Divestment and Engagement: The Effect of Green Investors on Corporate Carbon Emissions*

Matthew E. Kahn
University of Southern California

John G. Matsusaka
University of Southern California

Chong Shu
University of Utah

This paper investigates if green investors can influence corporate greenhouse gas emissions through capital markets, and if so, whether they have a bigger effect by divesting their stock and limiting polluters' access to capital, or by acquiring polluters' stock and engaging with management. We focus on public pension funds, classifying them as green or nongreen based on which political party controlled the fund. To isolate the causal effects of green ownership, we use exogenous variation caused by state-level politics that shifted control of the funds, and portfolio rebalancing in response to returns on non-equity investment. Our main finding is that companies reduced their greenhouse gas emissions when stock ownership by green funds increased and did not alter their emissions when ownership by nongreen funds changed. Other evidence based on activist funds, voting, and shareholder proposals suggests that ownership mattered because of active engagement by green investors and not simply because management adapted proactively to changing shareholder preferences. We do not find that companies with green investors were more likely to sell off their high-emission facilities (greenwashing). Overall, our findings suggest that (a) corporate managers respond to the environmental preferences of their investors; (b) divestment of polluting companies may lead to greater emissions; and (c) private markets may be able to address environmental challenges independent of government regulation.

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* Comments welcome: kahnme@usc.edu; matsusak@usc.edu; chong.shu@eccles.utah.edu. We appreciate comments and suggestions from Harry DeAngelo, Ran Duchin, Alex Edmans, Doron Levit, Oguzhan Ozbas, Kelly Shue, Ivo Welch, T.J. Wong, Tiange Ye, Fang Yu, and workshop participants at China Europe International Business School, Shanghai Advanced Institute of Finance, and USC. Robert Huang provided excellent research assistance.

1. Introduction

Can environmental problems be addressed through private markets, or is government regulation the only viable solution? This question is being put to the test by shareholder activists who, skeptical of governments' ability to combat climate change, are using capital markets to pressure polluters to reduce their carbon emissions. In addition to the debate over whether private markets can address externalities in the first place, there is disagreement over the most effective strategy for bringing pressure through financial markets: is it *divestment* – selling fossil fuel stocks in order to deprive polluting companies of capital and more resources for clean energy – or *engagement* – acquiring fossil fuel stocks and using ownership rights to press for pollution cuts?

The purpose of this study is to provide an empirical assessment of how corporations adjust their carbon emissions, if at all, in response to a change in the composition of their shareholders: do they reduce emissions when green investors divest, when they invest, or neither?[1] The debate over divestment versus engagement is taking place in state legislatures, among investment trustees, and in academic discourse. In 2021, Maine became the first state to require its public pension funds to divest from fossil fuel businesses; the huge New York State and New York City pensions have announced their intention to stop investing in fossil fuel companies; and California lawmakers are advancing legislation to compel the state's two massive pension funds, CalPERS and CalSTRS, to do the same. By one estimate, almost $40 trillion in assets has been committed to divestment (Johansmeyer 2022).

Proponents justify divestment as a way to reduce portfolio risk from stranded assets, redirect capital from dirty to clean energy, and take a symbolic stand in support of sustainability. Others argue that it is ineffective: in its statement opposing California's divestment bill, CalPERS (2023) argued that "divestment has little – if any – impact on a company's operations and therefore does nothing to reduce greenhouse gas emissions. . . . The companies in question can easily replace CalPERS with new investors, ones who are unlikely to speak up as loudly or as consistently as we have about the urgent need to move toward a low-carbon economy." Some critics also claim that divestment is politically motivated; officials in some red states have threatened to withhold business from banks and investment companies that pursue divestment strategies.

The opposite strategy that some green investors favor is to *acquire* stocks of polluting companies and engage the companies' management as shareholders. According to CalSTRS (2023),

[1] There is also debate over the magnitude of the damages associated with greenhouse gas emissions and whether these emissions are damaging in the first place. Our focus is on the narrower question of whether capital markets can influence corporate emissions.

"it is important that long-term investors, such as CalSTRS, actively engage fossil fuel companies . . . to transition their business models to cleaner forms of energy," and divestment would "severely hinder" such collaboration. To bring about change, the fund argued that it needs to have a "seat at the table." A survey by Krueger et al. (2020) found that many large ESG investors share this perspective, considering engagement a better approach than divestment.

The basic theoretical argument for divestment is developed in Heinkel et al. (2001), which shows that divestment can reduce the stock price of targeted firms by limiting risk sharing. The effectiveness of this strategy is limited by the number of non-divesting investors who are willing purchase the stock. Edmans et al. (2023) identify another limit: by refusing to hold brown stocks, divestment gives polluting companies no incentive to make incremental improvements; they show that it may be more effective for investors to acquire brown companies that have reduced their emissions even if they still pollute. Engagement has its own problems: attempting to put pressure on management by acquiring an ownership stake presents free-rider problems (Berle and Means 1967), and managers may feel obligated to follow the so-called Friedman doctrine and focus exclusively on profit (Friedman 1970) even if its shareholders want green policies. Putting some of these ideas together, Broccardo et al. (2022) develop a model in which investors can influence prices through divestment ("exit") or acquire shares and use them to cut emissions through a binding vote ("voice"); they find that neither strategy achieves socially optimal outcomes for realistic parameter values, but engagement may be more effective if a majority of investors have social preferences.

Conceptually, our research task is straightforward: to estimate if companies are more likely to cut emissions if the fraction of green shareholders increases or decreases. The challenge lies in the implementation: we need to be able to measure changes in green ownership, and because investors choose whether to acquire or sell a company's stock, we need a strategy to identify causal effects of ownership.

To measure green ownership, we focus on an important class of investors, public pension funds. Public pensions control a significant amount of capital, $5.6 trillion in assets by one measure. We argue that pension funds' preferences concerning carbon emissions can be proxied by the political party that controls the fund, with Democrats more favorable toward decarbonization than Republicans. We define a public pension fund as "green" in two ways: first, based on the partisan composition of a fund's board of trustees, and second, based on the governor's party affiliation (because governors can influence pension fund investment by their power to appoint trustees and through legislative and regulatory actions).

To address the challenge of causal identification, we rely on two sources of variation in shares held by green investors that are arguably exogenous with respect to company emissions. The first source of variation stems from shifts in political control in a state. Changes in the party in control of the governor's office and pension trustees are driven by a state's political dynamics and are not connected to emission changes at companies held by their public pension funds. The second source of exogenous variation comes from the fact that public pension funds typically maintain target ratios for their investment in public equities relative to other asset classes such as private equity, real estate, and commodities. If the non-public-equities part of a fund's portfolio experiences an increase in value, the fund must acquire more public equities to restore its target ratio. We show that this rebalancing, which is also unconnected to emissions in portfolio companies, provides a strong instrument for changes in a fund's stock holdings.

Our key finding is that an increase in the fraction of shares held by green public pension funds caused companies to reduce their carbon emissions during the period 2010-2021. In our baseline estimate, a 1 percentage point increase in a company's shares held by green pension funds was associated with an approximately 3 percent reduction in plant emissions over four years. In contrast, we find a positive, but not always statistically significant, association between ownership by nongreen public pension funds and changes in corporate carbon emissions. We show that these patterns are robust to alternative specifications of emissions changes and various fixed effects. These patterns also hold if we control for the party of the governor in a facility's state to remove direct policy effects on emissions. In short, engagement reduced emissions; divestment did not. These findings suggest that divestment strategies are likely to be counterproductive – resulting in increased emissions compared to the alternative of holding the stock.

We also investigate three potential mechanisms by which ownership of a company's stock might lead to emission cuts. First, the mere ownership of a company's stock by green shareholders might cause corporate managers to alter company policies if they seek to maximize shareholder utility, as some argue they should (Hart and Zingales 2017). Second, ownership might allow investors to engage management, either through adversarial means, such as voting against incumbent directors and sponsoring shareholder proposals (Krueger et al. 2020), or through collaboration and persuasion, expressing preferences and sharing of knowledge. The evidence we assemble is largely suggestive but points to a primary role for engagement, probably involving both adversarial and persuasive means. We find that emissions reductions were more strongly associated with ownership by pensions known for actively engaging management than passive funds, suggesting the importance of active engagement. We also find that active green funds were more likely to vote against director nominees and to support shareholder proposals, both of which are adversarial actions, but the magnitudes are modest, and we find no evidence that green investors lead to more environmental proposals.

Finally, we explore how companies achieved their emission reductions. Following a standard decomposition used by environmental economists, we focus on three methods: output reductions (scale and composition), innovation (technique), and asset sales. We find that companies cut output to achieve their emission reductions; among plants that generated electricity, reductions in electricity output tracked emission reductions almost one-to-one on average. In terms of innovation, we find no evidence that companies with green owners increased the number of patents they filed related to green technology. As for asset sales, we find little evidence that companies with green owners were more likely to divest their high-emission facilities, so-called "greenwashing." For our sample, it appears that companies cut their emissions mainly by reducing the amount of power produced in their dirtiest facilities.

Our study is related to an existing literature that studies whether green investment produces higher or lower stock returns for investors, and if so, why (Delmas et al. 2015, Trinks et al. 2018, Bolton and Kacperczyk 2020, Hsu et al. 2023, Aswani et al. 2023; Atilgan et al. 2023). We focus on the flip side of this issue, whether green shareholdings have real effects on corporate environmental performance. Two studies that consider environmental effects concentrate on the impact of activist campaigns rather than ownership per se: Naaraayanan et al. (2021) study a 2014 campaign by the New York City pension funds targeting 75 companies with proxy access proposals, finding that the targeted companies cut their toxic chemical emissions; and Akey and Appel (2019) study 218 companies targeted by activist hedge funds, also finding that they reduced their emissions. Also related to our study, Heath et al. (2023) examine the connection between share ownership by socially responsible investment mutual funds and contemporaneous toxic chemical releases, finding a small and statistically insignificant effect, which we also find, while Chava (2014) finds that polluting firms faced a higher cost of capital.

Our study also contributes to the literature on stock divestment as a strategy to achieve social goals. Activist investors with social goals have pursued divestment strategies going back at least to the 1980s, when many divested from companies doing business in South Africa. California pension funds have divested from Iran, Sudan, thermal coal, tobacco companies, and gun manufacturers (Gedye 2023). The evidence on divestment has focused on its effect on financial markets and asset prices (for example, Teoh et al. (1999) find no effect of South African divestment on the stock prices of companies doing business in South Africa) or on the return to divesting funds themselves (Wilshire Advisors 2022). But little is known about whether financial markets can cause companies to change their real behavior. Our paper provides some of the first direct evidence on the real effects of divestment.

At the most general level, our study also speaks to the issue of public versus private solutions to environmental externalities. The United States has not enacted a carbon tax. Standard economic logic suggests that in the absence of such regulation, firms will not take costly actions to mitigate their emissions. Yet firms may be exposed to other pressures. The corporate environmental management literature argues that large firms have an incentive to build reputations for being "green" in order to reduce the intensity of regulatory inspections (Lyon and Maxwell 2004). Consumers may boycott polluters, such as those seen in response to major oil spills (Barrage et al. 2020); and may reduce their own emissions because of a disutility from polluting, such as choosing to buy an electric car (Kotchen 2006). Our evidence suggests that pressure from another private actor – investors – can reduce carbon emissions even without government regulation.

2. Data and Sources

Emissions. Our core analysis focuses on carbon dioxide emissions, a primary focus of activist investors and regulators.[2] Carbon emissions have a global impact, unlike other forms of air pollution, water pollution, and hazardous waste generation that are local in nature. Our primary data are annual facility-level Scope 1 greenhouse gas emissions, from 2010 to 2021. Scope 1 emissions are direct greenhouse gas emissions from sources controlled by a company. Companies are required to provide these data to the Environmental Protection Agency's (EPA) Greenhouse Gas Reporting Program (GHGRP) for every facility in the United States that emits at least 25,000 metric tons of carbon dioxide in a year. The data go through an EPA verification process and are then made publicly available to investors, researchers, and others.

While the EPA data are widely used and considered the most reliable numbers available, they have some limits that should be kept in mind when interpreting the findings. First, they exclude facilities outside the United States, meaning that they undercount the emissions of companies with significant operations outside the United States. This is important for only a small number of companies, such as ExxonMobil. Second, the data exclude emissions from mobile sources, which excludes among other things, airplanes and cars. This matters for a handful of

[2] The SEC's proposed climate disclosure rules focus on Scope 1 and Scope 2 gas emissions (SEC 2022).

transportation companies, such as American Airlines. Third, the data do not include Scope 2 and Scope 3 emissions, which are indirect greenhouse gas emissions associated with assets not under the company's control, such as emissions from electricity that the company purchases or emissions within its supply chain.[3]

We classified a company as a facility's parent if it owned more than 50 percent of the facility. Then, we merged facilities with their parents' financial information from Compustat using a fuzzy name-matching algorithm, manually deleting false-positive mismatches. In the end, we were able to match 5,241 facilities from 685 publicly traded companies. The emitting facilities were mainly in sectors such as Petroleum and Natural Gas Systems (26 percent), Power Plants (21 percent), Waste (15 percent), Chemicals (6 percent), Metals (5 percent), and Minerals (4 percent).

Pension fund holdings. We began with the 50 largest public pension funds in the United States, ranked based on assets by *Pensions & Investments*. Of these, we included the 24 that appear in the Thomson Reuters Institutional Holdings database that tabulates their portfolio holdings. The Thomson Reuters database does not include funds that outsourced management of their equity portfolio instead of managing it in-house, or that did not file a 13F form with the SEC, which is required of all pension funds that manage more than $100 million in qualifying securities. Our final sample includes 9 of the 10 largest American public pension funds, covering 88 percent of public pension fund assets, with New York City Retirement Systems the notable exception because it did not file a 13F form. Annual fund holdings are the average of quarterly holdings. In cases where a fund's holdings were missing from the Thomson Reuters database, we scraped the SEC's website for the 13F form and calculated holdings directly. These data do not include pension fund assets managed by a third party, such as BlackRock. Other information about public pension funds – such as their asset allocation and returns in private equity, fixed income, or real estate – were drawn from Public Plans Data of Boston College's Center for Retirement Research.

