action 100+

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1. Introduction

Climate change has proven to be a challenging issue to tackle due to the political economy constraints that prevent an agreement on a global pollution-control policy (Tirole, 2012). In the absence of a first-best Pigouvian tax, two of the major tools deployed have been (i) regional carbon emission pricing schemes and (ii) finance-led initiatives to increase transparency on climate change risks in order to channel capital away from high emissions-intensive investments and towards green solutions. A recent survey on climate finance by Stroebel and Wurgler (2021) also identifies carbon taxes and the growing role played by institutional investors in financial markets as likely the most influential forces for climate action.

We focus our attention on the role of investor-led initiatives to combat climate change and how their impact depends on carbon pricing schemes in place. The main initiative was started in 2000 as the Carbon Disclosure Project (CDP) by a group of institutional investors, with the objective to get companies worldwide to voluntarily disclose their greenhouse gas (GHG) emissions and also set reduction targets.[1] Following the Paris Agreement at the 2015 UN Climate Change Conference, a second initiative, the Climate Action 100+, was launched for investors to directly engage with the largest corporate GHG emitters to curb their contribution to climate change. In this paper, we examine both but with a focus more on CDP signatory investors, since that disclosure initiative might have had more time to produce an effect both in terms of portfolio investment decisions but also corporate decision-making. Importantly, it allows us to a have a sufficiently long period to study how the CDP initiative interacts with the rollout of regional schemes to price the external costs of GHG emissions (with the largest scope one being the EU ETS "cap and trade" system launched in 2005).

We refer to institutional investors that join these initiatives as "climate-conscious" investors and test if these institutions are actively decarbonizing their equity portfolios and, if so, whether they are just "greening their portfolios" (simply rebalancing away from firms with high carbon emissions),

[1] We use the terms "GHG emissions" and "carbon emissions" interchangeably in the paper for simplicity. While CO_2 is the largest contributor, there are other gases such as methane, nitrous oxide and fluorinated gases (collectively known as GHG) that are responsible for the "greenhouse effect". 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 2052 (IPCC, 2018). According to Climate Action Tracker (2022), even if governments achieve their 2015 Paris Agreement pledges, the planet is likely to warm well above the 2°C limit by 2100.

or if their actions have actually contributed to "greening the planet" (by helping reduce emissions from their portfolio companies). As theorized by Oehmke and Opp (2022), a coalition of climate-conscious investors could help address the climate challenge by collectively taking the role of a large socially responsible fund that reduces negative externalities arising from dirty production and financing constraints related to clean production such that it tilts the equilibrium towards lower corporate emissions. This model assumes that socially responsible investors at least partly internalize the social cost of carbon emissions. On the other hand, if investors care more about their own portfolios, they might take actions that only reduce the exposure to climate change on the specific firms they are invested in. Biais and Landier (2022) also highlight that the payoff to these responsible investors depends on government emissions regulations becoming tighter. In their survey of large institutional money managers, Krueger, Sautner, and Starks (2020) provide evidence that a combination of financial, reputational and regulatory considerations are key drivers as to why investors care about climate risks. It is therefore important to examine how portfolio decarbonization strategies by investors interact with existing government policies to price carbon emission externalities.

Our study compares portfolio-level carbon metrics of climate-conscious investors to other institutional investors that have not joined the voluntary climate initiatives. Guided by the literature on "exit" (divestment) versus "voice" (engagement) in promoting socially desirable outcomes (Broccardo, Hart and Zingales, 2022), we conjecture that climate-conscious investors could choose to either divest faster from portfolio companies with high emissions and/or alternatively opt to engage more with these companies. Importantly, we also study how these institutional investor climate initiatives interact with the national or regional carbon emission pricing schemes. Climate-conscious investors based in countries with these schemes should have stronger incentives to decarbonize their portfolios because the social price of carbon is non-zero and these institutions start to face greater reputational concerns or may worry about increasing future climate regulation.

To answer these research questions, we combine corporate GHG emissions data with global institutional equity holdings to calculate portfolio-level carbon metrics from 2005 to 2019. We conduct tests on the year-on-year changes in portfolio carbon metrics to investigate if climate-conscious

institutional investors (which we define as CDP signatories that receive more accurate emission information on their investee firms) are decarbonizing their portfolios faster than other institutional investor peers that are not supporting CDP. We uncover some weak evidence but this average effect, however, masks substantial heterogeneity. We document that CDP investors domiciled in jurisdictions with carbon emission schemes decarbonize their portfolios at a rate of about 3 percentage points faster than other non-CDP institutional investors. In contrast, CDP investors based outside an emissions scheme (for example, those based in the U.S. where there is no federal carbon pricing) do not actively decarbonize relative to their other institutional peers. This -3% faster decarbonization rates is economically meaningful as UNEP (2019) estimated a required annualized decrease 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 investor-led initiatives to reduce GHG emissions, consistent with our hypothesis that lowering GHG emissions is a more salient issue in countries that increasingly price the social cost of carbon.

Next, we test the different strategies that institutional investors can pursue to achieve portfolio decarbonization. It can be achieved either by institutions reducing their portfolio stakes in the top GHG emitters and rebalancing towards lower GHG emitters (*Portfolio Re-weighting*) or through targeted engagement with the portfolio companies to reduce their GHG emissions and greening their business models (*Corporate Changes*). We therefore decompose the total change in an investor's portfolio carbon emissions into (1) a component that comes from the investor changing its portfolio weights and (2) a component coming from the 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 therefore mostly "greening their portfolios". In contrast, improvements in portfolio emissions that result from corporate changes whereby portfolio firms become less polluting over time suggest that investors may, at least to some extent, be engaging with firms to lower their emissions and help "green the planet". Our results show that portfolio re-weighting (and not corporate changes) explains most of the faster decarbonization by CDP investors and

that this portfolio greening is concentrated in institutions that are domiciled in emissions scheme jurisdictions. We also observe that these results hold when we expand carbon metrics to capture not just the direct GHG emissions stemming from operations that are owned or controlled by the portfolio firms (Scope 1) but also their indirect emissions (Scopes 2 and 3).

Our failure to uncover large-scale evidence on corporate changes suggests a lack of systematic investor engagement by CDP signatories with portfolio companies on their carbon emissions. However, it may be the case that engagement strategies need to be targeted on the most polluting firms, take time to materialize, or require engagement-focused investor initiatives. When we isolate the top 100 Scope 1 emitting firms in each year (that concentrate a large fraction of total emissions) and examine two-year engagement horizons, we continue to find mostly portfolio re-weighting but also some (albeit weaker) evidence of corporate changes. 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 2015 Paris Agreement to specifically target the world's 100 largest corporate GHG emitters. Investor signatories of CA100+ decarbonize faster their but again mostly via portfolio re-weightings away from high-emission companies. Overall, we conclude that there is not much evidence of corporate changes, but the caveat with this analysis is that engagement-focused initiatives may be more recent and not have yet had the time to produce effects during our sample period.

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 working on transition to a green economy. Specifically, we examine how investor portfolios are exposed to firms developing green technologies to limit and adapt to climate change (proxied by patents as in Cohen, Gurun, and Nguyen, 2021, Hege, Pouget, and Zhang, 2022 and Bolton, Kacperczyk, and Wiedemann, 2022) and starting to generate 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 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. Again, a caveat is the limited

time series in our analysis which might be a consequence of our sample period covering still the early stages of the green transition.

How important is the scale of decarbonization of institutional investors' equity portfolios in aggregate we document in the paper? Our analysis shows that between 2005 and 2019 the portion of total industrial emissions that come from the direct emissions of publicly listed firms grew from 30% to 41% of total global CO2-equivalent emissions (Panel A Figure 1).[2] We then split the GHG emissions by public firms into the fractions attributable to institutional investors, closely held shares, and other minority shareholders in proportion to the ownership stake held by each group in their portfolio firms. We find that the total GHG emissions that can be apportioned to institutional investor portfolios based on their aggregate 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 total market capitalization over the same period (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 actively decarbonizing their portfolios relative to other investor groups. In aggregate, our tests suggest that this is achieved primarily by tilting away and therefore selling their shares in high-carbon emission companies to the hands of non-institutional investors who may have less incentives to tackle climate change. 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 literature on how financial market participants incorporate information on firms' climate risk exposures (e.g., Bolton and Kacperczyk (2021a, 2022a), Pastor,

[2] Part of the growth in the share of total emissions that come from publicly-listed firms in Figure 1 is due to the increased coverage by the corporate GHG data provider (S&P Trucost) but it is important to note that the majority of industrial GHG emissions still come from non-public entities (The Economist, 2020) and therefore beyond the reach of public equity investors. However, institutional investor decarbonization is also observed if we focus on just the firms that are part of MSCI ACWI (a benchmark that many international institutional investors track) as we still find that despite institutional ownership having increased, their aggregate GHG footprint actually shrunk over the sample period.

Stambaugh, and Taylor (2021, 2022) and Hsu, Li and Tsou (2023)).[3] Bolton and Kacperczyk (2021b) examine the effects of carbon emission disclosures on stock returns and document that one cost of disclosing is increased divestment by institutional investors. Bolton and Kacperczyk (2022b) also study whether climate-related firm commitments via CDP and the science-based target initiative (SBTi) lead to a reduction in carbon emissions but the effect is small and concentrated in companies that already have lower carbon emissions (and not to those that need to reduce their emissions the most). Our main results on portfolio re-weighting suggest that investors are primarily greening their portfolios and pushing the problem of carbon emissions on to other investor groups, making the negative externality "someone else's problem". Such behavior could be further exacerbated if firms are also decarbonizing via plant divestments documented by Duchin et al (2022).

