Influence without Activism: Green Investors and Corporate Emissions[*]

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Do firms adjust their policies based on shareholder preferences? Using variation in ownership by environmentally oriented public pension funds, we find that firms reduce carbon emissions when green ownership increases. We find no evidence that ownership by green investors is associated with increased shareholder activism through shareholder proposals or anti-director voting. These findings suggest that managers may attempt to align corporate social policies with shareholder preferences, even without traditional shareholder activism. The findings also suggest that divestment of fossil fuel stocks may result in companies polluting more than if green investors had held those stocks instead.

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1. Introduction

Can financial markets influence firms' environmental policies? Research on green investing has largely focused on activist investors, showing that pressure tactics such as shareholder proposals and contested director elections can affect firm behavior (Dimson et al. 2015; Naaraayanan et al. forthcoming). Yet most investors lack the resources and scale to engage in such costly and coordinated interventions. Less is known about whether routine ownership by non-activist investors influences corporate policies.

There are reasons both to expect and doubt that stock ownership by non-activist green investors would influence corporate emissions. According to the Friedman Doctrine (Friedman 1970), managers should focus on maximizing profits and disregard investors' non-pecuniary preferences. Under this view, changes in the composition of shareholders would have no effect on a company's environmental policies. On the other hand, managers are ultimately accountable to shareholders, and some argue that managers should pursue shareholder interests broadly defined to include nonfinancial returns (Hart and Zingales, 2017). In 2019, the Business Roundtable backed away from its traditional endorsement of value maximization, arguing that corporations have responsibilities to stakeholders and society in addition to shareholders. From this perspective, one would expect corporate policies to adapt to the environmental preferences of their investors.

This paper studies how changes in the share of stock owned by non-activist green investors influence a company's emissions. Our analysis focuses on variation in ownership by large public pension funds, for which we proxy environmental preferences using the partisan control of the fund's board of trustees or the party of the state's governor. We classify pension funds as "green" if they are controlled by Democrats, and non-green otherwise, relying on the well-documented correlation between partisan affiliation and environmental preferences. Public pensions control a significant amount of capital, $5.6 trillion in assets by one measure, and are convenient to study precisely because their environmental preferences can be inferred from their partisan control.

Our identification comes from two sources of variation in a company's green ownership. The first is changes in the partisan composition of trustees and governors, which occur through state elections. The second is changes in pension funds' total equity holdings driven by portfolio rebalancing: in response to exogenous variation in returns on non-equity assets, funds must adjust their public equity positions to maintain target allocation ratios across asset classes. Crucially, both sources of variation operate at the level of the pension fund, while the outcomes we study – facility-level emissions – are distributed across firms operating throughout the United States. This structure allows us to isolate changes in investor preferences that are not driven by companies' emission decisions.

We find that increases in ownership by green pension funds are followed by significant reductions in firm-level carbon emissions over subsequent years, while increases in ownership by non-green pension funds are not. These effects are economically meaningful: a 1 percentage point increase in a company's shares held by green pension funds was associated with approximately a 3 percent reduction in plant emissions over four years. The results are robust across a range of specifications, including alternative measures of emissions, different fixed effects, and controls for local political conditions and other institutional ownership. Importantly, these effects arise from the aggregation of relatively small, diffuse changes in ownership rather than from large, coordinated interventions, suggesting that firms' emissions respond to changes in the preferences of non-activist investors. Green investors appear to make companies greener.

We also directly consider whether these effects can be linked to traditional activist activities. We find that changes in green ownership are not associated with increases in the number of shareholder proposals, the approval rate of proposals, or votes against incumbent directors. This suggests that our emissions findings are unlikely to be the result of organized activist campaigns, and aligns with the idea that managers respond to the preferences of shareholders even without activism. We also find that the relationship between green investors and emissions cuts is stronger for pension funds that directly engage with management. This is consistent with the idea that engagement provides a way for non-activist investors to communicate their preferences to managers (Carleton et al. 1998; Dimson et al. 2015).

Environmental economists emphasize several margins along which firms can reduce emissions. We assemble several pieces of evidence to assess which of these margins account for the reductions we observe. For the subset of companies that operate electricity-generating facilities, emissions cuts occur primarily through reductions in output. We find no evidence of increased innovation, as would be expected if reductions were achieved through new technology, and no evidence that reductions occur through the sale of polluting assets (so-called "greenwashing").