Table 1 provides a snapshot of the public pension funds in our data. We report public equity investment by market value, number of companies held, and number of portfolio companies with

[3] There is some controversy over whether to hold companies accountable for Scope 2 and Scope 3 emissions; these emissions seem conceptually different from Scope 1 emissions that are directly controlled by the company. Based on an exploratory examination of the Scope 2 emissions data from S&P Global Trucost, a commercial vendor, we share the concerns expressed by Aswani et al. (2023) about the reliability of those data. Those numbers are based on reports voluntarily provided by companies, not verified by the EPA, supplemented with estimates made by the vendor.

EPA data as of December 2020. The nation's largest public pension fund, CalPERS, held stock worth $101.3 billion, spread across 3,505 companies, 332 of which appeared in the EPA's data. The largest funds have highly diversified holdings, holding hundreds of companies that emit greenhouse gases.

Party control of pension funds. The data on partisan affiliation of pension fund trustees was collected as follows. First, we identified the main governing board responsible for approving general investment policies and appointing the chief investment officer. We then referred to the governing documents to determine how the board was constituted. There are three broad categories of appointees: (1) Ex officio members. These included elected officials such as the governor, state treasurer, and CEO of the state school board association, and appointed officials such as the state's finance director. Elected officials were classified according to their self-declared party, and appointed officials were assigned to the party of the official that appointed them, typically the governor. (2) Appointed members, not otherwise part of the government. Most of these trustees were appointed by the governor. Sometimes the governor's choice had to be approved by the legislature. In some cases, the governor chose from a list of nominees provided by another body, such as retirees or public school teachers. We assigned these trustees to the party of the governor. Trustees appointed by legislative leaders or legislative committees were assigned the party of the majority party in the legislature. (3) Members elected by stakeholders. Examples would be trustees elected by retired workers who are beneficiaries, by current workers, or by local governments. In most cases, the voters were public employees. Since state and local government employees are about twice as likely to identify as Democrats than Republicans (Newport et al. 2011), we categorized these trustees as Democrats, assuming that trustees are chosen by the median voter. Trustees that were selected by groups whose orientation was more uncertain – judges, police officers, and school boards – were classified according to their self-declared party when we could locate this information, and otherwise to a residual "uncertain" category.[4] The party of each state's governor each year was identified from public records. All of them were either

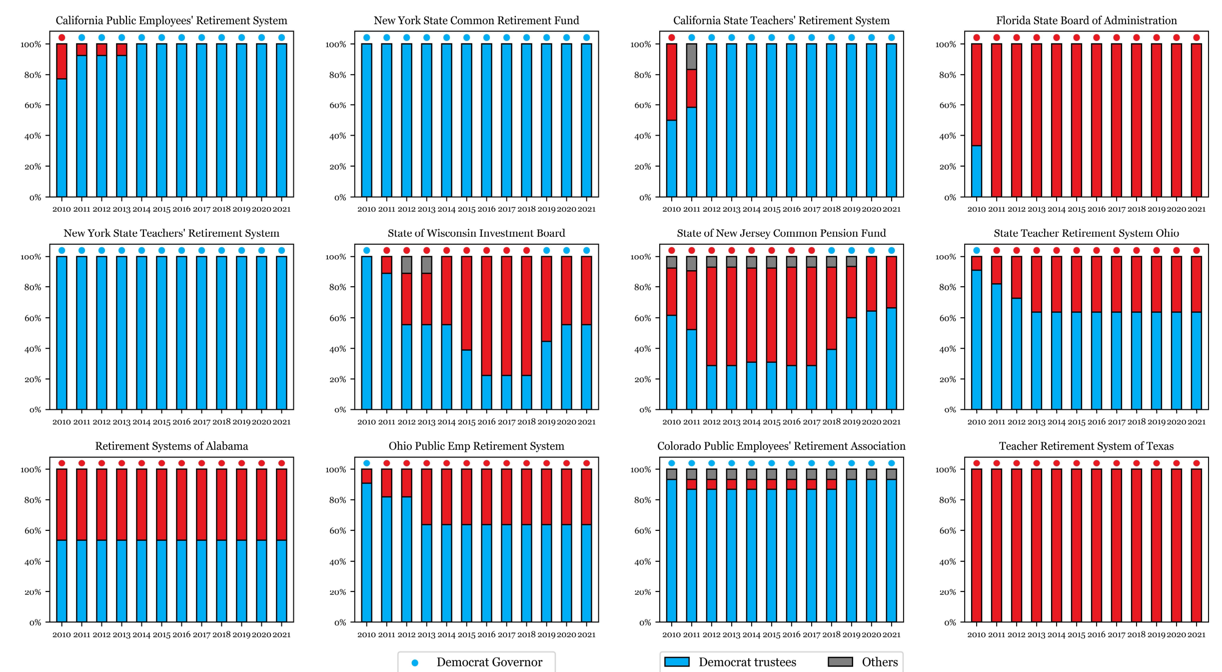
[4] In making these classifications, we took into account departures and vacancies in seats that were not concurrent with a change in the officeholder who appoints the trustee. For example, in some states, the trustees appointed by the governor serve terms that are asynchronous with gubernatorial elections, so that a new governor can change the trustees only with a lag. If a governor of one party reappointed a trustee that had been appointed by a governor of another party, we classified the trustee according to the party of the governor that first appointed the trustee. We also made an attempt to track vacancies in boards. If there was turnover in a seat within a calendar year, we classified half of the year to the party of one member and half of the year to the party of the other member.

Democrats or Republicans, except for Bill Walker of Alaska, an independent who we classified as a Republican based on his historical affiliation.

Figure 1 shows the party of the governor and partisan composition of the trustees of the 12 public pension funds with the largest equity holdings. There is a strong, yet imperfect, correlation between the two measures. Some funds displayed substantial time-series variation in party control while others were extremely stable. The State of Wisconsin Investment Board, for example, drifted from 33 percent to 100 percent Democrat. The five largest funds showed little variation in party control, and the huge New York state funds were always 100 percent controlled by Democrats, while Florida and Texas were almost always controlled by Republicans.

Electricity output. For a subset of electricity-producing facilities within the GHGRP dataset, we obtained data regarding electricity output from the Energy Information Administration (EIA) via Form EIA-923. To link the greenhouse gas dataset from the EPA with the electricity generation dataset from the EIA, we relied on the crosswalk map provided by the EPA. This map connects the Facility ID in the EPA dataset to the generators' Office of Regulatory Information Systems (ORIS) codes. Some individual facilities in the GHG dataset might encompass multiple generators; in such instances, we aggregated the electricity output to the facility level by summing the output from all of the facility's generators within a given year. We successfully matched 1,099 electricity-producing facilities with the EIA dataset. The majority of these were power plants (876 facilities), with a

Figure 1. Party Affiliation of Governor and Pension Fund Trustees



smaller number within the waste industry (87 facilities). Electricity output is measured in megawatt-hours at the generator level.

Other pollutants. We obtained information on other pollutants from the EPA's Toxics Release Inventory (TRI) dataset, covering the period from 2010 to 2020. This dataset provides details on emissions of over 600 different toxic chemicals. The most common among them, and our primary focus, are Lead, Nickel, Ammonia, Chromium, and Toluene. To merge the TRI dataset with Compustat, we used the linking table provided by Duchin, Gao, and Xu (2023). We were able to match 5,740 facilities with 778 publicly traded companies.

Green Patents. We obtained patent data from PatentsView, which provides each patent's filing date, inventor, assignee, and Cooperative Patent Classification (CPC). We identified 3,903,010 patents for the period 2010 to 2021, of which 282,274 are classified as "green patents." A patent is classified as a "green patent" if its CPC is "Y02": technologies or applications for mitigation or adaptation against climate change. We linked the patent filing company to company names in the Compustat dataset using a fuzzy matching algorithm. This step allowed us to identify 68,049 green patents associated with 1,564 publicly traded companies. We confined our analyses to firms included in the EPA GHGRP dataset, thereby limiting our sample to 185 unique companies.

Shareholder proposals and voting. We obtained information on shareholder proposals from ISS Voting Analytics. The data provide a description of each proposal, sponsor information, and the voting outcome. There were 11,225 shareholder proposals filed during 2010-2021, of which 1,079 were related to environmental issues, and 17 received a majority of votes in favor. Voting data for public pensions was taken from the Insightia database by Diligent Market Intelligence. This database categorizes proposals by issue type, allowing us to focus on director elections and environmental proposals. We were able to locate voting records for 21 public pension funds, accounting for 11,942 votes across 1,036 environmental proposals and 4,179,401 votes across 645,730 director elections.

3. Definition of Green Funds and Descriptive Information

Our operating assumption is that Democrats are more supportive of carbon emission reductions than Republicans. This squares with conventional wisdom and casual observation. For example, the 2022 Inflation Reduction Act, touted by the EPA as "the most significant climate legislation in U. S. history,"[5] was approved in the U. S. House of Representatives with all 220

[5] From the EPA web site: https://www.epa.gov/green-power-markets/inflation-reduction-act.

Democrats voting in favor and 207 Republicans voting against, and in the U. S. Senate with 51 Democrats and aligned independents voting in favor and 50 Republicans voting against. Similarly, Cragg et al. (2013) found that conservative members of Congress were less likely than liberal members to vote for the American Clean Energy and Security Act of 2009, which would have introduced carbon pricing. A recent Pew survey of the American public found that 49 percent of Democrats wanted to phase out oil, coal, and natural gas entirely, compared to only 11 percent of Republicans (Tyson et al. 2023); and Kahn and Matsusaka (1997) found that partisan affiliation was the strongest predictor of votes on environmental ballot initiatives.

We capture differences in fund preferences by the partisan affiliation of the fund's trustees and by the party of the state's governor. The board of trustees sets the rules for a fund's investment and governance policies and is its ultimate decision-maker. The governor matters because in many states the governor appoints some or all of the trustees, and may be able to exert influence over the state's pension funds through laws, regulations, and informal means.[6] Because both measures are plausible and may capture different forces, we typically employ both measures in our analysis. They usually point in the same direction, with the governor's party usually the stronger predictor. We refer to a fund in a state with a majority of Democrats as trustees or a Democratic governor as a "green" fund.[7]

We calculate green ownership of a company's stock as the percentage of shares controlled by green funds. Using the trustee measure, the percent green ownership is:

$$\%green(TRUST) = \frac{\sum_f DEMTRUST_f \times shares_f}{share\ \ outstanding},$$

where f is a fund, $DEMTRUST$ is the fraction of trustees that were Democrats, and $shares_f$ is the number of shares held by fund f. The analogous measure for the governor is:

$$\%green(GOV) = \frac{\sum_f DEMGO\ \ _f \times shares_f}{shares\ outstanding},$$

[6] For example, Governor Greg Abbot of Texas signed a law in 2021 to ban the state's pension funds from doing business with companies that discriminate against the oil and gas sector.

[7] An oversimplification in our approach is treating all members of a party as if they had the same preferences, but a Democratic governor in Alabama may be less green than a Democratic governor in California. In practice, blue state funds tend to be controlled by Democrats and red state funds by Republicans.

where $DEMGOV$ is an indicator equal to one if the state's governor was a Democrat. We also create variables for $\%nongreen$ ownership based on shares controlled by Republicans.

Table 2 provides summary statistics on facilities and companies that were carbon emitters according to the EPA data. Figure 2 shows the greenhouse gas emissions of the 10 companies with the most combined facilities emissions across the sample period and the holdings of each parent company by "green" or "nongreen" pension funds. Recall that this captures only emissions from domestic facilities. The two largest greenhouse gas emitters are power companies, American Electric Power and Southern Company. Panel A shows a downward drift in emissions for most facilities over time. Panel B shows that green funds, defined by party of the governor, increased their holdings of these heavy emitters in recent years. This suggests that green funds in aggregate have been pursuing an engagement rather than a disinvestment strategy. Panel C shows that nongreen funds have not increased their holdings of carbon emitters in recent years, meaning that the growth in Panel B is not mechanical.

4. Green Ownership Reduces Emissions

This section estimates the relationship between green public pension plan ownership and carbon emissions. We show the baseline correlation, provide arguably causal estimates, and report robustness tests.

A. Baseline Estimates

Our workhorse regression is the following, or some variant thereof:

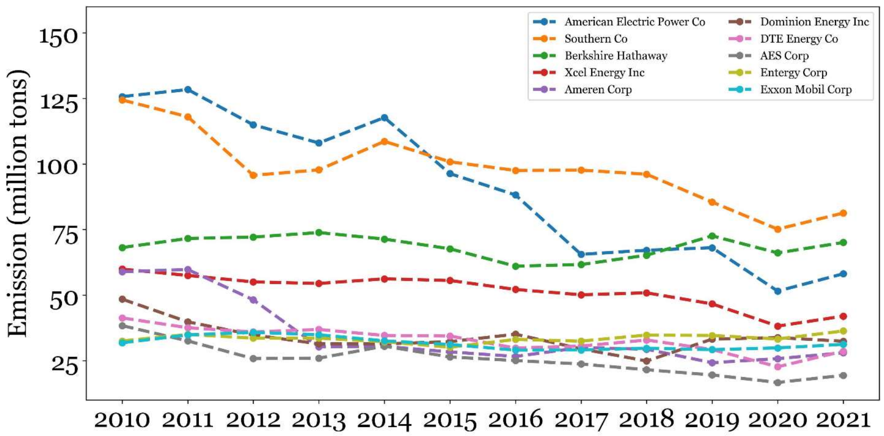
$$(1) \qquad \Delta emissions_{i,t,t+s} = \beta_1 \cdot \%green_{i,t} + \beta_2 \cdot \%nongreen_{i,t} + \gamma_t + \lambda_i + e_{i,t}.$$

where i indexes a carbon-emitting facility, t indexes the year, and s is the number of years ahead. The dependent variable is a facility's change in emissions from the "current" year to $s \in \{1,2,3,4\}$ years later. In our main regressions, we specify the change as a percentage of the current year but we also show that the patterns are similar for level changes and for a negative change dummy.[8] In our main estimates, we include facilities even if they were sold off by the company during the

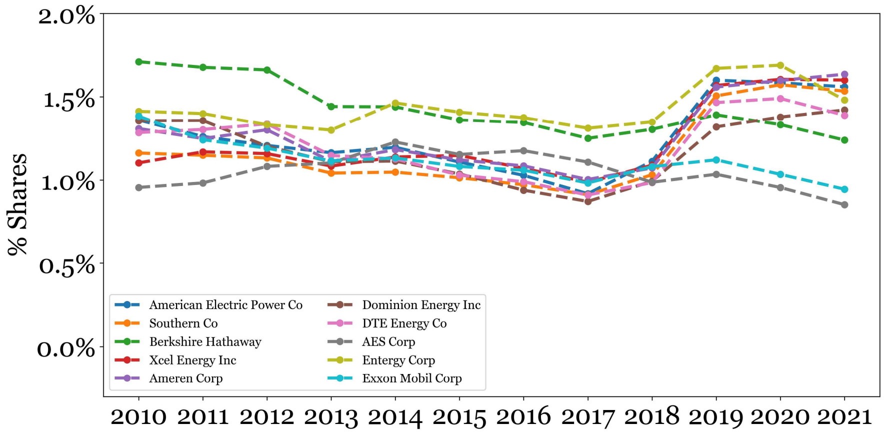
[8] We winsorized the percentage change at 5 percent in the right tail. This is necessary because cases with very small baseline emission levels produce huge percentage changes. The findings are similar if we instead delete changes greater than 1,000 percent in magnitude. We winsorized level changes at 1 percent in each tail.