Our focus is on the potential role for coalitions of large institutional investors to make a green equilibrium more likely (Oehmke and Opp, 2022 and Biais and Landier, 2022). Most of the existing literature has examined these issues from a corporate lens. Ilhan et al. (2023) documents a positive association between climate-conscious institutional ownership and better firm-level climate risk disclosure. Flammer, Toffel, and Viswanathan (2021) look at the role of shareholder activism campaigns while Azar et al. (2021) document the engagement efforts by the "Big Three" institutional investors. Cohen, Kadach and Ormazabal (2022) also find that CDP signatories positively influence firm disclosure. Our study takes an alternative perspective by examining the topic from the lens of institutional investor portfolios. We document that the dominant portfolio decarbonization strategy by CDP investors has not been via engagement (corporate changes) but rather through divestment (portfolio re-weighting) especially in geographies with carbon pricing policies. We conclude that the effect of re-weighting actions of investors that are part of these climate initiatives is likely too small to have a meaningful impact on the overall greening of the economy. In a recent paper, Pedersen (2023) also

[3] While we do not attempt to survey the whole literature, our paper is also related more broadly to research on climate finance (Hong, Karolyi, and Scheinkmann (2020) and Giglio, Kelly, and Stroebel (2021)), 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 (Dimson et al. 2015, 2022; Edmans, Levit and Schneemeier, 2022).

argues that green finance working through the cost of capital may be ineffective compared to the preferrable mechanism suggested by economic theory (carbon taxes or allowances).

While some of the papers mentioned above examine investor engagement, other researchers have focused more extensively on the issue of portfolio divestment.[4] Choi et al. (2022), for instance, show that an increase in climate awareness leads to stock prices of public high-emission firms falling and also divestment by institutional investors. However, Berk and van Binsbergen (2022) evaluate the quantitative impact of ESG divestitures more generally and conclude that these may have little impact. Atta-Darkua (2020) examines implications for firm equity value and ownership structure when a large institutional investor publicly excludes a firm from its portfolio due to unethical behavior. Our paper takes a wider lens on portfolio decarbonization and focuses not just on titling away based on corporate carbon emission levels but also titling in towards companies developing clean technology solutions.

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. With funding from grants and investor membership fees, CDP is a non-profit organization founded in 2000 as the Carbon Disclosure Project in order to that collect and distribute information on firm-level exposure to, and management of climate risks (https://www.cdp.net/en/info/about-us/20th-anniversary). 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.

[4] 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). A broader version is exclusionary ethical investing (Heinkel, Krauss, and Zechner (2001), Hong and Kacperczyk (2009) and Davies and van Wesep (2018)).

In the later part of our analysis, we also examine membership in the Climate Action 100+ (CA100+), an investor initiative focused on engagement (https://www.climateaction100.org/). Launched in 2017, this investor coalition engages with the global top 100 (subsequently expanded to the top 166) public-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 to identify 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.[5] 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 more than 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, asset owners accounted for a larger proportion of the early cohort of signatories but the percentage of investment managers in CDP increased over time.[6] 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 focused initiative.

[5] 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 and 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 member, but Fidelity Management & Research Co. LLC (US) is not.

[6] 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 since their equity assets will be part of their respective investment managers' portfolio filings.

To study the interaction between public policies and private initiatives to reduce GHG emissions, we split investors depending on whether these are headquartered in a country with an active carbon emission pricing scheme in a given year or not. For this purpose, we use the World Bank Carbon Pricing Dashboard to identify countries with carbon pricing instruments, including taxes and emission trading schemes.[7] 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. 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 the carbon content of fossil fuels (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 countries with carbon emissions pricing schemes were CDP members by the end of sample period while this was the case for only 5 of the top 10 domiciled outside an emission scheme country (most prominently the U.S. which does not have a federal carbon tax and Canada which started one only in 2019). This difference is even more pronounced for CA100+ which has no member from the top largest US institutions – one potential explanation is that the level of commitment required with joining CA100+ may be incompatible US fiduciary duties which have been shown to limit incorporation of environmental or other ESG considerations (Gibson Brandon et al. 2022). Logit regressions in Table IA.2 in the Internet Appendix 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*).

[7] 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. For details on ETS see https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en and Bolton, Lam and Muuls (2023).

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.[8] Trucost standardizes and validates the firm-level emission data. The sample spans from 2005 to 2019 and by the end of the period covers over 15,000 publicly listed firms representing over 95% of the total world market capitalization. We focus our analysis on 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.[9] 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, 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 covered by Trucost grew from about 9 gigatons (billion tons) of CO2e in 2005 to close to 16 gigatons of CO2e in 2019.[10] In aggregate, corporate emissions by publicly listed firms rose from 30% to 41% of total global CO2e emissions estimated by EDGAR[11] 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 in the Internet Appendix show that there has been an increase in the rates of corporate GHG disclosures, either full or partial. The small dip in percentages in 2016 is due to the coverage expansion of the Trucost proprietary carbon estimation model that year.

[8] 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.

[9] 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.

[10] 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).

[11] 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).

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. The first measure 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 institutional investor's position in a company is equal to 1% of the company's market capitalization, then the institution "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 emission footprint 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 total public firm emissions 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.[12]

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 or other factors which could lead to re-pricings of firms due to their carbon emissions. *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. We focus on absolute rather than relative GHG emission portfolio measures because such measures better reflect an investor's contribution to climate change. To achieve Net-Zero targets, companies must curb their absolute emissions, irrespective of whether they are more efficient in their use of carbon emissions (Bolton and Kacperczyk, 2021a, 2022a). However, , we also examined relative exposure metrics commonly 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 equity market value held by an investor. Figure IA.1 in the Internet Appendix illustrates that a similar pattern of portfolio decarbonization by institutional investors is observed using these alternative measures. We also replicate our absolute emissions regressions results in the subsequent sections of the paper using alternatively these relative emissions measures. Tables IA.12 to IA.17 present this robustness check which is important given the debate on appropriate carbon metrics (see Aswani, Raghunandan, Rajgopal (2023) and the reply by Bolton and Kacperczyk (2023)).

To provide some illustrative examples, Figure IA.3 in the Internet Appendix shows the GHG emissions metrics for four prominent institutional investors: the "Big Three" investment management

[12] 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.

companies (Blackrock, State Street, Vanguard) and the world's largest sovereign wealth fund (Norges Government Pension Fund Global). Panel A shows that all four institutions have gradually reduced their portfolio *Scope 1* average emissions. However, since the aggregate size of their equity portfolios have been rising (Panel E), so has their total portfolio *Scope 1 Footprint* (Panel B). [13]

2.3. Summary Statistics

Table 2 provides summary statistics for the sample used in subsequent regression analysis. Besides the carbon metric and green business variables, we account for investor and portfolio characteristics 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 investment style (*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

In order to study whether investor-led initiatives help address climate change we begin our analysis by examining the time trends in institutional investors' exposure to climate risk by plotting time series averages of portfolio carbon emission metrics. Panel A of Figure 2 shows a downward trend in the *Scope 1* portfolio emissions measure but decarbonization is also a common feature for the MSCI ACWI index (a large cap benchmark that is commonly tracked by major institutional investors around the world). As a first indication that public carbon pricing policies matter, we see that portfolio decarbonization is concentrated among those investors based in countries with carbon emission pricing schemes (Panel B), with it being less pronounced for investors located elsewhere (Panel C).

[13] In unreported tests, we find that the results of our paper are robust to removing the Big Three and GPFG from our sample.

We next examine portfolio decarbonization by institutional investors in a multivariate regression model. We compute decarbonization by calculating log differences between periods $t + 1$ and t which allow us to interpret the dependent variable as percentage annual changes. For each portfolio carbon metric, we run two specifications. The 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) and winsorize all continuous variables at the 1% and 99% cutoff levels each year. We include year fixed effects to absorb the yearly decarbonization rates of companies in the stock market. The main variable of interest is *CDP*, a dummy that identifies climate-conscious investors, and the coefficient captures the incremental decarbonization rate of these investors relative compared to those 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. The evidence of stronger decarbonization by CDP investors is even weaker when focusing on annual percentage changes in *Scope1*, with the effect becoming insignificant once portfolio controls are included (column 2).

While our paper focuses on 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. (2023) and Bolton and Kacperczyk (2022)) as well as SBTi efforts (Bolton, Kacperczyk and Samama, 2022) using data we gather from CDP data spanning from 2010 to 2018. As expected, Panel D of Table IA.3 in the Internet Appendix shows that indeed the portfolios of investors that join the CDP tend to have between 3 and 7 percentage points higher levels of firm emission disclosures (both in terms of *Carbon Disclosure %* and *Full Carbon Disclosure % (95%+)*) and 2 to 7 percentage points higher prevalence of corporate emission reduction targets (*Emissions Target %*) but not consistently higher verified science-based target setting (*Science-based Emissions Target %*). However, the regression results with investor fixed effects do not show 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 provides only suggestive evidence, and we perform more formal tests below to better tease out the two portfolio decarbonization strategies.

We decompose the total change in portfolio carbon emissions into: (1) the component that comes from investors changing their portfolio weights in different firms (*Portfolio Re-weighting*); as well as (2) the component of the effect of portfolio firms' emissions improving over time (*Corporate Changes)*. To separate the two components, we allow only one of them to change at a time and ignore interaction terms. 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 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 (column 5). Their *Scope 1 Footprint* is also decreasing faster by roughly the same percentage once we account for investor portfolio characteristics (column 6). In contrast, the corporate changes results (see columns 7-8) are statistically insignificant, suggesting that portfolio re-weighting is the primary method that CDP investors employ to decarbonize their portfolios. However these average effects mask 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 to study how private investor initiatives such as the CDP interact with government policies to reduce GHG emissions. Investor-led initiatives co-exist with carbon emission trading schemes in some jurisdictions, absent a first-best global carbon cap or tax scheme. We conjecture that climate-conscious investors located in regions with carbon pricing schemes have higher incentives to decarbonize their portfolios. First, institutions affected by carbon emission schemes may be more concerned about current and future regulation on their investee companies. (Biais and Landier (2022) and Ramadorai and Zeni (2021)). Second, institutions located in regions with carbon taxes or emission caps might face stronger reputational concerns to decarbonize their portfolios when the social cost of carbon becomes more material. Survey evidence from institutional investors confirms that the protection of their reputation and legal duties are two important motivations for considering climate risks (Krueger, Sautner, and Starks 2020).