This paper relates to several strands of the literature. A large body of work studies shareholder activism, showing that targeted interventions involving shareholder proposals and coordinated campaigns can affect firm policies (Brav et al. 2008) and environmental outcomes specifically (e.g., Dimson et al. 2015; Naaraayanan et al. forthcoming). Other work studies how firms' environmental ratings respond to environmental or media shocks, finding that the magnitude of the responses depends on institutional ownership (e.g., Dyck et al. 2019; Safiullah et al. 2022; Gantchev et al. 2022).

The analysis here focuses on a different aspect of the relationship between ownership and firm behavior. Rather than studying targeted interventions or responses to external shocks, we examine whether routine changes in ownership by non-activist green investors affect firms' emissions. In this sense, the paper is related to research on how institutional ownership affects corporate governance and operational policies (e.g., Appel et al. 2016; Azar et al. 2021; Heath et al. 2022). Our focus is on a specific type of investor – environmentally oriented "green" investors – and on their effect on carbon emissions, an investor type and outcome that have received little direct attention to date.

The paper also contributes to the debate over stock divestment as a strategy to achieve social goals (Teoh et al. 1999; Broccardo et al. 2022). Maine and New York, several cities, and many universities have divested from fossil fuel companies in order to deprive polluters of capital and redirect investment toward clean energy. Other organizations, including the large California CalPERS and CalSTRS funds, have taken the opposite approach, acquiring shares in polluting firms in order to have a "seat at the table" (CalSTRS 2023). Our evidence that increases in green ownership are associated with emission cuts supports the idea that engagement can be effective and suggests that divestment is potentially counterproductive.

2. Economic Setting, Data, and Measurement

A. Economic Setting and Sources of Variation

Public pension funds are among the largest institutional investors in American capital markets. They are governed by boards of trustees that set investment policies and oversee portfolio decisions, often under guidelines established by state-level political actors. Pension funds are large enough in aggregate for managers to be aware of their preferences, but not so large as to be able to dictate corporate election outcomes or firm policies.

An important characteristic of these funds is that they differ in environmental preferences, and their preferences are shaped by state-level election outcomes. As discussed below, funds governed by Democratic officials tend to place greater emphasis on reducing carbon emissions than those governed by Republicans. Because a majority of trustees are appointed by politicians, election outcomes can shift the partisan composition of the board, altering a fund's environmental orientation. These changes are determined at the state level and are not directly linked to the emissions decisions of the firms in the funds' portfolios, which are scattered across the country.

Another important characteristic of these funds is that they adjust their holdings of public equities in response to changes in the performance of other asset classes in their portfolios. Because funds typically maintain target allocations across public equities, fixed income, private equity, and other investments, fluctuations in returns on non-equity assets lead to mechanical changes in equity holdings through portfolio rebalancing. When non-equity assets perform well, funds increase their equity holdings to restore target shares, and when they perform poorly, funds reduce their equity exposure. These adjustments arise from portfolio mechanics and are not connected to conditions specific to the individual firms held by a fund.

A firm's share of environmentally oriented pension funds varies for two reasons that we are able to capture: through changes in investor preferences following partisan turnover, and through changes in holdings arising from portfolio rebalancing. We use this variation to examine how firms respond to changes in the environmental preferences of their shareholders.

B. Definition of Green Investors

We classify pension funds as "green" based on the partisan affiliation of the officials who control them. Our operating assumption is that Democratic-controlled funds are more supportive of reducing carbon emissions than Republican-controlled funds. This squares with conventional wisdom and a wide range of evidence on partisan differences in environmental preferences, including Congressional voting patterns, public opinion surveys, and research on environmental policy.[1]

We employ two measures of partisan control: the partisan affiliation of the fund's trustees and the party of the state's governor. We use the board of trustees because it sets the rules for a fund's investment and governance policies and is its ultimate decision-maker. We use the party of the governor because in many states the governor appoints some or all of the trustees, and is able to exert influence over the state's pension funds through laws and regulations.[2] Because these measures capture related but distinct channels of influence, we use both in our analysis.