Figure 2. Ten Highest Scope 1 Polluting Companies

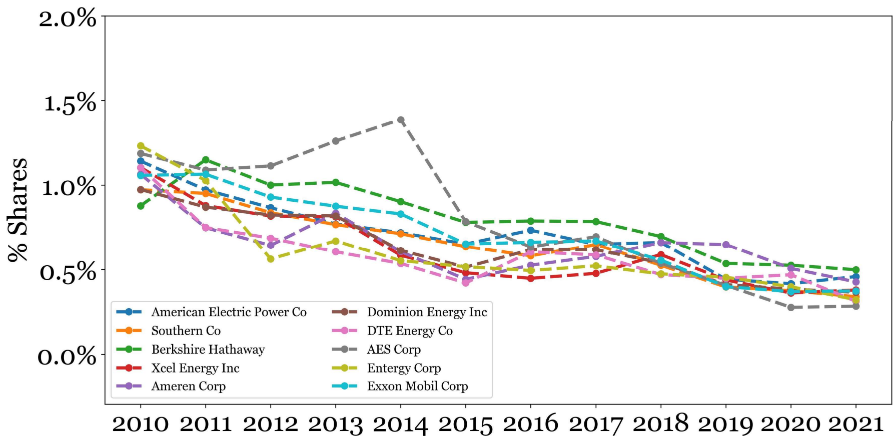
Panel A. Emissions



Panel B. Ownership by Green Funds



Panel C. Ownership by Nongreen Funds



period in order to determine if green ownership led to emissions reduction, regardless of the facility's subsequent ownership. We consider sell-offs separately after presenting the main results. The independent variables are the percent of the parent company's stock owned by green and nongreen public pension funds. The omitted category is shares owned by other institutional investors and retail investors. We always include year fixed effects, which remove possible macro-level correlations between partisan political outcomes and emissions (which could arise, for example, if partisan outcomes are associated with aggregate economic conditions). The case for facility fixed effects is less obvious, so we report estimates with and without them.

The implicit economic model underlying equation (1) is that green funds have preferences over *changes* in emissions rather than over the levels. This is a natural starting point for investigation since media outlets often focus on reductions in emissions and, as Hartzmark and Shue (2023) show, sustainable investors appear to reward companies based on percentage changes in their emissions. Theoretically, Edmans et al. (2023) argue that it can be optimal for green investors to reward companies based on changes in their emissions rather than levels because, intuitively, investing based on levels provides no lever to induce high polluters to cut back. Any explanatory factors other than green and nongreen ownership that are not constant by year or facility are incorporated into the error term in the equation (1). This might include other institutional investors such as BlackRock that attempt to exert pressure on leading carbon emitters.

Table 3 reports results using different definitions of a green fund, and different specifications of $\Delta emissions$. In panel A1, where a fund is classified as green based on party of the trustees, the first coefficient indicates that a 1 percentage point increase in shared owned by green public pension funds was associated with a 0.82 percent reduction in carbon emissions over the subsequent year, a coefficient that is not statistically different from zero. The regressions in the second, third, and fourth columns show a statistically significant reduction in emissions that grew over time, reaching 3.08 percent over four years. Detectable cuts in emissions emerged after two years, and they appear to have been persistent. The coefficients for nongreen funds are positive and also statistically significant, indicating that nongreen ownership was associated with emission increases, which lends some support to the notion that the green ownership coefficient is not mechanical or spurious. In Panel A2, a fund is green if the state's governor was a Democrat. The coefficients on green ownership are negative for all intervals and statistically significant for all but the one-year interval, telling essentially the same story as panel A1. In contrast to A1, the coefficients on nongreen ownership in A2 are usually not statistically significant.

A potential concern with our benchmark equation is that in addition to influencing whether a state's pension funds are green, the governor may also be able to influence emissions from in-state facilities directly through laws or regulation. To allow for this possibility, we re-estimate equation (1) including a dummy equal to one if the state's governor was a Democrat, reported in panels B1 and B2, for different measures of green ownership. During our period, over 60 percent of facilities were located in states with Republican governors.

Inclusion of the dummy for the governor's party does not change the ownership coefficients in any material way, indicating that the green ownership is not simply a proxy for regulatory action by a state's governor. The coefficient on the dummy itself is always negative and statistically significant, meaning facilities cut emissions faster in states with Democratic than Republican governors. We report the coefficient scaled by 100; its value of -3.46 in the fourth column of Panel B1 implies that a shift from a Republican to a Democratic governor was associated with 3.46 percent emission cuts. Comparing this to the coefficient of 3.14 on green ownership in the same regression, we can infer that changing from a Republican to a Democratic governor cut emissions by the same amount as a 1.1 percentage point increase in green ownership. This gives a rough sense of the effect of regulation versus private markets.

B. Treatment Effects Using Exogenous Sources of Variation

We now consider the issue of causal inference more systematically and report our main findings. There are two sources of variation in the green ownership variable: changes in a fund's preferences, and changes in the amount of stock it owns. A fund's preference is determined largely by election returns that are independent of the emissions of companies in the fund's portfolio. A fund's holdings of a company's stock, on the other hand, may be related to the company's emissions: green shareholders may "cherry-pick"' companies that have already decided to reduce their greenhouse gas emissions or avoid those not planning to cut emissions. To identify causal effects associated with the number of shares held, we exploit the institutional fact that pension funds have target ratios for the allocation of their portfolio between public equity and other investments. (for example, in 2021 CalPERS targeted its public equity investment at 50 percent).[9] If a fund's "other investments" experience an unusually high return, the fund must acquire more public equity in order to restore its portfolio to the target ratio, and conversely, if other investments experience an unusually low return.

With this as motivation, we estimate a first-stage regression to predict fund f's percentage change in holdings of company j as a function of the return of its other investments (private equity, fixed income, real estate, hedge fund, and commodities) in the previous year:

[9] See CalPERS's annual report, https://www.calpers.ca.gov/docs/forms-publications/acfr-2022.pdf.

(2) $\%\Delta shares_{f,j,t,t+1} = \alpha_0 + \alpha_1 \cdot RET\_OTHER_{f,t} + e_{f,j,t}$.

If pension funds rebalance annually, then $\alpha_1 > 0$. The estimated parameters $\hat{\alpha}_0$ and $\hat{\alpha}_1$ from (2) and the fund's holdings in $t-1$ are used to calculate predicted shares held by fund f in company j at time t based on that fund's holdings at time $t-1$:

(3) $\widehat{shares}_{f,j,t} = \left(1 + \hat{\alpha}_0 + \hat{\alpha}_1 \cdot RET\_OTHER_{f,t}\right) \cdot shares_{f,j,t-1}$.

Finally, we use the predicted shares from (3) to calculate predicted green and nongreen ownership for each company and fund, aggregate across funds, and then run versions of regression (1). This two-step procedure is similar to an instrumental variable regression where returns on other investments serve as the instrument. The analogue to the exclusion restriction is that a pension fund's return on its other investments is not related to the future change in facility emissions of the companies in which it invests, which seems plausible.

Table 4 shows the first-stage regression with different fixed effects. The model in the first column, with no fixed effects, shows that a 1 percentage point increase in a pension fund's return on other investments was associated with a 1.37 percent increase in its public equity. The model in the second column, which we use to construct the instrumented shares, includes year fixed effects, and indicates that a 1 percentage point increase in a pension fund's return on other investments was associated with a 3.41 percent increase in its public equity holdings. The third column includes year-company fixed effects. The F-statistic in column (2) is 59.1, well above the conventional threshold for an instrument being a good predictor. We report all three regressions to illustrate the robustness of the connection between other investment returns and changes in public equity holdings.

Table 5 shows the second-stage regressions in a format that parallels Table 3.[10] The panels differ according to how green ownership is defined (trustees vs. governor) and whether a facility-state governor dummy is included. The findings are similar across all panels: increases in green fund ownership reduced carbon emissions out to four years, and the effect was statistically significant in all regressions. The coefficient on nongreen ownership is less often statistically

[10] To account for the two-stage estimation procedure, the standard errors in the second stage can be adjusted by using a bootstrap procedure. The results are essentially similar with coefficients significant at the 1 percent level.

significant using predicted ownership. In panels B1 and B2, the coefficient on Democratic governor remains negative, and statistically significant for three and four years out. A comparison of the green ownership and Democratic governor coefficients in the fourth column of Panel B1 indicates changing from a Republican to Democratic governor cut emissions by approximately the same amount as increasing green ownership by about 0.6 percentage points.

C. Robustness to Alternative Specifications

We next demonstrate that the connection between emissions changes and ownership is robust to alternative empirical specifications. First, one concern with expressing emission changes as percentages is that a given absolute reduction in emissions is larger in percentage terms at a low-emission compared to a high-emission facility. Indeed, because some ESG ratings focus on percentage changes, Hartzmark and Shue (2023) suggests that companies may game the ratings by concentrating cuts at their low-emission facilities. To explore this issue, Panel A of Table 6 re-estimates the baseline regressions using the change in emissions in levels as the dependent variable. The limitation of this specification is that it tends to overweight facilities with the largest initial emission levels (in a sense, the opposite problem from the percentage change variable). The story that emerges from this specification is essentially the same as before. The coefficient on green fund ownership is negative over all time periods and for both definitions of green funds, and is always statistically different from zero. To understand the units: the coefficient on green ownership in Panel A1 indicates that a 1 percentage point increase in green fund ownership was associated with 13,300 to 41,300 tons fewer emissions over the next one to four years. This is a meaningful reduction in emissions compared to the average of 506,445 tons in our sample. The coefficient on nongreen ownership is small and statistically insignificant in all regressions.

In Panel B of Table 6, the dependent variable is simply a dummy equal to 1 if emissions declined. Although crude, this strips out scale effects entirely. Over any given year, 53 percent of facilities reduced emissions, and over four years, 57 percent reduced emissions. The first regression shows that a 1 percentage point increase in green fund ownership was associated with a statistically significant 3.02 percentage point increase in the probability of carbon emission reduction over the subsequent year. The probability rises to 3.66 percentage points over two years, and 4.31 percentage points over four years, all statistically significant at the 1 percent level. The coefficients on green ownership in Panel B2 tell the same story. The coefficients on nongreen ownership are always negative but not reliably statistically different from zero.

A third alternative specification includes facility fixed effects, essentially a two-way fixed effects model. This removes all time-invariant, facility-specific factors that determined changes in emissions. While this specification has some appeal, since the dependent variable is a change, facility fixed effects strip out a constant level of change, which is not obviously a better approach. Panel C of Table 6 reports the results using both definitions of a green fund. The coefficient on green ownership, as before, is negative and statistically significant in all regressions in both panels. The coefficients are noticeably larger in magnitude with facility fixed effects than without, suggesting that (in the cross-section) there is not a lot of sorting of green investors into facilities that would bias the baseline regressions. The coefficients on nongreen funds are statistically insignificant in all regressions and the signs vary by years.

Our estimates to this point assume a linear relationship between emissions changes and green ownership, implicitly assuming that the effect of increases and decreases in green ownership are symmetric. It is conceivable that companies responded asymmetrically to increases versus decreases. To allow for this possibility, Table 7 reports variants of the baseline regression that allow the slope of the ownership variables to vary depending on whether ownership increased or decreased.[11] The coefficients on green ownership are negative in all regressions, for both ownership increases and decreases, and statistically significant and similar in magnitude three and four years out. The negative coefficients on green ownership reductions shows more specifically than before that divestment leads to emission increases. The coefficients on nongreen ownership are positive for both increases and decreases, but usually statistically insignificant, and never statistically different from each other.

4. Why Green Ownership Reduced Emissions: Responsive Managers, Pressure, and Persuasion

Having shown that companies with green investors were more likely to reduce their carbon emissions, in this section we investigate why green ownership had this effect. We report several pieces of suggestive evidence, much of which points in the same direction. The analysis is framed around three mechanisms.

[11] We do not include separate intercepts for increases and decreases. If those intercepts are included, they are always small and statistically insignificant but they make it more difficult to interpret and compare coefficients.

- *Responsive managers.* Corporate executives are employees of the company's owners, and as Friedman (1970) noted, have a "responsibility to conduct the business in accordance with their desires." Usually, investors are motivated to make money but in some cases they may have additional objectives, such as emissions reductions. According to this mechanism, managers may have cut carbon emissions because they believed that was the preference of their investors.

- *Pressure.* According to this mechanism, a form of "voice," managers must be pressured to reduce emissions. A priori, it is not clear why managers would be opposed to GHG abatement (why there would be an agency problem of this form), but that is often assumed to be the case in public discourse. Pressure can be applied through shareholder proposals or by voting against managers that do not cut emissions (Aggarwal et al. 2023; Michaely et al. 2023).