To test these interaction effects, 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 (column 8).

Next, we decompose the total changes into those stemming from portfolio re-weighting vs. corporate changes (described in Section 3.1 and Appendix B). The results in Table 4 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 (Panel B, columns 1-4) where the social cost of carbon is more salient. These are mostly European-based CDP members since the world's first emissions trading system (EU ETS) started in 2005 and remains the largest 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, columns 7-8). Combining these contrasting results, it could indicate a substitution effect between government and investor-led actions on climate change.

We can also comment on the economic magnitude of these effects. Across the two portfolio carbon metrics, CDP investors inside an emissions scheme decarbonize 4 annual percentage points faster 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 drop 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.

We conduct several robustness tests but report these in the Internet Appendix to conserve space. In Table IA.4, we conclude that portfolio re-weighting is still the dominant decarbonization strategy if we restrict our tests to the subset of carbon emissions that stem from portfolio firms in three sectors that have the largest total GHG emissions (materials, utilities, and energy). In Table IA.5, 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, but this is not the case for CDP investors outside an emissions scheme. In Table IA.6, we investigate if CDP 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 find that CDP investors do not reweight their portfolios towards firms that have achieved the largest reductions in emissions, so our results suggest there is more "tilting away" than "tilting towards". Table IA.8 checks if our results could be driven by emissions scheme CDP investors owning more firms headquartered in a country under an emissions scheme, but conclude that it does not appear that results are driven by higher corporate exposure to emissions scheme stocks but rather by the location of the investor. Finally, to account for the fact that some investors have larger portfolios than others, in Table IA.9 we run weighted regressions which put more weight on the observations of investors with more assets under management but the results are similar to those in the main regressions in Table 4.

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) suggest that

firms may outsource their direct Scope 1 emissions to their suppliers. In Table 5, we examine changes across investors' full portfolio emissions (*Scope 1 + 2 + 3*) including not just direct emissions but also those from purchased electricity (Scope 2) and supply chain (Scope 3). [14] 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. In Table IA.7 of the Internet Appendix we show that CDP investors reduce the ratio of their portfolio Scope 1 to total emissions, particularly those based in a country with an active emissions scheme. Taken together, the results suggest that CDP investors are decarbonizing their total portfolio emissions, despite the fact that there may be some portfolio emissions "outsourcing".

Our results raise the question whether portfolio re-weighting may still have real effects by imposing higher cost of capital on firms that are being divested by CDP investors. To provide an upper bound on the impact of re-weighting, we calculate an estimate based on Berk and van Binsbergen (2022). If we assume the pool of CDP investors were to divest all firms in the three material sectors (materials, energy, and utilities), we estimate a change in the cost of capital for those firms of 15 basis points.[15] This seems 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. Nevertheless, divestment could have broader effects by changing social preferences and impact on corporate decision-making. For example, Becht et al. (2023) argue that divestment campaigns can change economic narratives and increase stranded asset risks of high-emission activities while Gormsen

[14] Scope 2 emissions comprise companies' indirect GHG emissions from the purchased energy and Scope 3 those from upstream supply chain and purchased materials and also downstream emissions inherent in the use of its products and services (these definitions follow the Greenhouse Gas Protocol https://ghgprotocol.org/). Though Scope 2 and 3 emissions are a growing focus for investors since these constitute a large part of total GHG emissions for many industries, an important caveat is that these are often not consistently disclosed 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 (which we ignore).

[15] We adapt the Berk and van Binsbergen (2022, formula in 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.

et al (2023) present evidence that green firms have higher discount rates and perceive their cost of capital to be substantially lower than that of brown firms following the 2015 Paris Agreement.

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.

We start by examining possible investor engagement with the top 100 emitting firms which are deemed most important to tackle climate change. Figure IA.4 in the Internet Appendix shows that, in 2005, over two thirds of the overall carbon footprint of institutional investors can be attributed to those top 100 emitting firms (68%), falling to just under half of total emissions in 2019 (46%). It also shows that other investors decarbonized at a lower rate (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 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 faster than non-CDP investors (columns 3-4 of Panel B). There is some evidence of corporate changes for those investors based outside a scheme, who achieve 0.9 percentage points faster footprint decarbonization (column 6 of Panel C).

Engaging with portfolio firms to achieve corporate changes can be a more involved process taking multiple years to deliver tangible results, unlike portfolio re-weighting which can be implemented within a year via stock rebalancing. To test this hypothesis, we run regressions with two-year portfolio changes in Table 7. This analysis shows that the magnitude of decarbonization via portfolio-reweighting is higher for CDP investors for those institutions based in a country with emission schemes, relative to non-CDP investors (Panel B). There is again some evidence of corporate changes in the portfolios of climate conscious investors for those investors outside an emissions scheme (column 6 of Panel C).

We next turn our attention to the more targeted engagements via the CA100+ investor initiative. The pressure to engage 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 target corporations). 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 CA100+, with over three-fourths of CA100+ members also being 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 members of CA100+. 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 members 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, the results are not very clear (Panel C).

Overall, we conclude that there is not much evidence of corporate changes. One caveat with this analysis is that engagement-focused initiatives may be more recent and not have yet had the time to produce effects during our sample period. The other important limitation might be that US institutional investors have legal impediments on coordinated engagement in environmental issues. As shown in Table IA.1 CA100+ did not immediately attract membership from top US institutions. Prior research has highlighted how the uncertainty over US fiduciary duties has historically limited the scope of ESG incorporation (Gibson Brandon et al. 2022) and more recently institutions like Blackrock (which joined CA100+ only in 2020) have also had to defend themselves against accusations of "acting in concert"and collusive behavior by Republican lawmakers.[16]

4. Greening of Business Activities by Climate-Conscious Investors

[16] Reuters, "BlackRock defends work with climate groups amid Republican attacks" (September 7, 2022)

In this section, we study the role of institutional investors in promoting 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 may 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, it may become increasingly hard with each passing year to achieve the required reductions to reach net-zero emissions in alignment with the Paris Agreement.

4.1. Green patents

In order to measure an investor portfolio's exposure to firms developing climate-related technologies we collect data from the Global Corporate Patent Dataset (GCPD) developed by Bena, Ferreira, Matos, and Pires (2017). We then identify which patents are on technology classes related to climate change mitigation and adaptation using the OECD environmental-related mapping developed by Hascic and Migotto (2015) and used by Cohen, Gurun and Nguyen (2021) and Hege, Pouget, and Zhang (2022). Once we classify the set of climate patents by each public-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 in GCPD, 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 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 not statistically significant. In Internet Appendix Table IA.10 we conduct the same analysis with two-year changes instead of yearly changes and find similar results.

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. One caveat is that these green patent measures capture only a fraction of inventions as some new green technologies may not be patented. Another limitation is that the GCPD 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. The 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 selling electrified cars, wind turbines, solar panels or providing carbon emission monitoring solutions.

To construct these portfolio measures, we access data from FTSE Russell on revenue exposure to green business activities for over 16,000 stocks starting in 2017 and classified using the EU Taxonomy on sustainable activities. 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 determining which economic activities are environmentally sustainable.[17] One caveat with this analysis the short sample period over which we can observe the green revenue data which allows us to run effectively 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 tests whether climate-conscious investors consider measures of green revenue in their investee firms. In Panel A, we find that CDP investors do indeed have a significantly higher exposure to firms generating higher green revenues. However, this effect is economically modest given that the average firm in the portfolios of climate-conscious investors have only about 0.3-0.5 percentage points more green revenues (which translates to 14-20 percent higher green revenues relative to the sample

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

standard deviation). The results suggest that CDP investors increase their exposure to green revenue via portfolio re-weighting (columns 7-9) but there is little evidence of corporate changes (columns 10-12). 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 show higher portfolio green revenues. 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.11 and find consistent results.

We conclude that climate-conscious investors have started to gain higher exposure to green revenue (but not to climate patents) but this is via re-weighting and find no evidence of engagement. One caveat is that this might be a consequence of being in the early stages of transition to green economy and many of the new technologies may not yet generate revenues so it may still be too early to conclude.

5. Conclusions

In this paper, we document how institutional investors are decarbonizing their equity portfolios to reduce their exposure to climate change risks. 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 initiative: the 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 depend on the rollout of government carbon emission pricing schemes. We conclude that CDP investors located in a country with a carbon pricing scheme 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). We continue to find mostly portfolio re-weighting even among CA100+ investors after the 2015 Paris Agreement and do not uncover much evidence of engagement. Finally, while climate action calls for capital to spur the development of green solutions, we fail to find evidence that climate-

conscious investors seek companies developing green technologies or encouraging their portfolio firms to generate significant green revenues.

Overall, our paper raises the concern that addressing the steep challenge posed by climate change and that an all-economy energy transition requires more than portfolio re-weighting that "greens a portfolio" but does not help "green the planet". Institutional investors that decarbonize their equity holdings via portfolio re-weightings may be pushing away the problem to other investor groups that are even less motivated to tackle corporate carbon emissions. This could be a consequence of the early initiatives we study (CDP and CA100+) not asking for explicit investor commitments which is now the case with the ambitious 2022 Glasgow Financial Alliance for Net Zero (GFANZ). Despite its original rapid growth in membership, it has faced backlash for being too binding with Vanguard and other investors recently deciding to withdraw from the Net Zero Asset Managers coalition. These warrant further examination and future research should also examine portfolio decarbonization more holistically to encompass not just public equities but also emissions financed via private equity investments, debt holdings, or project finance.