We define a company's green (pension) ownership as the share of its stock held by green funds. Under the trustee-based measure, a firm's green ownership is the share of its stock held by pension funds, with each fund's holdings weighted by the fraction of its trustees who are Democrats. Under the governor-based measure, a firm's green ownership is the share of stock held by funds in states with a Democratic governor. We also construct measures of non-green ownership based on Republican control of the board and governor's office.[3]

Information on the partisan affiliation of trustees was hand-collected from publicly available sources. Trustees fall into three broad categories: ex officio members such as the

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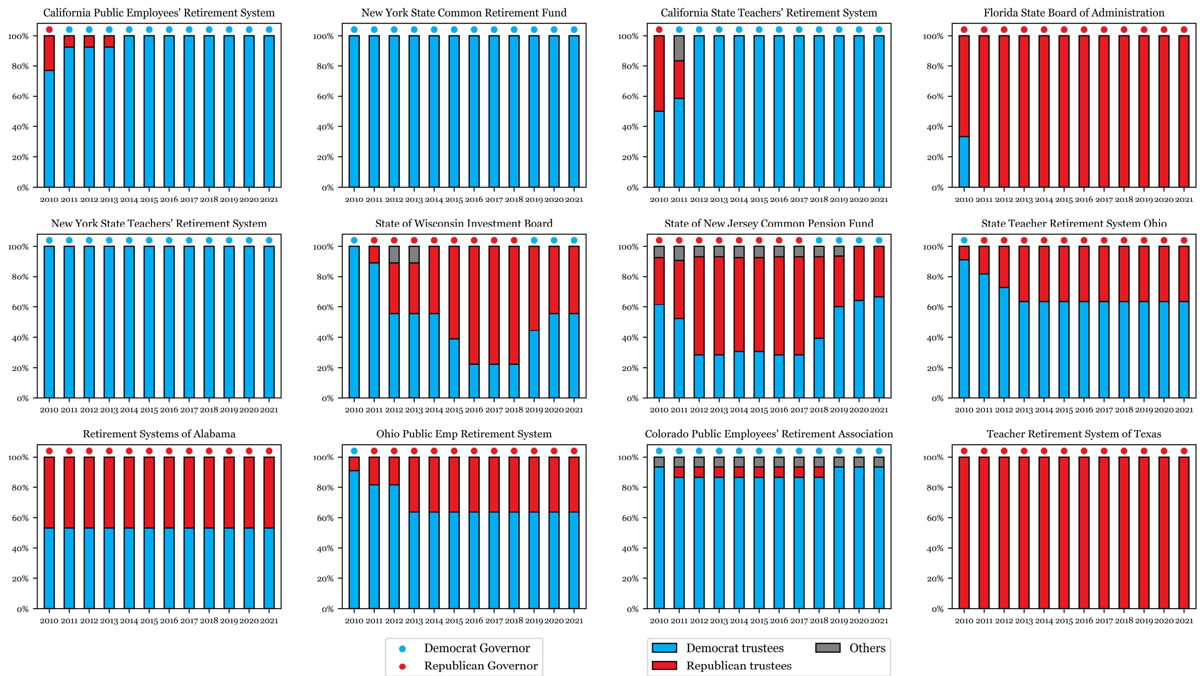
[1] For example, the 2022 Inflation Reduction Act, touted by the EPA as "the most significant climate legislation in U. S. history," was approved in the U. S. House of Representatives with all 220 Democrats voting in favor and 207 Republicans voting against, and in the U. S. Senate with 51 Democrats 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.

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

[3] This approach abstracts from within-party heterogeneity in environmental preferences. For example, a Democratic governor in Alabama may be less green than a Democratic governor in California.

Figure 1. Party Affiliation of Governor and Pension Fund Trustees



state treasurer and governor; members appointed by political actors, most often the governor; and members elected by stakeholders such as employees or retirees. We assign party affiliation based on self-declared party where available, or based on the party of the appointing authority. Additional details on classification rules are provided in Appendix IA4.

As a validation of our classifications, we collected the annual financial reports of our sample funds and counted the frequency of phrases related to climate change, such as "greenhouse gas" and "carbon emission," using the top 100 bigrams identified in Sautner et al. (2023). We find a strong positive relationship between our measures of green ownership and the frequency of climate-related terms (see Internet Appendix Figure IA1). Figure 1 shows the party of the governor and partisan composition of the trustees for the largest public pension funds in our sample. There is a strong, though not perfect, correlation between the two measures. Some states have stable partisan control during our sample period while others change, so that aggregate green ownership varies over time.