- *Persuasion.* According to this mechanism, managers can be persuaded by green investors. Investors may share information about the consequences of cleaner facilities, their preferences, and their willingness to support managers aligned with their preferences. Persuasion is a nonadversarial form of voice. CalPERS characterizes its engagement strategy as "constructive" and describes it as: (1) gathering facts about the issues and expressing its concerns to the company; (2) sharing CalPERS' principles and investment beliefs with the company; (3) seeking the company's perspective on the issue; and (4) seeking a resolution to address its concerns.[12] There is abundant evidence that some institutional investors communicate extensively with companies in order to persuade them to take a specific course of action, and that these efforts are often successful (Carleton et al. 1998; Dimson et al. 2015).[13]

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[12] Available at https://www.calpers.ca.gov/page/investments/corporate-governance/corporate-engagements.

[13] Carleton et al. (1998) studied private letters that TIAA-CREF sent to 45 companies on governance matters during 1992-1996, finding that they reached an agreement 98 percent of the time, and without resorting to a shareholder vote 70 percent of the time. Dimson et al. (2015) described letters, telephone calls, and direct conversations on environmental and social issues between an unnamed institutional investor and senior management of target companies during 1999- 2009, finding a success rate of 18 percent.

A. Active vs. Less Active Green Investors

According to the "responsive managers" mechanism, a company's response to green ownership should not vary depending on whether the investor is actively engaged or passive. To assess this empirically, we identify a set of pension funds that were particularly active, and compare how emissions responded to ownership by these funds compared to less active funds. Our classification is based on SEC Form PX14A6G that public pension funds must file as a cover letter when they wish to communicate with other shareholders on matters related to voting, such as expressing a preference for director candidates or opposing a proposal. Of the 27 funds in our sample, three of them filed PX14A6G forms at our sample companies during our sample period: CalPERS (216 filings), New York State Common Retirement Fund (NYSCRF) (25 filings), and CalSTRS (14 filings).[14] We classify these three as the "active" green funds, and define the others as "less active." We then estimate the connection between emission changes and green ownership separately for active and non-active funds.[15]

Table 8 shows the results with year fixed effects (the results are similar with facility fixed effects). Across all specifications, the coefficient on active green ownership is negative and statistically significant. The coefficient on less-active green ownership is always smaller, often considerably so, and not statistically significant. For regressions two or more years out, the active and less-active coefficients are statistically different from each other in five of six specifications. Ownership by active green funds resulted in larger emissions cuts than ownership by less-active green funds. This suggests that emission reductions were not simply the result of managers responding to changes in their ownership, but partly due to engagement by active green funds.

B. Pressure: Shareholder Proposals and Voting

Investors can engage management by exerting pressure using shareholder proposals or voting against management in corporate elections. An example of a pressure campaign was the Boardroom Accountability Project spearheaded by the New York City pension funds in 2014, which involved filing shareholder proposals at 75 companies in order to force them to expand proxy

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[14] The highly active New York City pension funds are not included in our data because they did not submit 13F filings of their holdings.

[15] These three funds also happen to be among the largest, meaning that activism as we define it is correlated with size. This is not a problem for our test since the main question is whether managers take into account overall shareholder preferences or gives more weight to some investors than others.

access. To gauge the importance of the adversarial channel more generally, we explore the connection between shareholder proposals and green ownership.

In most American corporations, shareholders have a right to make proposals that are voted on by shareholders collectively, subject to meeting certain minimum conditions, such as having held stock worth at least $2,000 or 1 percent of firm value continuously for the preceding year (Matsusaka et al. 2021). Most proposals are precatory, meaning that managers are not required to implement them even if they receive a majority of votes in favor. However, investor groups may withhold support for director candidates who do not implement shareholder proposals, and there is evidence that companies do respond to proposals with majority support, and may even partially accommodate unsuccessful proposals if they attract a sizeable block of votes (Thomas and Cotter 2007; Ertimur et al. 2010; Matsusaka and Ozbas 2017).

Here we focus on environmental proposals.[16] For example, an oil company may be asked to report on how it expects to respond to global pressures to achieve net-zero carbon emissions. A company in our sample received at least one environmental proposal in 15 percent of the sample years. Shareholder proposals are usually opposed by managers, and are thus a form of adversarial engagement. Under the pressure hypothesis, an increase in green investors would lead to more shareholder proposals.

Our empirical model is:

$$(4) \qquad Proposal\ dummy_{c,t} = \beta_1 \cdot \%green_{c,t} + \beta_2 \cdot \%nongreen_{c,t} + \beta_3 X_{c,t} + \gamma_t + \lambda_c + e_{c,t},$$

where the unit of observation is a company (c) in a given year (t). We include all publicly traded companies with emissions in the EPA data. In addition to ownership, we control for firm size, since large firms are known to attract more proposals, and for the level of greenhouse gas emissions.

Table 9 shows the estimates for both measures of green ownership. The dependent variable in column (1) is a dummy equal to one if a company received an environmental proposal. The coefficient on green ownership implies that a 1 percentage point increase in shares held by green pension funds led to a 1.24 to 1.76 percentage point increase in the probability of receiving an environmental proposal, not statistically different from zero. The coefficient on nongreen fund ownership is also statistically insignificant in both panels. The dependent variable in column (2) is a

[16] Specifically, we study proposals with a "resolution" classification in ISS Voting Analytics: carbon, climate change, coal, energy, environment, environmental, fossil fuel, GHG, global warming, greenhouse, methane, pollution, sustainability.

dummy equal to one if a proposal received a majority of votes in favor, conditional on the company receiving a green proposal in the first place. This is not a strong test because of the limited number of environmental proposals, and the limited variation in outcomes: only 2 percent of proposals received more than 50 percent support. The coefficients on green ownership are negative but statistically insignificant. The bottom line is that we cannot conclude that green ownership led to more environmental proposals being proposed or approved, which runs against the hypothesis that green ownership works through adversarial pressure. Our failure to find a connection between green ownership and proposals is distinct from but parallels evidence in Appel et al. (2016) that the presence of passive mutual funds did not attract more hedge fund activism.

Another form of adversarial pressure is voting against the recommendations of management in corporate elections. We study this by estimating:

$$(5)\qquad D(yes)_{f,p,c.t} = \beta_1 \cdot D(green)_f \cdot D(active)_f + \beta_2 \cdot D(green)_f \cdot D(passive)_f + \lambda_p + e_{f,c,p,t},$$

where the unit of observation is a vote cast by fund f on election item p at company c in year t. We examine votes on shareholder proposals and directors. The dependent variable is a dummy equal to one if a fund voted in favor of the election item.[17] The explanatory variables are dummies for active green funds and passive (less-active) green funds, meaning that the omitted category is nongreen public pension funds. Funds are defined to be green in Panel A if a majority of the trustees were Democrats and in Panel B if the governor was a Democrat.[18] By including a fixed effect for the election item, we implicitly control for the merits of each proposal.

Column (1) of Table 10 shows the estimates for votes on shareholder proposals on environmental issues. Management typically opposes shareholder proposals, so a vote in favor can be interpreted as a vote against management. Active green funds were more likely to support environmental proposals – 7.2 percentage points more likely according to the trustee classification

[17] For shareholder proposals, we included votes cast "for" and "against", excluding all other options such as abstention. For director elections, we coded votes case "for" as 1 and votes "against", "withheld", abstain", and "did not vote" as 0. Overall, pensions voted in favor of 55 percent of environmental proposals, 66 percent of nonenvironmental proposals, and 93 percent of directors.

[18] In Panel A, funds are classified as green if the number of Democratic trustees exceeded the number of Republican trustees, dropping observations with ties. The median voter theorem provides one theoretical justification. The results are similar if we use the percentage of Democratic trustees instead of a dummy variable except that the coefficient in the first column becomes statistically different from zero.

and 27.4 percentage points according to the governor classification – compared to nongreen pension funds, but the coefficient is statistically significant only in Panel B. Column (2) shows that active green pension funds were significantly more likely to support nonenvironmental shareholder proposals, 13.9 percentage points or 17.6 percentage points for the trustee and governor classifications respectively. Column (3) shows that active green funds were 7.8 percentage points or 4.3 percentage points, depending on the green definition, less likely to support management's director nominees than nongreen funds. Across the two panels, we see that all but one case active green funds were significantly more likely to vote in an adversarial manner, which supports the notion that their influence is partly due to pressure.

The coefficients for passive, or less-active, green funds, are statistically insignificant in most regressiosn. The exceptions are in panel A, where passive funds were less likely to support shareholder proposals in an Panel B where they were more likely to support directors. Both are consistent with the idea that passive investors were more likely to support management, but the imprecision of the estimates elsewhere in the table caution that this conclusion might not be robust.

From the evidence in this section, we tentatively conclude that active funds were effective in part because they applied pressure through voting. However, the fact that their voting did not attract more shareholder proposals or lead to passage of more proposals suggests that its value may have been primarily symbolic, functioning as a threat more than direct means to change policy. We speculate that adversarial pressure may complement persuasive engagement, where most of the work gets done. Indeed, the dichotomy between the two forms of activism is somewhat artificial – an effective persuasion strategy may go hand-in-hand with implied threats that are occasionally carried out in order to establish credibility. This interpretation would be consistent with fund managers' own characterizations: the joint CalPERS and CalSTRS statement on *The Importance of Corporate Engagement on Climate Change* expresses a preference for "constructive engagement" over divestment, and that "we firmly believe that active and direct engagement as a first line approach is the best way to resolve issues . . . [and] that engagement, or having a voice at the table, is an effective tool to mitigate risk such as climate change."[19]

[19] The undated statement is available at: https://www.calpers.ca.gov/docs/corporate-engagement-climate-change.pdf. See also Wilkes (2023) which notes that most members of the Climate Action 100+ "seek to persuade companies to do more on climate through `engagement', which involves lobbying corporate and executive directors, rather than voting to oust them,"

5. How Companies Reduced Emissions: Output Reduction, Sell-Offs, and Innovation

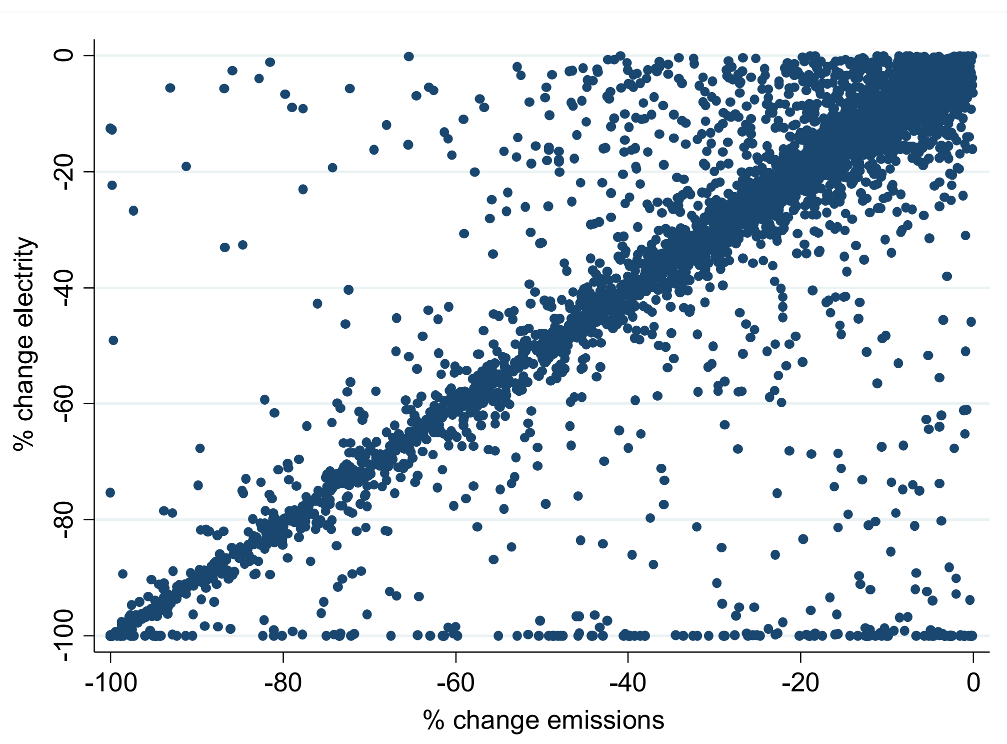
A polluter can reduce emissions in three ways: by reducing output from a polluting facility, by changing production processes so that a given level of output emits less pollution, and by selling off polluting facilities. Environmental economists use an accounting framework along these lines to decompose a firm's emissions (Copeland and Taylor 2004). Exxon can reduce its carbon footprint by cutting output (scale) or shifting its portfolio of products towards cleaner products (composition), and by introducing new technologies such as carbon capture to reduce emissions per unit of output (technique). This section probes for evidence on the use of each channel.

A. Emissions Reduction through Output Reduction

To gauge the importance of emissions cuts through output or scale reduction, we focus on the subset of facilities that produce electricity. These facilities, most of which are power plants and the rest in the waste industry, are required to report their output in terms of electricity generation. We test if the facilities that reduced emissions also reduced electricity output, a scale reduction, or if their output stayed the same, implying emission cuts through abatement.

Figure 3 plots emission changes against electricity generation changes over the years t to $t+2$, for those facilities that cut emissions. Emission cuts that were achieved by output reductions

Figure 3. Emission Cuts Against Electricity Cuts for Plants that Reduced Emissions



appear along the 45-degree diagonal. Output reduction appears to have been a common way to achieve emission reductions. There were some cases in which electricity fell more or less than emissions, with perhaps more of the former than the latter.

Table 11 explores the relationship parametrically. Panel A1 establishes a benchmark by regressing the percentage change in emissions on a dummy for facilities that reduced emissions. The first coefficient indicates that facilities that reduced emissions cut them by 55.4 percent on average over the first year. Panel A2 regresses the percentage change in electricity output on a dummy for emission cuts. The coefficient indicates that electricity cuts were 52.5 percent on average in the first year. Thus, emissions cuts were matched by approximately equal output cuts on average. The coefficients for longer windows tell the same story. This is not a mechanical relationship. The coefficients for regressions that control for facility fixed effects (panels B1 and B2) are similar. Across all specifications, emissions cuts were accompanied on average by proportionate cuts in output, suggesting that emission reduction was often achieved by cutting output rather than by abatement.