References:

Aswani, J., Raghunandan, A. and Rajgopal, S., 2023. Are carbon emissions associated with stock returns?. *Review of Finance* (forthcoming).

Atta-Darkua, V., 2020. Corporate ethical behaviours and firm equity value and ownership: evidence from the GPF''s ethical exclusions. *Working paper available at SSRN 3388868*.

Azar, J., Duro, M., Kadach, I. and Ormazabal, G., 2021. The big three and corporate carbon emissions around the world. *Journal of Financial Economics*, 142(2), pp.674-696.

Becht, M., Pajuste, A. and Toniolo, A., 2023. Voice Through Divestment. European Corporate Governance Institute–Finance Working Paper, (900).

Bena, J., Ferreira, M.A., Matos, P. and Pires, P., 2017. Are foreign investors locusts? The long-term effects of foreign institutional ownership. *Journal of Financial Economics*, 126(1), pp.122-146.

Berk, J. and van Binsbergen, J.H., 2022. The impact of impact investing. *Working paper available at SSRN 3909166*.

Bessembinder, H., 2016. Frictional costs of fossil fuel divestment. *Working paper available at SSRN 2789878*.

Biais, B. and Landier, A., 2022. Emission caps and investment in green technologies. *Working paper available at SSRN 4100087*.

Bolton, P. and Kacperczyk, M., 2021a. Do investors care about carbon risk?. *Journal of Financial Economics*, 142(2), pp.517-549.

Bolton, P. and Kacperczyk, M.T., 2022a. Global pricing of carbon-transition risk. *The Journal of Finance* (forthcoming).

Bolton, P. and Kacperczyk, M.T., 2021b. Carbon disclosure and the cost of capital. *Working paper available at SSRN 3755613*.

Bolton, P. and Kacperczyk, M.T., 2022b. Firm commitments. *Working paper available at SSRN 3840813*.

Bolton, P. and Kacperczyk, M., 2023. Are carbon emissions associated with stock returns? Comment. *Review of Finance* (forthcoming).

Bolton, P., Kacperczyk, M.T. and Samama, F., 2022. Net-zero carbon portfolio alignment. *Financial Analyst Journal*, 78(2), pp. 19-33.

Bolton, P., Kacperczyk, M.T. and Wiedemann, M., 2022, The CO2 Question: Technical Progress and the Climate Crisis. *Working paper available at SSRN 4212567*.

Bolton, P., Lam, A. and Muuls, M., 2023. Do Carbon Prices Affect Stock Prices?. *Working paper available at SSRN 4369925*.

Broccardo, E., Hart, O., & Zingales, L. (2022). Exit versus voice. *Journal of Political Economy*, 130(12), 3101-3145.

Choi, D., Gao, Z., Jiang, W. and Zhang, H., 2022. Carbon stock devaluation. *Working paper available at SSRN 3589952*.

Climate Action Tracker, 2022. The CAT thermometer. *Available at https://climateactiontracker.org/global/cat-thermometer/* (November 2022)

Cohen, L., Gurun, U.G. and Nguyen, Q.H., 2021. *The ESG-innovation disconnect: Evidence from green patenting*. *Working paper available at SSRN 3718682*.

Cohen, S., Kadach, I. and Ormazabal, G., 2023, Institutional Investors, Climate Disclosure, and Carbon Emissions, *Journal of Accounting & Economics* (forthcoming).

Dai, R., Duan, R., Liang, H. and Ng, L., 2021. Outsourcing climate change. *Working paper available at SSRN 3765485*.

Davies, S. W., & Van Wesep, E. D., 2018. The unintended consequences of divestment. *Journal of Financial Economics*, 128(3), pp. 558-575.

Dimson, E., Karakaş, O. and Li, X., 2015. Active ownership. *The Review of Financial Studies*, *28*(12), pp. 3225-3268.

Dimson, E., Karakaş, O. and Li, X., 2021. Coordinated engagements. *Working paper available at SSRN 3209072*.

Duchin, R., Gao, J. and Xu, Q., 2022. Sustainability or greenwashing: Evidence from the asset market for industrial pollution. *Working paper available at SSRN 4095885*.

Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F., 2019. Do institutional investors drive corporate social responsibility? International evidence. *Journal of Financial Economics*, 131(3), pp. 693-714.

Edmans, A., Levit, D. and Schneemeier, J., 2022, Socially responsible divestment, *Working paper available at SSRN 4093518*.

European Commission, Joint Research Centre, Olivier, J., Guizzardi, D., Schaaf, E., et al., 2021. GHG emissions of all world countries – 2021 Report.

Flammer, C., Toffel, M.W. and Viswanathan, K., 2021. Shareholder activism and firms' voluntary disclosure of climate change risks. *Strategic Management Journal*, *42*(10), pp. 1850-1879.

Freiberg, D., Grewal, J. and Serafeim, G., 2021. Science-based carbon emissions targets. *Working paper available at SSRN 3804530*.

Gibson Brandon, R., Glossner, S., Krueger, P., Matos, P., & Steffen, T. (2022). Do responsible investors invest responsibly?. *Review of Finance*, 26(6), pp. 1389-1432.

Giglio, S., Kelly, B. and Stroebel, J., 2021. Climate finance. *Annual Review of Financial Economics*, *13*, pp. 15-36.

Goldstein, I., Kopytov, A., Shen, L., & Xiang, H., 2021. On ESG investing: Heterogeneous preferences, information, and asset prices. *Working paper available at SSRN 3823042*.

Hartzmark, S.M. and Shue, K., 2023. Counterproductive impact investing: The impact elasticity of brown and green firms. *Working paper available at* SSRN 4359282.

Hascic, I., and Migotto, M., 2015, Measuring environmental innovation using patent data. OECD Environment Working Paper No. 89.

Hege, U., Pouget, S. and Zhang, Y., 2022. The impact of corporate Climate action on financial markets: Evidence from climate-related patents. *Working paper available at SSRN 4170774*.

Heinkel, R., Kraus, A., & Zechner, J., 2001. The effect of green investment on corporate behavior. *Journal of Financial and Quantitative Analysis*, 36(4), pp. 431-449.

Hong, H., Karolyi, G.A. and Scheinkman, J.A., 2020. Climate finance. *The Review of Financial Studies*, *33*(3), pp. 1011-1023.

Hong, H., & Kacperczyk, M., 2009. The price of sin: The effects of social norms on markets. *Journal of Financial Economics*, 93(1), pp. 15-36.

Hsu, P., Li, K., & Tsou, C., 2023. The pollution premium. *The Journal of Finance*, 78 (3), 1343-1392.

Gormsen, N.J., Huber, K. and Oh, S., 2023. Climate capitalists. *Working paper available at SSRN 4366445*.

Ilhan, E., Krueger, P., Sautner, Z. and Starks, L.T., 2023. Climate risk disclosure and institutional investors. *The Review of Financial Studies*, 36 (7), pp. 2617-2650.

Intergovernmental Panel on Climate Change (IPCC), 2018. Global warming of 1.5°C. Special report. *Available at https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_Low_Res.pdf*.

Krueger, P., Sautner, Z. and Starks, L.T., 2020. The importance of climate risks for institutional investors. *The Review of Financial Studies*, 33(3), pp. 1067-1111.

Matos, P., 2020. ESG and responsible institutional investing around the world: A critical review. *CFA Institute Research Foundation*

Oehmke, M. and Opp, M., 2022. A theory of socially responsible investment. *Working paper available at SSRN 3467644*.

Pastor, L., Stambaugh, R. F., & Taylor, L. A., 2021. Sustainable investing in equilibrium. *Journal of Financial Economics*, 142(2), pp. 550-571.

Pastor, L., Stambaugh, R.F. and Taylor, L.A., 2022. Dissecting green returns. Journal of Financial Economics, 146(2), pp. 403-424.

Pedersen, L.H., 2023. Carbon Pricing versus Green Finance. *Working paper available at SSRN 4382360*.

Pedersen, L. H., Fitzgibbons, S., & Pomorski, L., 2021. Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, 142(2), pp. 572-597.

Stroebel, J. and Wurgler, J., 2021. What do you think about climate finance?. *Journal of Financial Economics*, *142*(2), pp. 487-498.

The Economist, 2020, How much can financiers do about climate change?, June 20 edition.

Tirole, J., 2012. Some political economy of global warming. *Economics of Energy & Environmental Policy*, 1(1), pp. 121-132.

United Nations Environment Programme (UNEP) UNEP, U., 2019. Emissions gap report 2019. *Available at https://www.unep.org/resources/emissions-gap-report-2019*.

United Nations Framework Convention on Climate Change (UNFCCC), 2022, 'What is the Paris agreement?' *Available at https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement*.

Zhang, S. (2022). Carbon Premium: Is It There? *Working paper available at SSRN 4490555*.

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 members 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 as a fraction of 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 (http://stats.oecd.org/wbos/fileview2.aspx?IDFile=0befc58e-d72f-4ff9-b27e-84e446240e34). 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 in more detail the portfolio carbon change measures we analyze in Section 3.2 where we test decarbonization strategies. We decompose the total change in portfolio carbon emissions into: (1) the component that comes from investors changing their portfolio weights in different firms (*Portfolio Re-weighting*); as well as (2) the component of the effect of portfolio firms' emissions improving over time (*Corporate Changes*). To separate the two components, we allow only one of them to change at a time and ignore interaction terms.