Table 1. Stock Ownership by Top 12 Public Pension Funds 2020

	Stock owned ($B)	# Companies held	# Companies with GHG emissions
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

C. Ownership Data

We collect information on pension fund stock ownership from Form 13F filings, which funds are required to file quarterly if they manage $100 million in qualifying securities in-house.[4] Funds that outsource their portfolio management to third parties, such as BlackRock, are not included in our sample.

Our starting point is the 500 largest U. S. pension funds ranked by assets, according to *Pensions & Investments*. From this list, we identify all state public pension funds with available 13F filings and construct annual holdings by averaging quarterly positions. Our final sample includes 29 public pension funds, including all 12 of the largest state public pension funds, and covers approximately 88 percent of total public pension fund assets. Table 1 provides a snapshot of the holdings of the largest public pension funds in our sample in December 2020. It shows that they hold highly diversified portfolios spanning thousands of publicly traded companies, including hundreds that report greenhouse gas emissions. This implies that a large number of emitting firms in the economy are exposed to changes in the environmental preferences of their investors.

[4] We used Thomson Reuters Institutional Holdings when possible, otherwise scraping the information from the SEC website.

D. Emissions Data

Our analysis focuses on carbon dioxide emissions, a primary concern of both investors and regulators.[5] Carbon emissions are a global externality, unlike other forms of air pollution, water pollution, and hazardous waste generation that are local in nature.

We use annual facility-level Scope 1 greenhouse gas emissions from the Environmental Protection Agency's (EPA) Greenhouse Gas Reporting Program (GHGRP) for the period 2010 to 2021. Scope 1 emissions are direct greenhouse gas emissions from sources controlled by a company. Facilities that emit 25,000 or more metric tons of carbon dioxide in a year are required to report their emissions. The EPA verifies and publishes the data.

The GHGRP database, while commonly used for research, has some limitations. First, it excludes facilities outside the United States, so undercounts emissions of firms with foreign operations. Second, emissions from mobile sources, such as airplanes and cars, are not included. Third, the data do not include Scope 2 and Scope 3 emissions, which are indirect emissions from assets outside the company's control, such as from electricity that the company purchases or emissions within its supply chain.[6]

We link facilities to their publicly traded parents if the parent owns a majority of the facility.[7] Our final sample includes 5,241 facilities from 685 publicly traded companies. The emitting facilities are concentrated in the petroleum and natural gas, power generation, waste, chemicals, metals, and minerals sectors. Table 2 reports summary statistics for the facilities and firms in our sample, including means of the key variables for comparison with the estimated effects.

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

[6] There is debate over whether firms should be held accountable for Scope 2 and Scope 3 emissions. These emissions are conceptually different from Scope 1 emissions because they are not directly controlled by the company. In addition, available data on Scope 2 and Scope 3 emissions are less reliable as they rely on voluntary disclosure and estimation by private vendors and are not verified by the EPA (Aswani et al. 2023).

[7] We merged facilities with their parents' financial information from Compustat using a fuzzy name-matching algorithm, manually deleting false-positive mismatches.

Table 2. Summary Statistics

A. Unit = Facilities × Year	Mean	25%	Median	75%	N
Emissions					
GHG emissions (million tons)	0.51	0.03	0.07	0.21	42,504
% 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 one year	7.4	0.0	0.0	0.0	37,841
% sold off in two years	13.8	0.0	0.0	0.0	33,270
% sold off in three years	19.6	0.0	0.0	0.0	28,872
% sold off in four years	24.3	0.0	0.0	0.0	24,701
B. Unit = Company ×Year					
Ownership					
% green fund ownership (TRUST)	0.9	0.4	1.0	1.3	3,726
% non-green fund ownership (TRUST)	0.5	0.1	0.3	0.5	3,726
% green fund ownership (GOV)	0.8	0.4	1.0	1.2	3,726
% non-green fund ownership (GOV)	0.5	0.1	0.4	0.7	3,726
% other institutions	62.4	51.3	71.2	83.4	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
Proposals					
# environmental proposals	0.21	0	0	0	2,346
# environmental proposals approved	0.02	0	0	0	2,346

Note. Data cover 2010-2021. For emissions, facility-years with negative emissions are excluded. % change in emissions and electricity are winsorized at 95 percent in the right tail. For proposals, includes all firms with emissions with at least one proposal across all years. For patents, includes all firms with emissions with at least one patent across all years.

E. Additional Data

We use several additional datasets to examine investor activism and the margins through which firms adjust their emissions.