B. Facility Sell-Offs

Companies can reduce their carbon emissions by selling polluting facilities to another company or spinning them off as stand-alone companies. We first note that our core findings in Tables 3 and 5 are not the result of facility sales. Because our analysis is conducted at the level of facilities, not companies, we are able to track facilities across time regardless of ownership, which means that the emission reductions observed in our regressions were real cuts.

It is nevertheless interesting to examine if green ownership affects a corporation's proclivity to shed polluting assets. While selling off or spinning off a unit would reduce the selling firm's emissions, it would not reduce overall pollution, and is therefore sometimes labeled "greenwashing." In a sample of 888 divestitures of polluting plants during 2000-2020, Duchin et al. (2022) show that divested plants did not reduce their emissions but divesting companies earned higher ESG ratings.[20] There may also be efficiency reasons for companies to sell off facilities. For example, some companies may have a comparative advantage in cleaning up polluting facilities,

[20] Similarly, Andonov and Rauh (2023) find that public corporations have reduced their ownership of electricity producers while private equity companies have increasd their ownership – but through closure and new entry not transfers of facilities.

such as Hilcorp, which specializes in acquiring aging oil wells that leak methane (Morenne 2023). Reallocation of plants to emission reduction specialists could be economically efficient.[21]

In our sample, one in four facilities was divested within a four-year time span. To estimate the role of green ownership, Table 12 reports various regressions of the form:

$$(6) \qquad D(facility\ sold)_{i,t,t+s} = \beta_1 \cdot \%\widehat{green}_{i,t} + \beta_2 \cdot \%\widehat{non\text{-}green}_{i,t} + \gamma_t + \lambda_i + e_{i,t}.$$

The dependent variable is 1 if facility i was sold or spun off between year t and year $t + s$. Once a facility was sold, we drop it from the analysis, meaning that repeat sales are excluded. Regressions include tear and facility fixed effects.

Companies were more likely to sell off polluting facilities as green ownership increased in six of eight specifications, but the coefficients are statsitcally significant in only two specifications. The magnitudes are modest: in the first column of panel A, a 1 percentage point increase in green ownership led to a 2.2 percentage point higher chance of selling a facility. All told, there is little evidence that companies shed their polluting assets when they had green owners. The coefficients on nongreen ownership are never statistically significant.

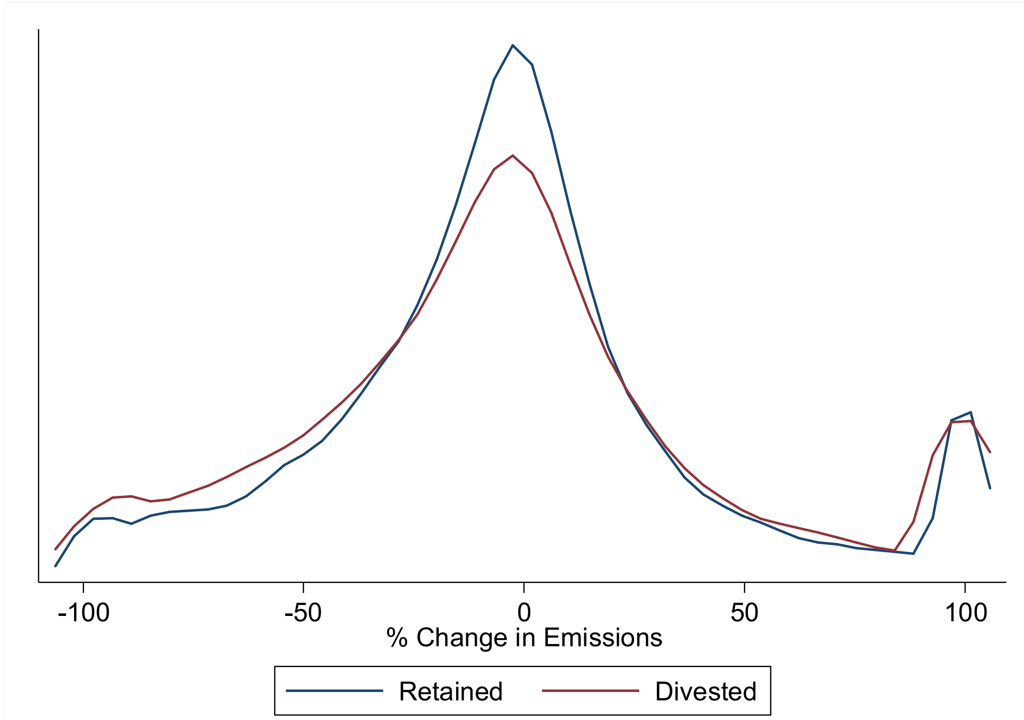
To gain perspective on the possibility that facilities were sold to companies with a comparative advantage in emissions reduction, we compare the emission changes of retained versus sold facilities. Figure 4 plots emission changes four years out (winsoring observations with greater than 100 percent change) for retained and divested units, with each observation representing a facility-year. Emission reductions were similar for retained and divested facilities, with retained facilities modestly more likely to cut emissions than divested units. This matches the finding in Duchin et al. (2022) for a different but partially overlapping sample.

C. Innovation

Companies can also reduce emissions by innovating new, cleaner production techniques (Kowalski 2023). Green investors express the hope that emission cuts will free up corporate resources to invest in new, cleaner technologies. Jennifer Grancio, of hedge fund Engine No. 1 that

[21] In unreported regressions, we explore the possibility that emissions cuts were brought about through changes in ownership, such as hypothetically transferring a facility a pollution-reduction specialist. We find no evidence that the emissions cuts were associated with changes in ownership.

Figure 4. Density of Emission Changes for Retained and Divested Facilities



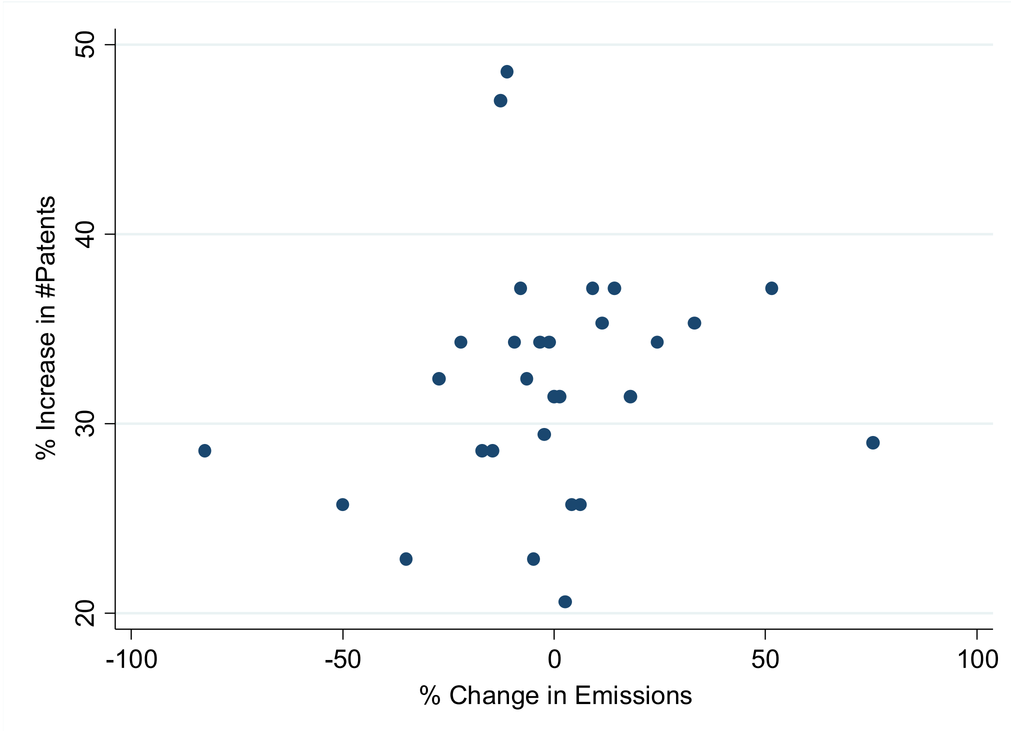
led a green campaign to secure seats on the board of ExxonMobil, argued: "[W]e need these huge engineering and development companies to also apply resources where they can . . . to look at new technologies and how do these companies maintain value after that transition when we're in more of a renewable environment or carbon capture environment."[22]

To explore the possibility of accelerated technique innovations by firms with green investors, we look at patenting activity by major emitting firms (Grubb et al. 2021; Popp 2005). For each company, we identify the number of green patents each year, which represent technologies intended to mitigate or adapt against climate change. Innovation depends on research that takes time, so we would not expect to see an increase in patents immediately. The number of patents is highly right-skewed and formulating changes in levels or percentages creates outlier problems, so the dependent variable we study is a dummy variable equal to one if a company increased the number of green patents over time.

For our sample, the mean number of patents filed by a company per year was 15.2, with a range of zero to 496. On average, 31 percent of companies increased the number of patents they

[22] *CNBC Transcript: Engine No. 1 COE Jennifer Grancio Speaks with CNBC's Sara Eisen Live During CNBS's ESG Impact Today*, October 6, 2022. Consistent with this idea, Cohen et al. (2021) document that the fossil fuel industry produces more green patents than almost every other industry.

Figure 5. Binned Scatterplot of Emission Changes Against Patent Increases over Two Years



filed from one year to the next. We keep the firms that filed at least one green patent during our sample period, resulting in a sample of 185 unique firms out of 686 total firms in the EPA dataset.

Figure 5 shows the percentage of companies that increased their patents over two years compared to bin changes in emissions. There was not a clear tendency for emission-cutting firms to increase their patents.

Table 13 presents regression estimates for two measures of green funds, and for two fixed effect specifications. The interpretation of the top left (statistically insignificant) coefficient is that a 1 percent increase in green fund ownership was associated with a 0.76 percentage point less likelihood of a company filing more green patents in the next year. Looking across the entire table, while the coefficients on green ownership are usually positive and, in some specifications, statistically different from zero over the three-year range, the overall impression is an absence of a reliable connection between patenting and green ownership. The story is the same for non-green ownership. We are hesitant to conclude, based on this evidence, that green investors prompted companies to increase their development of new green technologies.

D. Other Pollutants

We next explore if companies responded to green investors by cutting other types of pollution. These estimates are of interest for two reasons. First, as mentioned above, companies might respond to green investors by shifting the composition of their output, reducing production that emits carbon and increasing production that emits other pollutants (Greenstone 2003). Such a "Peltzman Substitution Effect" is more likely to occur in cases where environmentalists prioritize a specific pollutant's reduction and pay less attention to other pollution margins. Second, while green investors have emphasized greenhouse gas emissions, they may favor reducing other pollutants as well, and would not favor substitution into other pollutants. Did companies respond only to concerns about carbon emissions, or did they make adjustments across the pollution spectrum?

The EPA collects data on hundreds of chemicals that are emitted by production facilities. We focus our analysis on the five most common types: lead, nickel, ammonia, chromium, and toluene. After greenhouse gas emissions, lead emissions may be the highest profile pollutant, known to cause loss of I.Q. and brain functions to those exposed (Clay et al. 2023).

Table 14 reports versions of our basic regressions with changes in emissions of these chemicals as the dependent variable. Panel A shows results for lead emissions. The coefficients indicate that green ownership led to cuts in lead emissions over all four years, but with only the last coefficient statistically significant. We also detect negative effects of green ownership for nickel, ammonia, and chromium, with some coefficients statistically significant about half the time. There aren't statistically significant effects for Toluene. We take this as suggestive but not compelling evidence that green ownership causes companies to reduce emissions of non-GHG chemicals. It could be that green investors focus primarily on carbon emissions but do not monitor other pollutants as closely.

6. Conclusion

This paper investigates if activism from corporate shareholders can partially substitute for government regulation in encouraging decarbonization. We are particularly interested in the debate over whether environmental investors have the biggest impact when they divest fossil fuel stocks, thereby redirecting capital from dirty to clean energy producers, or when they acquire fossil fuel stocks and work for change through engagement with corporate managers. Our findings point to a clear conclusion: engagement is more effective than divestment for investors that want companies to reduce carbon emissions. Green investors make companies greener. We go to some lengths to show that our baseline findings are robust to alternative specifications of the variables, fixed effects, definitions of green ownership, and so forth. Having said that, we believe caution is in order when thinking about whether the findings would extend to other countries or time periods. Divestment of fossil fuel stocks emerged as a broad issue only around the start of our sample period, and that market responses during this first decade could have unique characteristics.

A somewhat puzzling aspect of our findings is that relatively small shareholdings seem to influence company behavior. While the number of shares held by public pension funds is large in absolute terms, it is nowhere near enough to give effective control of the company – so why do corporate managers appear to respond to these investors? There is a concrete example of this recently happening: the tiny hedge fund Engine No. 1 made headlines in June 2021 when it captured three board seats at ExxonMobil despite owning only 0.02 percent of the oil giant's shares. Engine No. 1 was successful in large part because it secured the support of three giant passive funds, BlackRock, Vanguard, and State Street, which together owned over 20 percent of the company. This suggests that green pension funds might be able to "punch above their weight" because they are able to attract support from other investors. Anecdotally, we observe attempts by large investors to coordinate, such as the formation of the Climate Action 100+ Alliance by large pension funds and asset managers (Doidge et al. (2019) describe an activist alliance in Canada).