1. Total Changes

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

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

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:

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

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

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

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

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

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

3. Corporate Changes

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

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

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

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

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

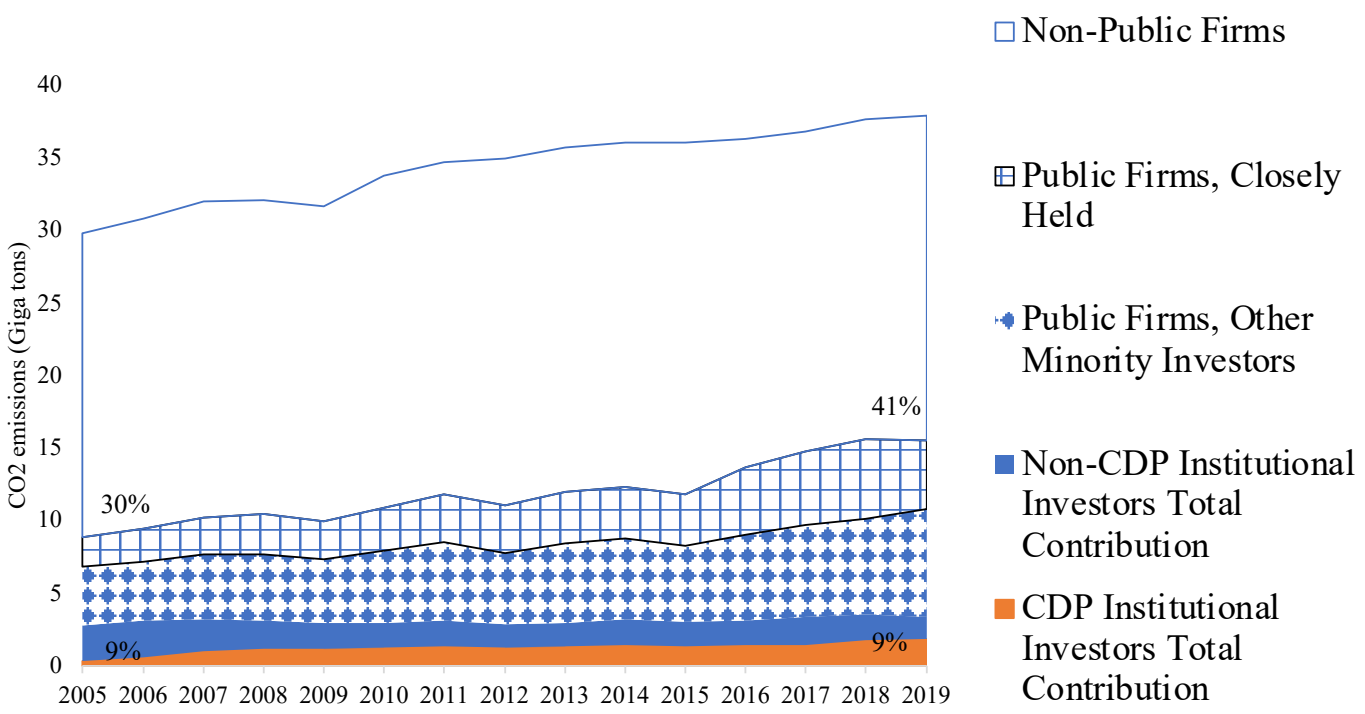
$$= \log\left(\sum_{j=1}^{N_{jt}}\left(\frac{\$\ Shares\ Held_{ijt}}{\$\ Market\ Cap_{jt}}\right) * Scope\ 1\ GHG\ Emissions_{jt+1}\right)$$

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

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

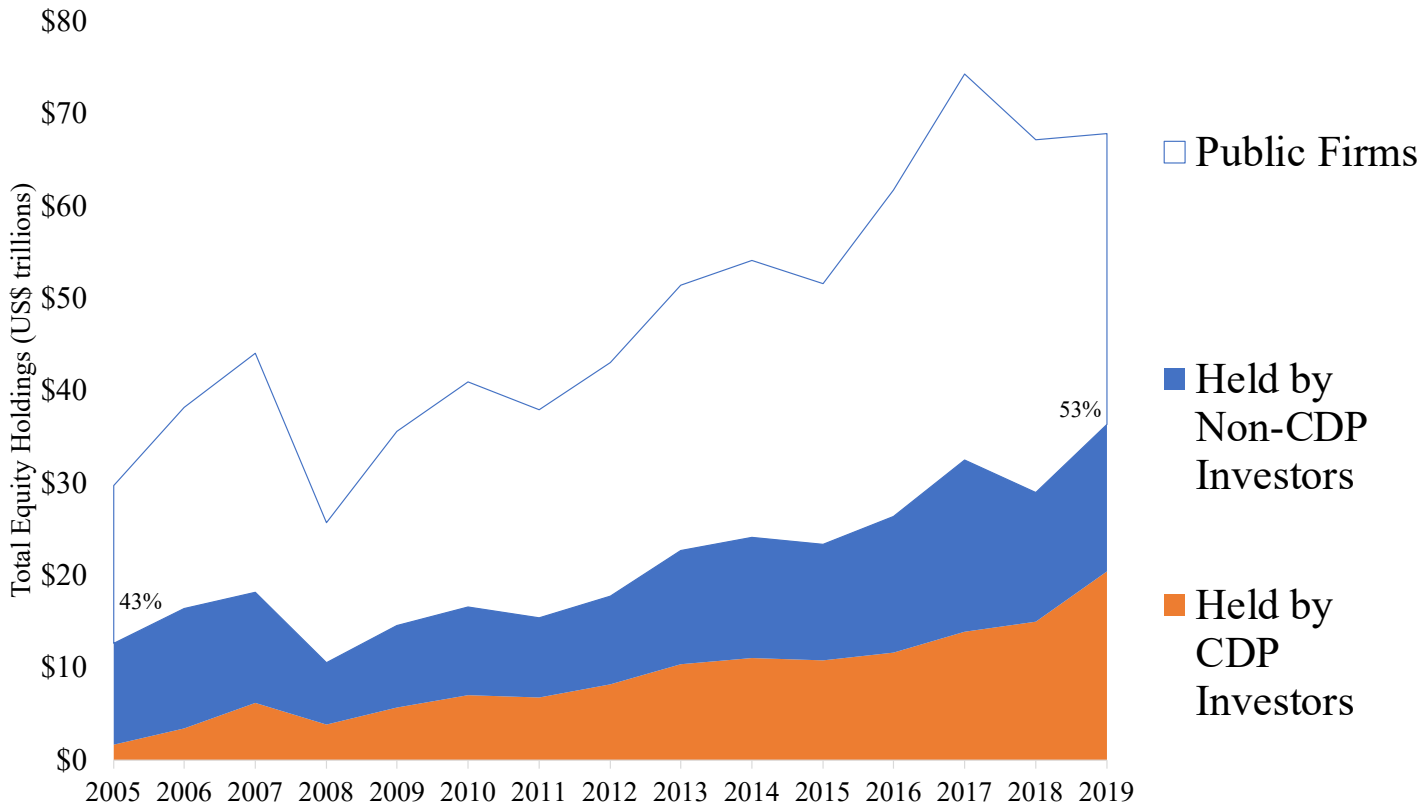
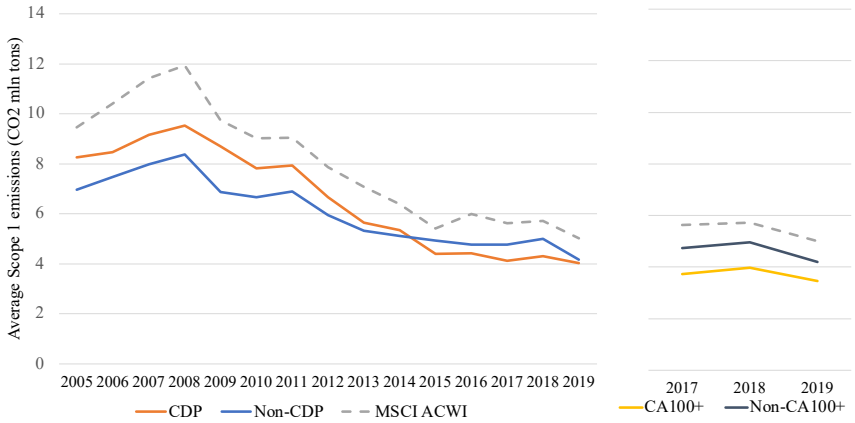


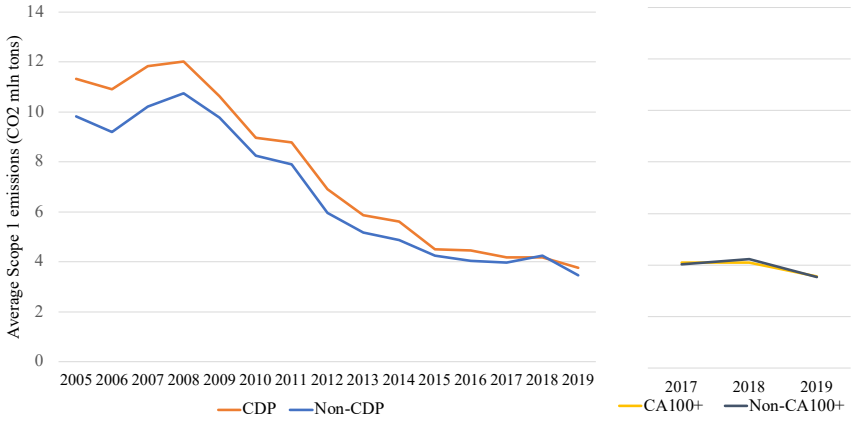
Figure 2: Portfolio Decarbonization by Climate-Conscious Institutional Investors