Shareholder proposals and voting. To evaluate whether the changes in green ownership are associated with changes in investor activism, we use data on shareholder proposals and voting. Information on shareholder proposals comes from ISS Voting

Analytics, and information on pension fund voting comes from the Insightia database by Diligent Market Intelligence.

Pension Fund Portfolios. We use data on pension funds' asset allocation and returns on their private equity, fixed income, and real estate assets to construct predicted changes in holdings due to portfolio rebalancing. These data are drawn from Public Plans Data of Boston College's Center for Retirement Research.

Electricity output. For facilities that generate electricity, we obtain output measured in megawatt-hours from Form EIA-923 published by the Energy Information Administration. These data allow us to assess whether emissions are reduced by cutting output. We match 1,099 electricity-generating facilities in the GHGRP dataset to the EIA data using a crosswalk provided by the EPA, and aggregate generator output to the facility level where necessary.

Other pollutants. To examine whether firms respond to green investors by reducing emissions of other pollutants, we use data on non-GHG pollutants from the EPA's Toxics Release Inventory (TRI), which covers emissions of over 600 toxic chemicals. We focus on the five major pollutants: lead, nickel, ammonia, chromium, and toluene. We were able to match 5,740 facilities with 778 publicly traded companies using a linking table provided by Duchin et al. (2023).

Green Patents. To study whether firms respond through process innovation, we use patent data from PatentsView. We identify patents involving technologies for mitigation or adaptation to climate change using the Cooperative Patent Classification code Y02. Among the firms in our main sample, 185 filed at least one green patent during the study period.

3. Green Ownership and Emissions

A. Baseline Relationship

We begin by examining the relationship between green ownership and subsequent changes in firm-level emissions. We find that increases in ownership by green pension funds are followed by reductions in emissions, while increases in ownership by non-green funds are not.

We estimate this relationship using:

$$(1) \qquad \Delta Emissions_{i,t,t+s} = \beta_1 \cdot Green_{i,t} + \beta_2 \cdot Non\text{-}green_{i,t} + \gamma_t + \lambda_i + e_{it}.$$

where i indexes a carbon-emitting facility, t indexes the year, and $s \in \{1,2,3,4\}$ is the number of years ahead. The dependent variable is the change in emissions from year t to $t+s$, expressed as a percentage of emissions in year t.[8] We focus on emissions changes rather than levels because investor attention and evaluation often center on reductions in emissions (Hartzmark and Shue 2023). The key explanatory variables are the shares of the parent firm's stock held by green and non-green pension funds (we report both trustee and governor measures), with all other ownership the omitted category. All specifications include year fixed effects to absorb aggregate shocks and common time trends in emissions. Because the dependent variable is already a change in emissions, first-differencing has already removed time-invariant facility heterogeneity – the standard motivation for facility fixed effects. We therefore omit facility fixed effects in our main specifications but report them as a robustness check.

We focus on facility-level emissions in order to capture real emissions changes – company-level measures can be affected by the sale and purchase of polluting assets even when emissions at individual facilities do not change. We report results over multiple horizons because firms may adjust emissions gradually – either through short-run changes in output or longer-run changes in production processes – and we do not have a strong prior on the speed of adjustment.

Table 3 reports the baseline estimates. Across all specifications, increases in green ownership are associated with declines in emissions that grow over time. A 1 percentage point increase in the share of a firm's stock held by green funds is associated with no statistically significant change in emissions after one year, but by reductions of roughly 3 to 3.5 percent over four years. Emissions cuts become detectable after two years and persist thereafter. In contrast, increases in non-green ownership are associated with stable or

[8] Throughout, we winsorize percentage changes in emissions at the 95th percentile of the right tail to limit the influence of observations with very small baseline emissions, which can produce extremely large percentage changes. The findings are similar if we exclude changes greater than 1,000 percent in magnitude.

Table 3. Green Ownership and Changes in GHG Emissions

Panel A, Trustees	One year	Two years	Three years	Four years
Green	-0.99	-2.15**	-3.23***	-3.40**
	(0.64)	(0.93)	(1.12)	(1.25)
Non-green	2.76***	4.72***	4.90***	4.74**
	(1.02)	(1.52)	(1.91)	(2.31)
N	28,515	24,841	21,296	18,058
Clusters	3,406	3,050	2,705	2,377

Panel B. Governor	One year	Two years	Three years	Four years
Green	-0.57	-1.90**	-2.87**	-3.09**
	(0.61)	(0.91)	(1.16)	(1.41)
Non-green	0.76	1.68*	1.26	0.96
	(0.65)	(0.91)	(1.19)	(1.32)
N	28,515	24,841	21,296	18,058
Clusters	3,406	3,050	2,705	2,377

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 $t + s$ 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 party of the governor as shown in the panel titles. Standard errors clustered at the company-year level are in parentheses. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

rising emissions. This suggests that the relationship for green funds does not stem from pension fund ownership per se, but from differences in investor preferences.