Two interesting case studies provide additional suggestive evidence on voting amplification. Fahlenbrach et al. (2023) find that Norges Bank, the world's largest sovereign wealth fund and a long-time activist on corporate governance issues, was able to swing about 3 percent of votes in favor of its positions on shareholder proposals when it pre-disclosed its voting intentions in 2021. Dimson et al. (2015) describe the activities of an anonymous active investor – letters, telephone calls, and direct conversations with senior managers – and highlight the investor's partnership with other investors, including public pensions, SRI funds, and religious groups. Theoretically, the largest pension funds are better suited to take the lead in acquiring information and other engagement efforts because their stakes are larger, mitigating the free rider problem, and smaller funds may follow their lead. Along these lines, Levit (2019) shows theoretically that effective engagement by a fund relies on the possibility that other shareholders will support the activist if it launches a public campaign. The economics of forming coalitions and overcoming free-rider problems among green investors is an interesting area for future research. Recently we have seen resistance to such coordination by red-state politicians on the grounds that it facilitates collusion and anti-competitive behavior (Kerber 2023).

Our study is not intended to advance a normative claim about the desirability of using capital markets to bring about emission reductions, or about the normative value of those reductions in the first place. Those are complicated issues that go beyond the scope of our analysis. Nevertheless, as a starting point for readers interested in these issues, we can outline how one might begin a benefit-cost analysis. Suppose we adopt the Biden administration's estimate of $51 per ton as the social cost of carbon (Chemnick 2021). Our regressions suggest that a 1 percentage point increase in shareholding by green pension funds – or a $200 million equity investment on average – leads to a 13,300 ton reduction in carbon emissions on average (Table 6, Panel A), which would translate to a reduction in social cost of $0.68 million.

The costs of carbon emissions are sometimes characterized as being nonlinear, with particularly bad outcomes occurring beyond a tipping point. From this perspective, the goal is reduce emissions enough so that the tipping point is not reached. The United States currently accounts for about 11 percent of global greenhouse gas emissions, approximately 50 percent of which comes from industry and power generation. According to our point estimates, if green ownership were to double from 1 to 2 percent on average in all companies, emissions of American firms would decline by about 7 percent, about a 0.5 percent reduction in global emissions. Thus, our estimates suggest that the effect of investor pressure on American corporations is too small if the goal is to avoid critical tipping points.

Finally, our study speaks to an ongoing discussion about the goals of the corporation. Central to this discussion is the question of whether corporations maximize profit or instead seek to maximize shareholder utility, as Hart and Zingales (2017) and others argue they should. We find that companies appear to weigh the preferences of green shareholders. When companies have more green investors, they adopt greener policies. This does not necessarily imply that companies are willing to forgo profits when they reduce emissions, but it would not be a stretch to think that is sometimes the case.

References

Aggarwal, Reena, Sandeep Dahiya, and Umit Yilmaz, "Why Do Investors Vote Against Corporate Directors?," working paper 924, European Corporate Governance Institute, 2023.

Akey, Pat and Ian Appel, "Environmental Externalities of Activism," working paper, University of Toronto and Boston College, 2019.

Atilgan, Yigit, K. Ozgur Demirtas, Alex Edmans, and A. Doruk Gunaydin, "Does the Carbon Premium Reflect Risk or Mispricing," ECGI Working Paper Series in Finance, November 2023.

Andonov, Aleksander and Joshua D. Rauh, "The Shifting Finance of Electricity Generation," working paper, University of Amsterdam and Stanford University, July 2023.

Appel, Ian R., Todd A. Gormley, and Donald B. Keim, "Passive Investors, Not Passive Owners," *Journal of Financial Economics*, 2016, Vol. 121, 111-141.

Aswani, Jitendra, Aneesh Raghunandan, and Shiva Rajgopal, "Are Carbon Emissions Associated with Stock Returns?," *Review of Finance*, 2023, forthcoming.

Barrage, Lint, Eric Chyn, and Justine Hastings, "Advertising and Environmental Stewardship: Evidence from the BP Oil Spill." *American Economic Journal: Economic Policy* 2020, Vol. 12(1), 33-61.

Berle, Adolph A. and Gardiner CC. Means, *The Modern Corporation and Private Property*, second edition, New York, NY: Harcourt, Brace and World, 1967.

Bolton, Patrick and Marcin T. Kacperczyk, "Carbon Premium Around the World," working paper, Imperial College London, 2020.

Broccardo, E, Oliver Hart, and Luigi Zingales, "Exit versus Voice," *Journal of Political Economy*, 2022, Vol. 130(2), 3101-3145.

CalPERS, *Why We're Opposing Divestment in Senate Bill 252*, May 13, 2023, available at: https://news.calpers.ca.gov/why-were-opposing-divestment-in-senate-bill-252/.

CalSTRS, *Bill Analysis: SB 252 (Gonzales) as introduced January 30, 2023*, April 20, 2023, available at: https://www.calstrs.com/files/643c8a402/SB252-introduced-1-30-23.pdf.

Carleton, Willard T., James M. Nelson, and Michael S. Weisbach, "The Influence of Institutions on Corporate Governance through Private Negotiations: Evidence from TIAA-CREF, *Journal of Finance*, August 1998, Vol. 53(4), 1335-1362.

Chava, Sudheer, "Environmental Externalities and Cost of Capital," *Management Science*, September 2014, Vol. 60(9), 2223-2247.

Chemnick, Jean, "Cost of Carbon Pollution Pegged at $51 a Ton," *Scientific American*, March 1, 2021, available at: https://www.scientificamerican.com/article/cost-of-carbon-pollution-pegged-at-51-a-ton/.

Clay, Karen, Alex Hollingsworth, and Edson R. Severnini, *The Impact of Lead Exposure on Fertility, Infant Mortality, and Infant Birth Outcomes,* working paper w31379, National Bureau of Economic Research, 2023.

Cohen, Lauren, Umit G. Gurun, and Quoc Nguyen, "The ESG-Innovation Disconnect: Evidence from Green Patenting," working paper, Harvard University, UT-Dallas, and DePaul University, 2021.

Copeland, Brian R., and M. Scott Taylor, "Trade, Growth, and the Environment," *Journal of Economic Literature,* March 2004. Vol. 42(1), 7-71.

Cragg, Michael I., Yuyu Zhou, Kevin Gurney, and Matthew E. Kahn. "Carbon Geography: The Political Economy of Congressional Support for Legislation Intended to Mitigate Greenhouse Gas Production," *Economic Inquiry*, 2013, Vol. 51(2), 1640-1650.

Delmas, Magali A., Nicholas Nairn-Birch, and Jinghui Lim, "Dynamics of Environmental and Financial Performance: The Case of Greenhouse Gas Emissions," *Organization & Environment* 2015, Vol. 28(4), 374-393.

Dimson, Elroy, Oğuzhan Karakaş, and Xi Li, "Active Ownership," *Review of Financial Studies*, December 2015, Vol. 28(12), 3225-3268.

Doidge, Craig, Alexander Dyck, Hamed Mahmudi, and Aazam Virani, "Collective Action and Governance Activism," *Review of Finance*, September 2019, Vol. 23(5), 893-933

Duchin, Ran, Janet Gao, and Qiping Xu, "Sustainability or Greenwashing: Evidence from the Asset Market for Industrial Pollution," working paper, Boston College, Georgetown University, University of Illinois, 2022.

Edmans, Alex, Doron Levit, and Jan Schneemeier, "Socially Responsible Divestment," working paper, London Business School, University of Washington, and Indiana University, July 2023.

Ertimur, Yonca, Fabrizio Ferri, and Stephen R. Stubben, "Board of Directors' Responsiveness to Shareholders: Evidence from Shareholder Proposals," *Journal of Corporate Finance*, 2010, Vol. 16, 53-72.

Fahlenbrach, Rüdiger, Nicolas Rudolf, and Alexis Wegerich, "Leading by Example: Can One Universal Shareholder's Voting Pre-Disclosure Influence Voting Outcomes?," working paper, École Polytechnique Fédérale de Lausanne, University of Lausanne, Norges Bank Investment, 2023.

Friedman, Milton, "A Friedman Doctrine – The Social Responsibility of Business Is to Increase Its Profits," *New York Times*, September 13, 1970.

Gedye, Grace, "Will California's Largest Pensions, CalPERS and CalSTRS, Divest from Fossil Fuels?," CalMatters, June 29, 2023.

Greenstone, Michael., "Estimating Regulation-Induced Substitution: The Effect of the Clean Air Act on Water and Ground Pollution," *American Economic Review Papers and Proceedings*, May 2003, Vol. 93(2), 442-448.

Grubb, Michael, Paul Drummond, Alexandra Poncia, Will McDowall, David Popp, Sascha Samadi, Cristina Penasco et al., "Induced Innovation in Energy Technologies and Systems: A Review of Evidence and Potential Implications for CO_2 Mitigation," *Environmental Research Letters,* 2021, Vol. 16(4), 043007.

Hart, Oliver and Luigi Zingales, "Companies Should Maximize Shareholder Welfare Not Market Value," *Journal of Law, Finance, and Accounting*, 2017, Vol. 2(2), 247-275.

Hartzmark, Samuel M. and Kelly Shue, "Counterproductive Sustainable Investing: The Impact Elasticity of Brown and Green Funds," working paper, Boston College and Yale University, March 2023.

Heath, Davison, Daniele Macciocchi, Roni Michaely, and Mathew CC Ringgenberg, "Does Socially Responsible Investing Chang Firm Behavior?," *Review of Finance*, 2023, 1-27.

Heinkel, Robert, Alan Kraus, and Josef Zechner, "The Effect of Green Investment on Corporate Behavior," *Journal of Financial and Quantitative Analysis*, December 2001, Vol. 36(4), 431-449.

Hsu, Po-Hsuan, Kai Li, and Chi-Yang Tsou, "The Pollution Premium," *Journal of Finance*, June 2023, Vol. 78(3), 1343-1392.

Johansmeyer, Tom, "How Fossil Fuel Divestment Falls Short," *Harvard Business Review*, November 4, 2022, available at: https://hbr.org/2022/11/how-fossil-fuel-divestment-falls-short.

Kahn, Matthew E. and John G. Matsusaka, "Demand for Environmental Goods: Evidence from Voting Patterns on California Initiatives," *Journal of Law and Economics*, 1997, Vol. 40(1), 137-174.

Kerber, Ross, "US House Judiciary Leader Subpoenas Documents from Climate Groups," Reuters, June 15, 2023, available at: https://www.reuters.com/sustainability/us-house-judiciary-leader-subpoenas-documents-climate-groups-2023-06-14/.

Kotchen, Matthew J., "Green Markets and Private Provision of Public Goods," *Journal of Political Economy*, 2006, Vol. 114(4), 816-845.

Kowalski, Kathiann M., "How an Ohio-Based Steel Company Cut Greenhouse Gas Emissions by Nearly a Third," *Ohio Capital Journal*, November 21, 2023.

Krueger, Philipp, Zacharias Sautner, and Laura T. Starks, "The Importance of Climate Risk for Institutional Investors," *Review of Financial Studies*, 2020, Vol. 33(3), 1067-1111.

Levit, Doron, "Soft Shareholder Activism," *Review of Financial Studies*, July 2019, Vol. 32(7), 2775-2808.

Lyon, Thomas P., and John W. Maxwell, *Corporate Environmentalism and Public Policy*. Cambridge University Press, 2004.

Matsusaka, John G. and Oguzhan Ozbas, "A Theory of Shareholder Approval and Proposal Rights," *Journal of Law, Economics, and Organization*, 2017, Vol. 33, 337-411.

Matsusaka, John G., Oguzhan Ozbas, and Irene Yi, "Can Shareholder Proposals Hurt Shareholders? Evidence from Securities and Exchange Commission No-Action-Letter decisions, *Journal of Law and Economics*, February 2021, Vol. 64, 107-152.

Michaely, Roni, Silvina Rubio, and Irene Yi, "Voting Rationales," working paper, Hong Kong University, University of Bristol, and University of Toronto, July 24, 2023.

Morenne, Benoit, "How a Houston Oilman Confounded Climate Activists and Made Billions; Jeffery Hildebrand built an empire by buying castoff wells from big companies under ESG pressure," *Wall Street Journal*, July 11, 2023.

Naaraayanan, S. Lakshmi, Kunal Sachdeva, and Varun Sharma, "The Real Effects of Environmental Activist Investing," working paper, London Business School and Rice University, 2021.

Newport, Frank, Dan Witters, and Sangeeta Agrawal, "Democrats Lead Ranks of both Union and State Workers," Gallup Poll, March 24, 2011, available at: https://news.gallup.com/poll/146786/democrats-lead-ranks-union-state-workers.aspx.

Popp, David, "Lessons from Patents: Using Patents to Measure Technological Change in Environmental Models," *Ecological Economics,* 2005, Vol. 54(2-3), 209-226.

Securities and Exchange Commission, *The Enhancement and Standardization of Climate-Related Disclosures for Investors*, March 21, 2022, available at: https://www.sec.gov/news/press-release/2022-46.

Teoh, Siew Hong, Ivo Welch, and C. Paul Wazzan, "The Effect of Socially Activist Investment Policies on the Financial Markets: Evidence from the South African Boycott," *Journal of Business,* 1999, Vol. 72(1), 35-89.

Thomas, Randall S. and James F. Cotter, "Shareholder Proposals in the New Millennium: Shareholder Support, Board Response, and Market Reaction," *Journal of Corporate Finance*, June 2007, Vol. 13, 368-391.

Trinks, Arjan, Bert Scholtens, Machiel Mulder, and Lammertjan Dam, "Fossil Fuel Divestment and Portfolio Performance," *Ecological Economics*, 2018, Vol. 146, 740-748.

Tyson, Alec, Cary Funk, and Brian Kennedy, "What the data says about Americans' views of climate change," Pew Research Center, April 18, 2023, available at: https://www.pewresearch.org/short-reads/2023/04/18/for-earth-day-key-facts-about-americans-views-of-climate-change-and-renewable-energy/.

Wilkes, Tommy, "Investors in Biggest Climate Pressure Groups Don't Like to Pressure," Reuters, June 12, 2023, available at: https://www.reuters.com/sustainability/investors-biggest-climate-pressure-group-dont-like-pressure-2023-06-12/.

Wilshire Advisors, Consultant Review of CalPERS Divestments, October 13, 2022, available at: https://www.calpers.ca.gov/docs/board-agendas/202211/invest/item06b-01_a.pdf.