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

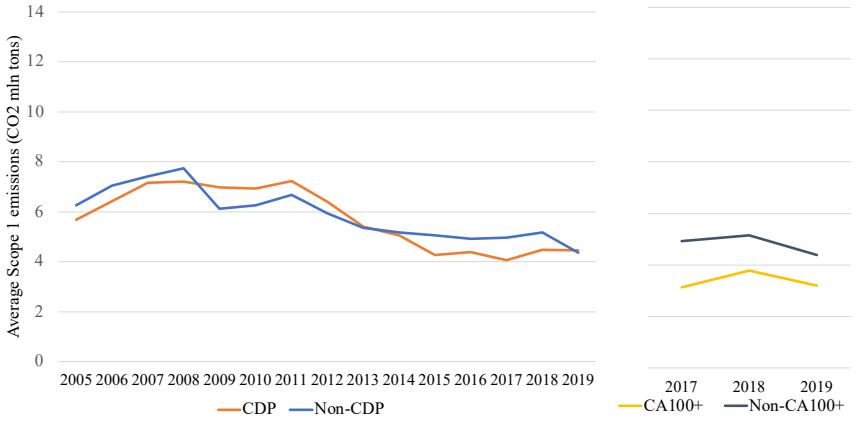
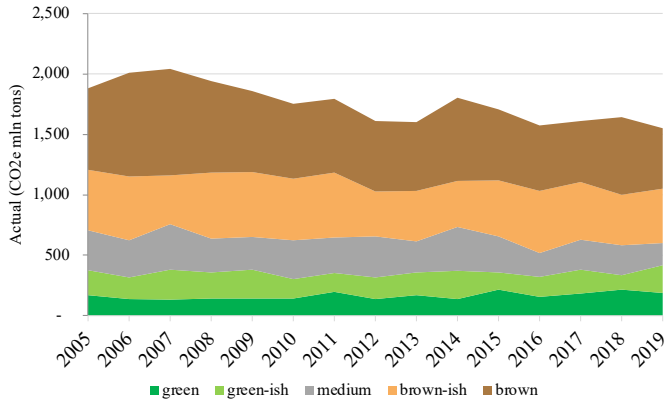


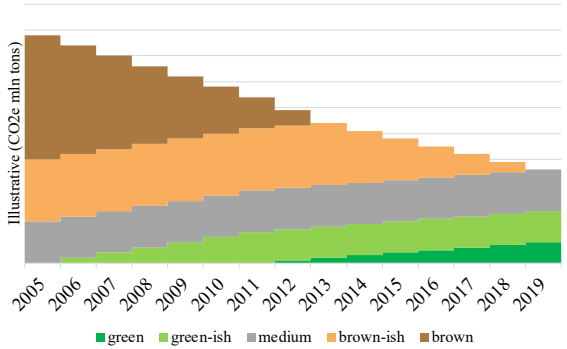
Figure 3: Portfolio Decarbonization Strategies

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

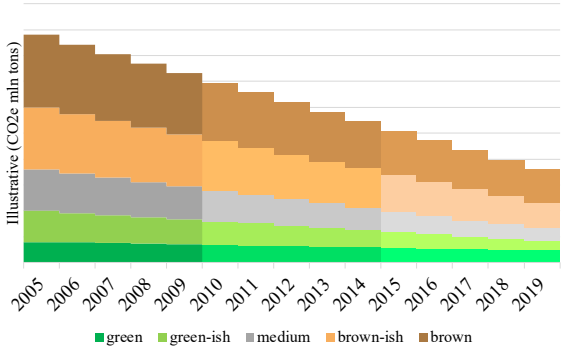


Table 1: Descriptive Statistics for Climate-Conscious Institutional Investors

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 levels variables in our analysis, and Panel B tabulates the data for the change variables. We winsorise all continuous variables at the 1 and 99% cutoff levels.

Panel A: Levels 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: Changes 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

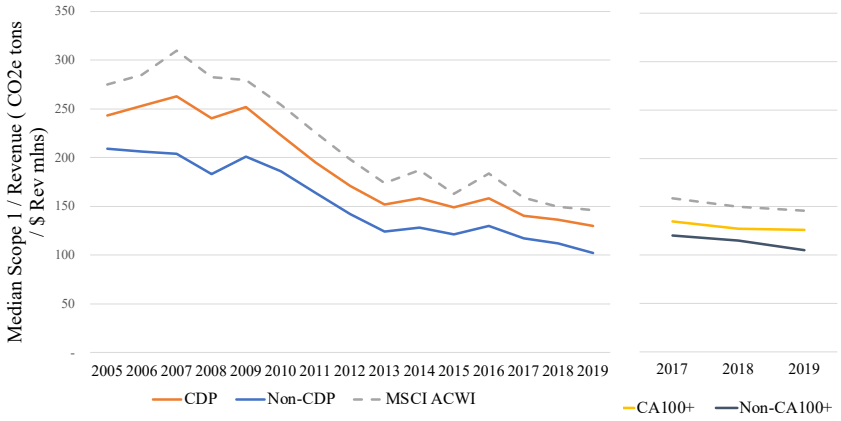
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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.

Panel A: Median Scope 1/ Revenue



Panel B: Median Scope 1/ Portfolio Size

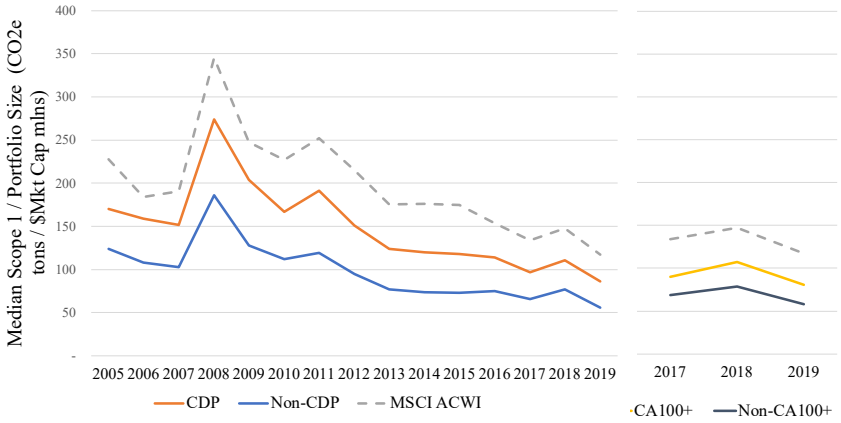
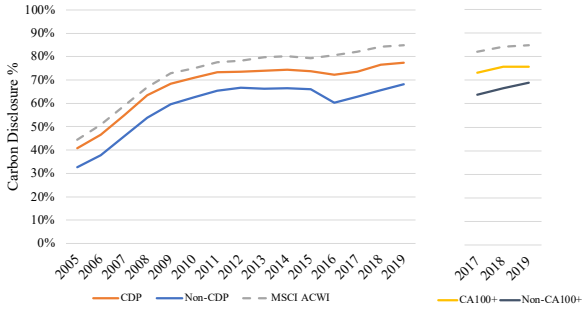


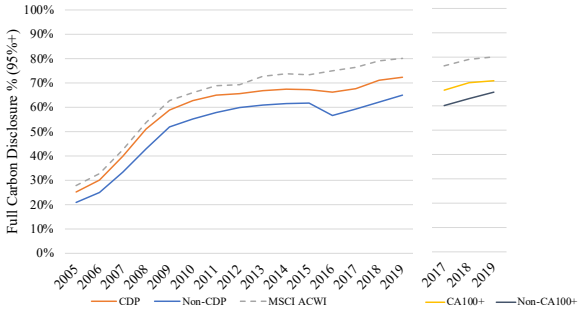
Figure IA.2: Portfolio Carbon Emissions : Corporate Disclosures and Targets

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.

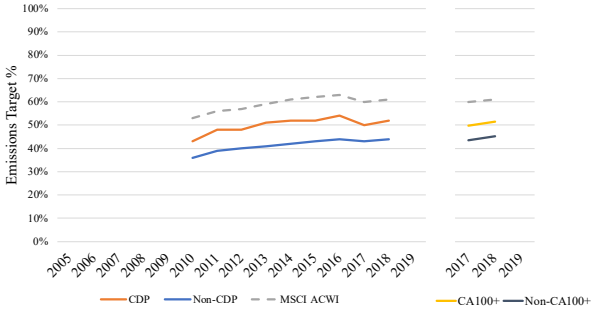
Panel A: Carbon Disclosure %



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



Panel C: Emissions Target %



Panel D: Science-based Emissions Target %

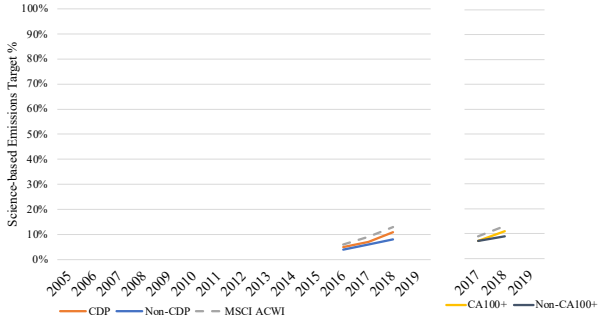
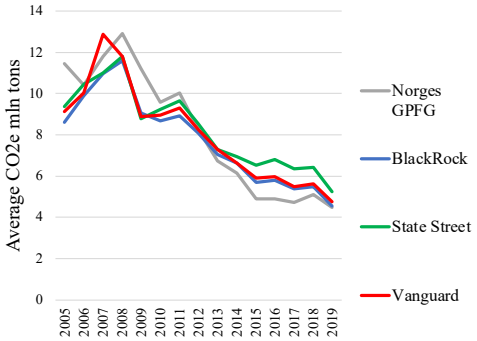


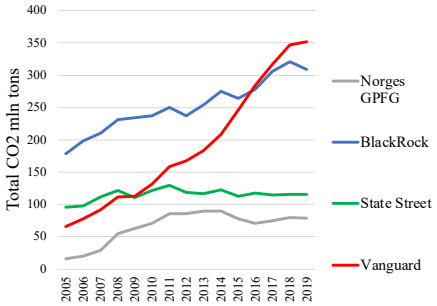
Figure IA.3: Portfolio Carbon Emissions and Equity Holdings for the Big 3 and Norges GPFG

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.

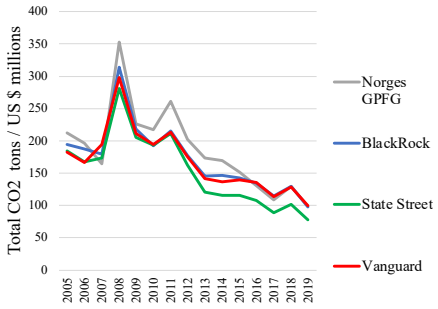
Panel A: Scope 1



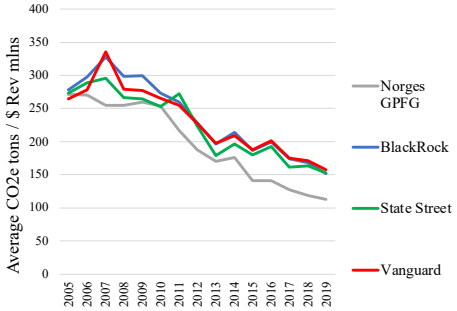
Panel B: Scope 1 Footprint



Panel C: Scope 1 / Portfolio Size



Panel D: Scope 1/Revenue



Panel E: Total Equity Holdings

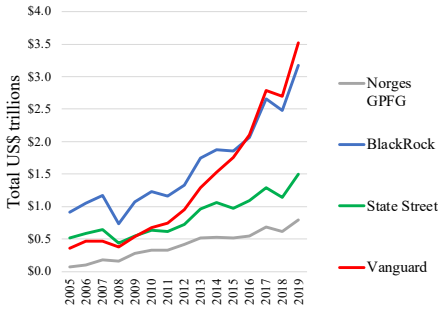


Figure IA.4: Institutional Share of Global Carbon Emissions: Top 100 Emitting Firms

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).

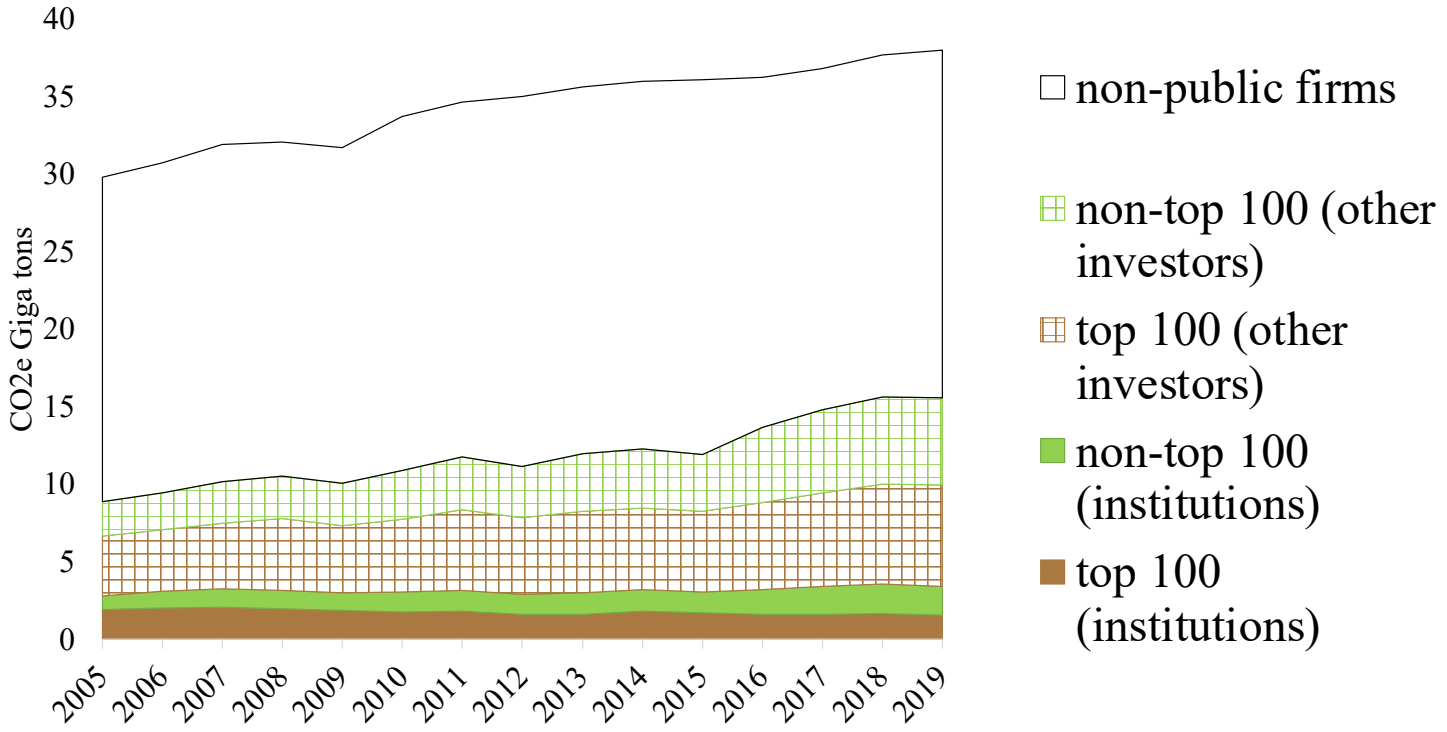


Table IA.1: Top Institutional Investors

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: 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.5: 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) (1)	Δ Total log Scope 1 Footprint Top 100 in Material Sector (t+1) (2)	Δ weights Top 100 in Material Sectors (t+1) (3)	Δ Total log Scope 1 Footprint Top 100 in Material Sector (t+1) (4)	Δ weights Top 100 in Material Sectors (t+1) (5)	Δ Total log Scope 1 Footprint Top 100 in Material Sector (t+1) (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) (1)	Δ Total log Scope 1 Footprint Non-Top 100 in Material Sector (t+1) (2)	Δ weights Non-Top 100 in Material Sectors (t+1) (3)	Δ Total log Scope 1 Footprint Non-Top 100 in Material Sector (t+1) (4)	Δ weights Non-Top 100 in Material Sectors (t+1) (5)	Δ Total log Scope 1 Footprint Non-Top 100 in Material Sector (t+1) (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) (1)	Δ Total log Scope 1 Footprint Non-Material Sectors (t+1) (2)	Δ weights Non-Material Sectors (t+1) (3)	Δ Total log Scope 1 Footprint Non-Material Sectors (t+1) (4)	Δ weights Non-Material Sectors (t+1) (5)	Δ Total log Scope 1 Footprint Non-Material Sectors (t+1) (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.6: 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.7: 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.8: Portfolio Decarbonization Strategies: CDP investors split by % of Portfolios under an Emissions Scheme

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 a member of the CDP initiative, split by whether the investor's equity portfolio has above or below 50% of its assets invested in companies headquartered in a country with an active carbon pricing emissions scheme . 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)
CDP * 50%+ Portfolio under an Emissions Scheme	-0.016	-0.040*	-0.016*	-0.040***	0.139	0.074
	[0.014]	[0.019]	[0.008]	[0.013]	[0.084]	[0.122]
CDP * <50% Portfolio under an Emissions Scheme	-0.010	-0.025*	-0.050*	-0.024	0.000	-0.025*
	[0.014]	[0.012]	[0.024]	[0.027]	[0.016]	[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	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)
CDP * 50%+ Portfolio under an Emissions Scheme	-0.028**	-0.037**	-0.018*	-0.040**	0.132	0.096
	[0.011]	[0.016]	[0.009]	[0.014]	[0.080]	[0.115]
CDP * <50% Portfolio under an Emissions Scheme	-0.018*	-0.016	-0.062***	-0.039	-0.008	-0.009
	[0.010]	[0.013]	[0.020]	[0.030]	[0.011]	[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	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)
CDP * 50%+ Portfolio under an Emissions Scheme	0.006	-0.007	0.003	0.000	0.005	-0.009
	[0.009]	[0.007]	[0.003]	[0.003]	[0.015]	[0.025]
CDP * <50% Portfolio under an Emissions Scheme	0.007	-0.009*	0.011	0.003	0.007	-0.013*
	[0.006]	[0.005]	[0.007]	[0.006]	[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	0.075	0.107	0.079	0.084	0.082	0.120

Standard errors in brackets

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

Table IA.9: Portfolio Decarbonization Strategies: Weighing Observations by Investor Size

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 a member of the CDP initiative. The regressions weight observations with larger investors more than smaller investors, using the *Portfolio Size* variable (log of investor assets). 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)
CDP	-0.011	-0.027**	-0.025***	-0.033**	0.002	-0.022*
	[0.010]	[0.010]	[0.007]	[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	50983	50983	11109	11109	39874	39874
Adjusted R^2	0.014	0.011	0.029	0.013	0.013	0.012

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)
CDP	-0.021***	-0.021**	-0.030***	-0.037***	-0.007	-0.009
	[0.006]	[0.009]	[0.005]	[0.011]	[0.009]	[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	50957	50957	11106	11106	39851	39851
Adjusted R^2	0.012	0.006	0.032	0.009	0.009	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)
CDP	0.007	-0.007	0.005	0.002	0.008	-0.011*
	[0.006]	[0.004]	[0.003]	[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	0.076	0.108	0.082	0.089	0.082	0.121

Standard errors in brackets

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

Table IA.10: 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.11: 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

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

Table IA.12: Portfolio Decarbonization by Institutional Investors: Relative Emissions