Table 1. Stock Ownership by Public Pension Funds

	Stock owned ($B)	# Companies held	# Companies with EPA data
California Public Employees' Retirement System (CalPERS)	101.3	3,505	332
New York State Common Retirement Fund (NYSCRF)	78.2	3,154	304
California State Teachers' Retirement System (CalSTRS)	56.8	3,017	293
Florida State Board of Administration	40.5	2,317	283
New York State Teachers' Retirement System	39.8	1,620	246
State of Wisconsin Investment Board	36.1	1,701	233
State of New Jersey Common Pension	23.9	1,602	242
State Teachers Retirement System of Ohio	22.9	2,156	246
Retirement Systems of Alabama	20.7	917	197
Ohio Public Employees Retirement System	17.5	1,909	266
Public Employees Retirement Association of Colorado	17.5	1,853	267
Teacher Retirement System of Texas	12.3	865	188
Treasurer of the State of North Carolina	12.1	1,009	192
Virginia Retirement System	8.5	1,084	149
Kentucky Teachers' Retirement System	8.4	1,762	258
Alaska Retirement Management Board	7.8	1,632	244
Oregon Public Employees Retirement Fund	6.8	1,579	242
Employees Retirement System of Texas	6.6	728	109
Utah Retirement Systems	5.4	981	187
Pennsylvania Public School Employees' Retirement	5.3	1,606	271
Municipal Employees' Retirement System of Michigan	4.0	250	84
Arizona State Retirement System	0.8	261	50

Note. The table describes the equity investments of public pension funds in our sample at the end of 2020.

Table 2. Summary Statistics

	Mean	25%	Median	75%	N
A. Unit = Facilities × Year					
Emissions					
GHG emissions (Million tons)	0.51	0.03	0.07	0.21	42,504
Lead emissions (Thousand pounds)	2.76	0.00	0.00	0.00	8,487
Nickel emissions (Thousand pounds)	1.75	0.00	0.00	0.02	6,985
Ammonia emissions (Thousand pounds)	60.30	1.16	10.33	45.32	6,572
Chromium emissions (Thousand pounds)	4.10	0.00	0.00	0.02	6,024
Toluene emissions (Thousand pounds)	10.42	0.45	1.59	8.72	5,789
% change in GHG emissions, year t to $t+1$	-0.94	-13.50	-1.08	10.16	37,803
% change in GHG emissions, year t to $t+2$	-1.77	-19.59	-2.56	12.12	33,242
% change in GHG emissions, year t to $t+3$	-2.28	-23.82	-3.46	12.12	28,847
% change in GHG emissions, year t to $t+4$	-1.77	-26.85	-4.16	15.27	24,676
Electricity					
Electricity generated (Terawatt-hour)	1.94	0.05	0.40	2.56	10,688
% change in electricity, year t to $t+1$	5.01	-18.44	-1.23	14.73	9,678
% change in electricity, year t to $t+2$	8.28	-24.17	-2.39	17.00	8,740
% change in electricity, year t to $t+3$	11.50	-29.33	-3.48	18.27	7,795
% change in electricity, year t to $t+4$	15.52	-32.23	-4.30	20.05	6,814
Divestitures					
% sold off in any year	7.4	0.0	0.0	0.0	37,841
% sold off in any two-year period	13.8	0.0	0.0	0.0	33,270
% sold off in any three-year period	19.6	0.0	0.0	0.0	28,872
% sold off in any four-year period	24.3	0.0	0.0	0.0	24,701
B. Unit = Company ×Year					
Ownership					
% green fund ownership (governor)	0.8	0.4	0.9	1.16	3,726
% non-green fund ownership (governor)	0.5	0.1	0.4	0.7	3,726
% green fund ownership (trustees)	1.0	0.4	1.1	1.4	3,726
% green fund ownership (trustees)	0.3	0.1	0.3	0.5	3,726
GHG emissions					
Emissions (M tons)	4.39	0.08	0.36	1.97	4,902
# facilities in EPA data	8.67	1	3	8	4,902
Green patents filed	15.2	0	1	5	1,690
Proposals					
# environmental proposals	0.13	0	0	0	2,324
# proposals sponsored by pension funds	0.10	0	0	0	2,324
# environmental proposals approved	0.02	0	0	0	2,324
Financials					
Assets ($B log)	8.97	7.78	9.02	10.35	4,858

EBIT/Assets	0.08	0.04	0.06	0.10	4,843
Debt/Assets	0.54	0.34	0.48	0.62	4,825
R&D/Assets	0.03	0.00	0.01	0.03	2,139
Market/Book	6.55	1.34	1.99	3.13	4,265

Note. The data cover 2010-2021. For emissions, only facility-years with positive emissions are included. For ownership, a fund is defined as green according to the party of the governor or the partisan balance of the trustees, as indicated in parentheses. Percent changes in emissions and electricity are winsorized at 95 percent in the right tail. For patents, includes all firms with at least one patent across all years. For proposals, includes all firms with at least one proposal across all years.

Table 3. Percent Change in GHG Emissions and Pension Fund Ownership

Panel A1	One year	Two years	Three years	Four years
% green (TRUST)	-0.82	-1.86**	-2.86**	-3.08**
	(0.64)	(0.93)	(1.12)	(1.23)
% nongreen (TRUST)	1.83**	3.21***	3.27**	3.23*
	(0.85)	(1.24)	(1.58)	(1.90)
N	28,515	24,841	21,296	18,058
Clusters	3,406	3,050	2,705	2,377

Panel A2	One year	Two years	Three years	Four years
% green (GOV)	-0.59	-1.92**	-2.88**	-3.10**
	(0.61)	(0.91)	(1.16)	(1.41)
% nongreen (GOV)	0.78	1.74*	1.30	1.01
	(0.66)	(0.92)	(1.20)	(1.32)
N	28,515	24,841	21,296	18,058
Clusters	3,406	3,050	2,705	2,377

Panel B1	One year	Two years	Three years	Four years
% green (TRUST)	-0.81	-1.87**	-2.89***	-3.14**
	(0.64)	(0.92)	(1.11)	(1.22)
% nongreen (TRUST)	1.87**	3.31***	3.46**	3.48*
	(0.85)	(1.24)	(1.57)	(1.89)
Dummy = 1 if facility-state	-1.00**	-1.70***	-2.75***	-3.46***
governor was Democrat	(0.43)	(0.64)	(0.80)	(0.92)
N	28,505	24,832	21,288	18,051
Clusters	3,396	3,041	2,697	2,370

Panel B2	One year	Two years	Three years	Four years
% green (GOV)	-0.59	-1.94**	-2.92**	-3.16**
	(0.61)	(0.91)	(1.16)	(1.40)
% nongreen (GOV)	0.82	1.81*	1.44	1.15
	(0.66)	(0.93)	(1.21)	(1.33)
Dummy = 1 if facility-state	-1.00**	-1.71***	-2.75***	-3.44***
governor was Democrat	(0.43)	(0.64)	(0.80)	(0.92)
N	28,505	24,832	21,288	18,051
Clusters	3,396	3,041	2,697	2,370

Note. Each column in each panel is a regression with year fixed effects. The unit of observation is a facility-year. The dependent variable is the percent change in emissions from the current year t to another year $t + n$ as indicated at the top of each column, winsorized at the 5 percent level in the right tail. Green and nongreen funds are defined by the party of the trustees or the party of the governor. The dummy for facility-state governor is divided by 100 for ease of interpretation. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. The data cover the period from 2010 to 2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 4. First-Stage Regressions Predicting Change in Fund Ownership

	(1)	(2)	(2)
Return on other investments	1.37***	3.41***	2.75***
	(0.41)	(0.44)	(0.42)
Constant	0.23***	…	…
	(0.02)		
N	44,654	44,654	44,389
F-statistic	11.3	59.1	43.6
Fixed effects	None	Year	Year x Company

Note. The table reports first-stage regressions, where the dependent variable is the percentage change in a fund's shares of a company, winsorized at 1 percent in each tail. The unit of observation is a fund-company-year. Each column is a regression with fixed effects as indicated. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 5. Percent Change in GHG Emissions with Predicted Ownership

Panel A1	One year	Two years	Three years	Four years
% $\widehat{\text{green}}$ (TRUST)	-1.42***	-1.86***	-2.96***	-3.64***
	(0.52)	(0.72)	(0.88)	(1.05)
% $\widehat{\text{nongreen}}$ (TRUST)	2.08***	2.08*	1.45	0.99
	(0.80)	(1.10)	(1.28)	(1.68)
N	26,208	22,483	18,953	15,821
Clusters	3,032	2,683	2,347	2,037

Panel A2	One year	Two years	Three years	Four years
% $\widehat{\text{green}}$ (GOV)	-1.27**	-1.40	-2.87***	-3.41***
	(0.54)	(0.86)	(1.09)	(1.29)
% $\widehat{\text{nongreen}}$ (GOV)	0.86	0.29	-0.07	-0.77
	(0.66)	(1.01)	(1.14)	(1.38)
N	26,208	22,483	18,953	15,821
Clusters	3,032	2,683	2,347	2,037

Panel B1	One year	Two years	Three years	Four years
% $\widehat{\text{green}}$ (TRUST)	-1.42***	-1.86***	-2.97***	-3.68***
	(0.52)	(0.72)	(0.88)	(1.05)
% $\widehat{\text{nongreen}}$ (TRUST)	2.13***	2.16**	1.57	1.17
	(0.79)	(1.09)	(1.27)	(1.66)
Dummy = 1 if facility-state	-0.70	-0.87	-1.40*	-2.23**
governor was Democrat	(0.46)	(0.66)	(0.82)	(0.96)
N	26,201	22,477	18,948	15,817
Clusters	3,025	2,677	2,342	2,033

Panel B2	One year	Two years	Three years	Four years
% $\widehat{\text{green}}$ (GOV)	-1.27**	-1.40	-2.89***	-3.46***
	(0.54)	(0.86)	(1.09)	(1.29)
% $\widehat{\text{nongreen}}$ (GOV)	0.90	0.34	0.01	-0.65
	(0.66)	(1.01)	(1.14)	(1.37)
Dummy = 1 if facility-state	-0.69	-0.84	-1.37*	-2.18**
governor was Democrat	(0.46)	(0.66)	(0.82)	(0.96)
N	26,201	22,477	18,948	15,817
Clusters	3,025	2,677	2,342	2,033

Note. This table reports regressions in which the dependent variable is the percentage change in emissions from the current year t to another year $t + n$ as indicated at the top of each column, winsorized at the 5 percent level in the right tail. The explanatory variables are the predicted percentage of shares owned by green funds and nongreen funds, using coefficient estimates from regression (2) in Table 4. Green and nongreen funds are defined according to the party of the trustees or governor, as indicated. The coefficient on the facility-state governor dummy is multiplied by 100 for ease of interpretation. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. The data cover 2010 to 2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 6. Robustness of Main Finding

Panel A. Dependent = Change in Level of Emissions + Year Fixed Effects

Panel A1	One year	Two years	Three years	Four years
% $\widehat{green}$ (TRUST)	-1.33***	-2.31***	-3.34***	-4.13***
	(0.47)	(0.55)	(0.75)	(0.96)
% $\widehat{nongreen}$ (TRUST)	0.22	0.58	1.43	0.83
	(0.93)	(1.27)	(1.49)	(1.96)
N	26,219	22,496	18,965	15,832
Clusters	3,032	2,683	2,347	2,037

Panel A2	One year	Two years	Three years	Four years
% $\widehat{green}$ (GOV)	-1.70***	-3.10***	-4.86***	-5.87***
	(0.54)	(0.64)	(0.95)	(1.24)
% $\widehat{nongreen}$ (GOV)	0.30	0.75	1.81	1.38
	(0.68)	(0.91)	(1.11)	(1.49)
N	26,219	22,496	18,965	15,832
Clusters	3,032	2,683	2,347	2,037

Panel B. Dependent = Dummy if Emissions Declined + Year Fixed Effects

Panel B1	One year	Two years	Three years	Four years
% $\widehat{green}$ (TRUST)	3.02***	3.66***	3.92***	4.31***
	(0.81)	(1.05)	(1.17)	(1.34)
% $\widehat{nongreen}$ (TRUST)	-5.22***	-4.67**	-4.71*	-3.54
	(1.51)	(2.20)	(2.42)	(3.01)
N	26,219	22,496	18,965	15,832
Clusters	3,032	2,683	2,347	2,037

Panel B2	One year	Two years	Three years	Four years
% $\widehat{green}$ (GOV)	2.74***	3.29***	4.36***	4.71***
	(0.90)	(1.22)	(1.34)	(1.57)
% $\widehat{nongreen}$ (GOV)	-2.45**	-1.66	-2.51	-1.52
	(1.22)	(1.70)	(1.65)	(1.97)
N	26,219	22,496	18,965	15,832
Clusters	3,032	2,683	2,347	2,037

Panel C. Dependent = %Change in Emissions + Year and Facility Fixed Effects

Panel C1	One year	Two years	Three years	Four years
% $\widehat{green}$ (TRUST)	-3.03***	-3.89***	-5.45***	-5.33***
	(0.83)	(1.10)	(1.39)	(1.66)
% $\widehat{nongreen}$ (TRUST)	1.69	1.76	-0.88	-2.17
	(1.19)	(1.76)	(2.27)	(3.03)

N	25,749	21,986	18,423	15,201
Clusters	2,990	2,642	2,309	1,996

Panel C2	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (GOV)	-2.97***	-3.38***	-5.68***	-5.55***
	(0.81)	(1.15)	(1.51)	(1.88)
% $\widehat{\text{nongreen}}$ (GOV)	0.34	-0.43	-2.00	-2.88
	(0.97)	(1.51)	(1.69)	(2.16)
N	25,749	21,986	18,423	15,201
Clusters	2,990	2,642	2,309	1,996

Note. Each column in each panel is a regression in which the unit of observation is a facility-year. The dependent variable is change in emissions from the current year t to another year $t + n$ as indicated in the panel title and at the top of each column; level change and percentage change are winsorized at the 5 percent level in the right tail. Green and nongreen funds are defined either by the party of the trustees or governor. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. The data cover the period from 2010 to 2021.The data cover 2010-2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 7. Separate Effects for Ownership Increase (Δ^+) versus Decrease (Δ^-)