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 / Revenue (t+1)		Δ Total 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)	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	-0.014*	-0.013*	-0.025	-0.017	-0.019**	-0.009	0.005	-0.008
	[0.007]	[0.006]	[0.016]	[0.011]	[0.007]	[0.010]	[0.004]	[0.005]
Portfolio Size	0.003	0.005	0.001	0.004	0.004	-0.001	0.001	0.003***
	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.001]	[0.001]
Europe	0.008	0.005	-0.035	-0.009	-0.005	0.014	-0.004	-0.026**
	[0.018]	[0.019]	[0.028]	[0.022]	[0.014]	[0.026]	[0.010]	[0.009]
North America	0.014	0.005	-0.028	-0.003	-0.013	0.004	0.013	-0.010
	[0.015]	[0.018]	[0.027]	[0.017]	[0.015]	[0.021]	[0.009]	[0.012]
Asset Owner	-0.015	-0.017	-0.030	-0.018	-0.021*	-0.009	0.007	-0.006
	[0.013]	[0.014]	[0.017]	[0.016]	[0.011]	[0.012]	[0.004]	[0.004]
# Companies		0.009		0.034**	0.014	0.027**	-0.005	0.010
		[0.010]		[0.011]	[0.009]	[0.009]	[0.005]	[0.006]
# Industries		-0.001*		-0.003***	-0.001**	-0.002**	-0.000	-0.001**
		[0.001]		[0.001]	[0.000]	[0.001]	[0.000]	[0.001]
Average Market Cap		0.007		-0.029	0.007	0.005	0.001	-0.031*
		[0.007]		[0.020]	[0.006]	[0.007]	[0.004]	[0.017]
Average Market-to-Book		-0.001		-0.002	0.004	-0.023	-0.008	0.019**
		[0.017]		[0.025]	[0.013]	[0.021]	[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	0.013	0.013	0.075	0.077	0.010	0.073	0.105	0.107

Standard errors in brackets

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

Table IA.13: Portfolio Decarbonization Strategies: Relative Emissions

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)

	Δ Emissions Scheme				Δ 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.14: Portfolio Decarbonization Strategies: Sum of Scope 1 + 2 + 3 Emissions, Relative 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 / Revenue (t+1)	Δ Total log Scope 1+2+3 / Portfolio Size (t+1)	Δ Total log Scope 1+2+3 / Revenue (t+1)	Δ Total log Scope 1+2+3 / Portfolio Size (t+1)	Δ Total log Scope 1+2+3 / Revenue (t+1)	Δ Total log Scope 1+2+3 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.007*	-0.009	-0.012**	-0.017**	-0.005	-0.001
	[0.003]	[0.010]	[0.005]	[0.007]	[0.006]	[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	50983	11109	11109	39874	39874
Adjusted R^2	0.034	0.167	0.066	0.295	0.030	0.148

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1+2+3 / Revenue (t+1)	Δ weights-only log Scope 1+2+3 / Portfolio Size (t+1)	Δ weights-only log Scope 1+2+3 / Revenue (t+1)	Δ weights-only log Scope 1+2+3 / Portfolio Size (t+1)	Δ weights-only log Scope 1+2+3 / Revenue (t+1)	Δ weights-only log Scope 1+2+3 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.010**	0.001	-0.013***	-0.021**	-0.005	0.014
	[0.003]	[0.009]	[0.004]	[0.008]	[0.005]	[0.013]
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	0.162	0.028	0.310	0.012	0.139

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only log Scope 1+2+3 / Revenue (t+1)	Δ emissions-only log Scope 1+2+3 / Portfolio Size (t+1)	Δ emissions-only log Scope 1+2+3 / Revenue (t+1)	Δ emissions-only log Scope 1+2+3 / Portfolio Size (t+1)	Δ emissions-only log Scope 1+2+3 / Revenue (t+1)	Δ emissions-only log Scope 1+2+3 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.003*	-0.010*	0.001	0.000	0.002	-0.013*
	[0.002]	[0.005]	[0.002]	[0.002]	[0.002]	[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	0.234	0.216	0.351	0.259	0.220	0.225

Standard errors in brackets

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

Table IA.15: Portfolio Decarbonization Strategies: Top 100 emitting firms, Relative Emissions

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 / Revenue Top 100 (t+1)	Δ Total log Scope 1 / Portfolio Size Top 100 (t+1)	Δ Total log Scope 1 / Revenue Top 100 (t+1)	Δ Total log Scope 1 / Portfolio Size Top 100 (t+1)	Δ Total log Scope 1 / Revenue Top 100 (t+1)	Δ Total log Scope 1 / Portfolio Size Top 100 (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.009	-0.010	-0.013	-0.015	-0.008	-0.005
	[0.007]	[0.011]	[0.010]	[0.009]	[0.012]	[0.018]
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	0.043	0.105	0.057	0.171	0.041	0.090

Panel B: Portfolio Re-weighting

	All		Emissions Scheme		No Emissions Scheme	
	Δ weights-only log Scope 1 / Revenue Top 100 (t+1)	Δ weights-only log Scope 1 / Portfolio Size Top 100 (t+1)	Δ weights-only log Scope 1 / Revenue Top 100 (t+1)	Δ weights-only log Scope 1 / Portfolio Size Top 100 (t+1)	Δ weights-only log Scope 1 / Revenue Top 100 (t+1)	Δ weights-only log Scope 1 / Portfolio Size Top 100 (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.006	0.009	-0.012	-0.012	0.005	0.023
	[0.006]	[0.012]	[0.012]	[0.007]	[0.008]	[0.017]
Observations	39697	39505	9352	9321	30345	30184
Adjusted R^2	0.009	0.091	0.013	0.156	0.010	0.078

Panel C: Corporate Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ emissions-only log Scope 1 / Revenue Top 100 (t+1)	Δ emissions-only log Scope 1 / Portfolio Size Top 100 (t+1)	Δ emissions-only log Scope 1 / Revenue Top 100 (t+1)	Δ emissions-only log Scope 1 / Portfolio Size Top 100 (t+1)	Δ emissions-only log Scope 1 / Revenue Top 100 (t+1)	Δ emissions-only log Scope 1 / Portfolio Size Top 100 (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.004	-0.006**	0.002	0.002	-0.001	-0.009**
	[0.003]	[0.002]	[0.002]	[0.002]	[0.004]	[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	0.313	0.130	0.347	0.157	0.319	0.138

Standard errors in brackets

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

Table IA.16: Portfolio Decarbonization Strategies: 2-Year Changes, Relative Emissions

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 / Revenue (t+1)	Δ2 Total log Scope 1 / Portfolio Size (t+1)	Δ2 Total log Scope 1 / Revenue (t+1)	Δ2 Total log Scope 1 / Portfolio Size (t+1)	Δ2 Total log Scope 1 / Revenue (t+1)	Δ2 Total log Scope 1 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.026***	-0.041**	-0.044**	-0.064***	-0.012	-0.018
	[0.007]	[0.016]	[0.015]	[0.015]	[0.013]	[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	45063	45063	9826	9826	35237	35237
Adjusted R^2	0.015	0.065	0.033	0.117	0.014	0.059

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

	All		Emissions Scheme		No Emissions Scheme	
	Δ2 weights-only log Scope 1 / Revenue (t+1)	Δ2 weights-only log Scope 1 / Portfolio Size (t+1)	Δ2 weights-only log Scope 1 / Revenue (t+1)	Δ2 weights-only log Scope 1 / Portfolio Size (t+1)	Δ2 weights-only log Scope 1 / Revenue (t+1)	Δ2 weights-only log Scope 1 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	-0.033***	-0.024	-0.044***	-0.068***	-0.013	0.011
	[0.010]	[0.014]	[0.012]	[0.014]	[0.014]	[0.021]
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	0.013	0.064	0.024	0.117	0.012	0.056

Panel C: Corporate Changes, 2-Year Changes

	All		Emissions Scheme		No Emissions Scheme	
	Δ2 emissions-only log Scope 1 / Revenue (t+1)	Δ2 emissions-only log Scope 1 / Portfolio Size (t+1)	Δ2 emissions-only log Scope 1 / Revenue (t+1)	Δ2 emissions-only log Scope 1 / Portfolio Size (t+1)	Δ2 emissions-only log Scope 1 / Revenue (t+1)	Δ2 emissions-only log Scope 1 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
CDP	0.007	-0.020**	0.002	-0.001	0.001	-0.029**
	[0.004]	[0.007]	[0.004]	[0.005]	[0.004]	[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	0.116	0.118	0.190	0.086	0.111	0.129

Standard errors in brackets

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

Table IA.17: Portfolio Decarbonization Strategies: Climate Action 100+, Relative Emissions

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 / 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)	Δ Total log Scope 1 / Revenue (t+1)	Δ Total log Scope 1 / Portfolio Size (t+1)
	(1)	(2)	(3)	(4)	(5)	(6)
only CDP	-0.014*	-0.017	-0.026**	-0.030**	-0.006	-0.006
	[0.006]	[0.011]	[0.011]	[0.012]	[0.010]	[0.014]
Climate Action 100+	0.010	-0.045**	-0.070***	-0.090***	0.056***	-0.023
	[0.009]	[0.017]	[0.011]	[0.009]	[0.010]	[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	50983	50983	11109	11109	39874	39874
Adjusted R^2	0.013	0.077	0.026	0.146	0.012	0.067

Panel B: Portfolio Re-weighting

	All		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)	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)
only CDP	-0.019**	-0.009	-0.026*	-0.034**	-0.007	0.010
	[0.007]	[0.010]	[0.013]	[0.014]	[0.009]	[0.013]
Climate Action 100+	0.004	-0.066***	-0.054***	-0.082***	0.046***	-0.063***
	[0.010]	[0.011]	[0.009]	[0.009]	[0.010]	[0.014]
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	0.073	0.021	0.146	0.009	0.062

Panel C: Corporate Changes

	All		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)	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)
only CDP	0.005	-0.008	0.002	0.001	0.002	-0.013*
	[0.004]	[0.005]	[0.003]	[0.002]	[0.003]	[0.007]
Climate Action 100+	0.008	0.002	-0.004	-0.010**	0.010**	0.011
	[0.006]	[0.011]	[0.003]	[0.005]	[0.003]	[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	0.105	0.107	0.153	0.084	0.106	0.120

Standard errors in brackets

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