Panel A	One year	Two years	Three years	Four years
% $\widehat{\text{green}}$ (TRUST) × Δ^+	-0.41	-1.06	-2.97***	-3.39***
	(0.58)	(0.86)	(1.06)	(1.20)
% $\widehat{\text{green}}$ (TRUST) × Δ^-	-1.73***	-2.02***	-2.96***	-3.67***
	(0.54)	(0.73)	(0.89)	(1.08)
% $\widehat{\text{nongreen}}$ (TRUST) × Δ^+	1.24	1.51	1.86	1.40
	(1.04)	(1.54)	(1.77)	(2.39)
% $\widehat{\text{nongreen}}$ (TRUST) × Δ^-	2.29**	2.14*	1.15	0.60
	(0.98)	(1.15)	(1.33)	(1.58)
N	26,208	22,483	18,953	15,821
p value: green Δ^+ = green Δ^-	0.00	0.14	0.98	0.77
p value: nongreen Δ^+ = nongreen Δ^-	0.32	0.67	0.71	0.72

Panel B	One year	Two years	Three years	Four years
% $\widehat{\text{green}}$ (GOV) × Δ^+	-0.54	-0.38	-2.99**	-2.48*
	(0.58)	(0.96)	(1.20)	(1.41)
% $\widehat{\text{green}}$ (GOV) × Δ^-	-1.81***	-1.93**	-2.77**	-3.67***
	(0.58)	(0.89)	(1.14)	(1.35)
% $\widehat{\text{nongreen}}$ (GOV) × Δ^+	0.75	0.33	0.27	-0.38
	(0.81)	(1.29)	(1.46)	(1.82)
% $\widehat{\text{nongreen}}$ (GOV) × Δ^-	1.04	0.28	-0.35	-1.05
	(0.72)	(1.05)	(1.16)	(1.37)
N	26,208	22,483	18,953	15,821
p value: green Δ^+ = green Δ^-	0.00	0.03	0.79	0.29
p value: nongreen Δ^+ = nongreen Δ^-	0.70	0.96	0.64	0.66

Note. This table reports regressions in which the dependent variable is the percentage change in emissions from the current year t to another year $t + n$ as indicated at the top of each column, winsorized at the 5 percent level in the right tail. The explanatory variables are the predicted percentage of shares owned by green and nongreen funds, using coefficient estimates from regression (2) in Table 4. Green and nongreen funds are defined according to the party of the trustees or governor, as indicated. Ownership variables are interacted with dummies for whether ownership (green or nongreen) increased (Δ^+) or decreased (Δ^-). All regressions include year fixed effects. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. The data cover the period from 2010 to 2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 8. Active versus Less Active Pension Funds

Panel A.	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$(TRUST) | active	-1.72**	-3.01***	-5.39***	-5.89***
	(0.75)	(1.04)	(1.43)	(1.84)
% $\widehat{\text{green}}$(TRUST) | less active	-0.93	-0.14	0.60	-0.38
	(1.16)	(1.52)	(1.85)	(2.21)
% $\widehat{\text{nongreen}}$(TRUST)	2.02**	1.93*	1.10	0.69
	(0.79)	(1.10)	(1.27)	(1.65)
p value: active = less active	0.61	0.17	0.03	0.11
N	26,208	22,483	18,953	15,821
Clusters	3,032	2,683	2,347	2,037

Panel B.	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$(GOV) | active	-1.84**	-3.21***	-5.54***	-6.26***
	(0.74)	(1.07)	(1.41)	(1.83)
% $\widehat{\text{green}}$(GOV) | less active	-0.18	2.06	3.15	3.34
	(1.19)	(1.76)	(2.14)	(2.75)
% $\widehat{\text{nongreen}}$(GOV)	1.01	0.71	0.30	-0.47
	(0.66)	(1.01)	(1.16)	(1.41)
p value: active = less active	0.29	0.02	0.00	0.01
N	26,208	22,483	18,953	15,821
Clusters	3,032	2,683	2,347	2,037

Note. Each column is a regression in which the unit of observation is a facility-year. The dependent variable is the percentage change in emissions from the current year t to another year $t + n$ as indicated at the top of each column, winsorized at the 5 percent level in the right tail. Green and non-green funds are defined by the party of the trustees or the governor. Active funds are CalPERS, CalSTRS, and NYSCRF. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. Regressions include year fixed effects. The data cover the period from 2010 to 2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 9. Shareholder Proposals and Green Ownership

	Dummy = 1 if company received an environmental proposal (1)	Dummy = 1 if an environmental proposal passed (2)
Panel A		
% $\widehat{\text{green}}$ (TRUST)	1.76	-2.35
	(1.71)	(3.41)
% $\widehat{\text{nongreen}}$ (TRUST)	-2.70	10.61
	(3.48)	(7.81)
Assets (log)	0.050***	-0.002
	(0.006)	(0.008)
Emissions (trillion tons)	5.20***	-0.04
	(0.51)	(0.39)
N	1,837	279
Panel B		
% $\widehat{\text{green}}$ (GOV)	1.24	-1.47
	(1.79)	(2.93)
% $\widehat{\text{nongreen}}$ (GOV)	-0.66	5.55
	(2.37)	(4.10)
Assets (log)	0.049***	-0.001
	(0.006)	(0.008)
Emissions (trillion tons)	5.21***	-0.06
	(0.51)	(0.39)
N	1,837	279

Note. Each column is a regression in which the unit of observation is a company-year. The dependent variable in column (1) is a dummy = 1 if a company received an environmental shareholder proposal, and in column (2) is a dummy = 1 if an environmental proposal was approved by a majority of votes. The data in column (1) covers all companies with emissions in the EPA data, and the data in column 2 covers companies with environmental proposals. All regressions include year fixed effects. The data cover 2010-2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 10. Yes Votes by Pension Funds on Proposals and Director Elections

	Environmental Proposals	Nonenvironmental Proposals	Director Elections
Panel A	(1)	(2)	(3)
Dummy = 1 if green (TRUST) × active	7.2	13.9***	-7.8***
	(5.2)	(1.8)	(2.1)
Dummy = 1 if green (TRUST) × passive	-26.3***	-7.9***	-2.6
	(4.5)	(1.7)	(1.7)
N	3,681	19,592	298,769
Cluster	173	178	181
Panel B			
Dummy =1 if green (GOV) × active	27.4***	17.6***	-4.3**
	(6.0)	(1.7)	(1.8)
Dummy = 1 if green (GOV) ×passive	3.8	-3.0	4.8***
	(5.6)	(2.0)	(1.2)
N	3,878	20,626	312,927
Clusters	185	190	193

Note. Each column is a regression in which the unit of observation is a pension fund vote on an election item at a company that emitted greenhouse gases. The dependent variable is a dummy = 1 if a fund voted in favor of the proposal or for the director. Green funds are defined according to the party of the majority of the trustees or the governor. Active funds are CalPERS, CalSTRS, and NYSCRF; all others are passive (less active). All regressions include election item fixed effects. Coefficients are multiplied by 100 to represent percentages. Standard errors clustered at the fund-year level are in parentheses beneath the coefficient estimates. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 11. Change in Electricity Generation at Facilities that Cut Emissions

	One Year	Two Years	Three Years	Four Years
A1. Dependent = % change in emissions				
Dummy if emission cut	-55.4***	-71.4***	-83.4***	-95.8***
	(1.0)	(1.4)	(1.6)	(2.0)
A2. Dependent = % change in electricity				
Dummy if emission cut	-52.5***	-69.8***	-81.8***	-96.0***
	(1.6)	(2.2)	(2.7)	(3.4)
Fixed effects	Year	Year	Year	Year
N	9,676	8,740	7,795	6,814

	One Year	Two Years	Three Years	Four Years
B1. Dependent = % change in emissions				
Dummy if emission cut	-55.5***	-68.1***	-75.5***	-81.7***
	(1.1)	(1.4)	(1.6)	(2.0)
B2. Dependent = % change in electricity				
Dummy if emission cut	-52.8***	-66.9***	-74.3***	-83.3***
	(1.8)	(2.4)	(2.9)	(3.7)
Fixed effects	Year, Facility	Year, Facility	Year, Facility	Year, Facility
N	9,662	8,715	7,779	6,749

Note. Each panel and column reports a regression in which the unit of observation is a facility. In panels A1 and B1, the dependent variable is the percent change in emissions from the current year t to another year $t + n$ as indicated at the top of each column, winsorized at the 5 percent in the right tail. In panels A2 and B2, the dependent variable is the percent change in electricity generated, winsorized in the same way. The explanatory variable is dummy = 1 if the facility reduced emissions over the period. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. The data cover 2010-2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 12. Divestiture of Polluting Facilities

Panel A	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (TRUST)	2.15**	3.22**	1.58	0.36
	(1.01)	(1.34)	(1.14)	(1.17)
% $\widehat{\text{nongreen}}$ (TRUST)	-1.36	-1.47	-1.26	-0.84
	(1.02)	(1.44)	(1.54)	(1.62)
N	20,837	18,197	15,606	13,079
Clusters	2,776	2,472	2,172	1,887

Panel B	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (GOV)	-0.29	1.29	0.32	-0.91
	(1.29)	(1.76)	(1.52)	(1.59)
% $\widehat{\text{nongreen}}$ (GOV)	1.83	1.47	0.61	0.59
	(1.35)	(1.49)	(1.38)	(1.38)
N	20,837	18,197	15,606	13,079
Clusters	2,776	2,472	2,172	1,887

Note. Each column in each panel is a regression in which the unit of observation is a facility-year. The dependent variable is a dummy =1 if the facility was divested between the current year t and year $t + n$ as indicated at the top of each column. Standard errors clustered at the company-year level are in parentheses beneath coefficient estimates. All regressions include year and facility fixed effects. The data cover 2010-2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 13. Increase in Green Patents

Dependent variable = Dummy if company increased patents

Panel A1. Year FE	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (TRUST)	-0.76	0.40	6.07*	2.64
	(2.94)	(3.11)	(3.29)	(3.34)
% $\widehat{\text{nongreen}}$ (TRUST)	8.15	8.42	-4.88	3.17
	(7.54)	(8.01)	(8.63)	(8.79)
N	1,186	1,066	944	831

Panel A2. Year FE	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (GOV)	-2.24	0.45	4.88	2.13
	(2.90)	(3.09)	(3.37)	(3.45)
% $\widehat{\text{nongreen}}$ (GOV)	7.31*	5.42	1.06	3.66
	(4.12)	(4.25)	(4.49)	(4.54)
N	1,186	1,066	944	831

Panel B1. Year and Company FE	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (TRUST)	0.15	0.77	15.76***	4.88
	(4.67)	(4.93)	(5.34)	(5.40)
% $\widehat{\text{nongreen}}$ (TRUST)	-5.84	-7.79	-15.35	0.07
	(10.37)	(10.69)	(11.23)	(11.20)
N	1,168	1,047	921	818

Panel B2. Year and Company FE	One Year	Two Years	Three Years	Four Years
% $\widehat{\text{green}}$ (GOV)	-3.32	-3.97	12.77**	0.21
	(4.72)	(5.08)	(5.68)	(5.81)
% $\widehat{\text{nongreen}}$ (GOV)	0.90	1.17	1.19	7.00
	(5.48)	(5.54)	(5.88)	(5.95)
N	1,168	1,047	921	818

Note. Each column in each panel is a regression in which the unit of observation is a company-year. The dependent variable is a dummy =1 if a company increased the number of green patents filed from the current year t to another year $t + n$ as indicated. Standard errors are in parentheses beneath the coefficient estimates. The data cover 2010-2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 14. Other Pollutants and Green Ownership

	One Year	Two Years	Three Years	Four Years
A. Lead and Lead Components				
$\% \widehat{green}$ (TRUST)	-2.35	-4.48	-6.73	-15.45**
	(1.73)	(2.97)	(5.71)	(6.48)
$\% \widehat{nongreen}$ (TRUST)	3.37	1.50	5.35	17.13
	(3.10)	(4.34)	(8.82)	(11.85)
N	3,096	2,420	1,847	1,446
Clusters	644	539	433	365
B. Nickel				
$\% \widehat{green}$ (TRUST)	-0.76	-4.78	-3.05	-8.94**
	(1.81)	(3.19)	(4.14)	(4.52)
$\% \widehat{nongreen}$ (TRUST)	4.92	12.87	14.44	15.05
	(4.44)	(8.20)	(10.96)	(12.23)
N	2,417	2,040	1,721	1,434
Clusters	472	414	361	312
C. Ammonia				
$\% \widehat{green}$ (TRUST)	1.32	-5.14	-7.69	-11.78*
	(2.77)	(3.88)	(5.47)	(6.35)
$\% \widehat{nongreen}$ (TRUST)	6.47	16.89*	19.73	23.63
	(7.69)	(9.75)	(12.81)	(15.82)
N	4,167	3,638	3,148	2,688
Clusters	1,057	946	841	737
D. Chromium				
$\% \widehat{green}$ (TRUST)	-4.87*	-8.38**	-6.58	-7.77
	(2.83)	(3.60)	(4.36)	(7.06)
$\% \widehat{nongreen}$ (TRUST)	2.54	15.34	18.31	32.09
	(5.27)	(11.15)	(13.79)	(24.00)
N	1,861	1,558	1,311	1,097
Clusters	407	353	308	266
E. Toluene				
$\% \widehat{green}$ (TRUST)	3.82	-2.14	0.96	5.27
	(2.48)	(3.00)	(3.92)	(4.80)
$\% \widehat{nongreen}$ (TRUST)	-2.65	8.44	6.99	-0.41
	(6.39)	(7.51)	(8.95)	(11.74)
N	3,060	2,668	2,292	1,961
Cluster	582	508	440	376

Note. Each column in each panel is a regression with year fixed effects. The unit of observation is a facility-year. The dependent variable is the percent change in emissions from the current year t to another year $t + n$ as indicated at the top of each column, winsorized at the 5 percent in the right tail; the type of pollutant is shown in the panel title. Standard errors clustered at the company-year level are in parentheses beneath the coefficient estimates. The data cover 2010-2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.