B. Causal Effects Using Political Turnover and Portfolio Rebalancing

We now turn to whether the relationship documented above is a causal effect of investor preferences. To address the concern that ownership is endogenous, we employ two plausibly exogenous sources of variation. The first is changes in partisan control of funds following elections. State-level election outcomes, which determine the partisan affiliation of the political actors that oversee a fund's investment, are independent of the emissions of companies in the fund's portfolio, which are distributed across the country.

The second source of variation arises from portfolio rebalancing. Pension funds typically have portfolio target ratios for public equity holdings, compared to "other investments" such as private equity, fixed income, real estate, and commodities (for example, in 2021 CalPERS targeted public equity investment at 50 percent).[9] When a fund's other investments experience a high return, it must acquire more public equity to restore its portfolio target, and conversely, when those returns are low. These adjustments arise from portfolio mechanics, and not through firm-specific emissions changes in portfolio companies.

Based on this fact, 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 in the previous year:

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

Rebalancing implies that funds with higher returns on other assets will increase their holdings of public equity.

We then use the estimated coefficients from this regression to construct predicted holdings for each fund-company pair:

$$(3) \qquad \overline{Shares}_{f,j,t} = \left(1 + \hat{\alpha}_0 + \hat{\alpha}_1 \cdot RET\_OTHER_{f,t}\right) \cdot Shares_{f,j,t-1}.$$

We aggregate these predicted holdings across funds to construct each firm's predicted green and non-green ownership by public pension funds, and use these predicted values in place of actual ownership in the regressions. Standard errors are constructed using a bootstrapping procedure.[10] This two-step procedure is similar to an instrumental variables strategy in which returns on other investments serve as the instrument. The key identifying assumption, analogous to the exclusion restriction, is that returns on other investments are not systematically related to future changes in emissions at the firms held in a fund's public equity portfolio.

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

[10] We calculate the standard errors from this procedure using a two-stage bootstrapping procedure adapted from Cameron et al. (2008) and Ashraf and Galor (2013), described in Internet Appendix 2.

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

	(1)	(2)	(2)
Return on other investments	1.30***	2.98***	2.45***
	(0.34)	(0.37)	(0.35)
Constant	0.20***	...	...
	(0.01)		
N	49,991	49,991	49,726
F-statistic	14.8	64.1	49.6
Fixed effects	None	Year	Year x Company

Note. The table reports first-stage regressions in which 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. Standard errors clustered at the company-year level are in parentheses. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 4 presents the first-stage regression estimates using different fixed effects to show the robustness of the relation. Returns on other assets are a strong predictor of changes in public equity holdings, with F-statistics well above the conventional threshold for a strong instrument.

Table 5 reports the second-stage estimates, using the first-stage model with year fixed effects to predict ownership. The results mirror the baseline findings. A 1 percentage point increase in predicted green ownership is associated with emissions reductions of about 3.3 to 3.6 percent over four years. Increases in non-green ownership are not associated with emissions changes.

C. Alternative Explanations and Additional Evidence

We next examine whether the relationship between green ownership and emissions can be explained by factors other than investor preferences.

One concern is that state politics affect the emissions of the firms held by a state's pension fund, in addition to influencing which party controls the funds, creating a spurious correlation between ownership and emissions. This is somewhat unlikely given that funds hold highly diversified portfolios that include numerous companies not operating in their home state. To address this possibility, we control for the political environment in the state where a facility is located by including a dummy variable equal to 1 if the governor is a Democrat.

Table 5. Predicted Green Ownership and Changes in GHG Emissions

Panel A. Trustees	One year	Two years	Three years	Four years
$\overline{Green}$	-1.35***	-1.83***	-2.95***	-3.61***
	(0.52)	(0.76)	(0.94)	(1.13)
$\overline{Non\text{-}green}$	1.84***	1.91	1.30	0.69
	(0.91)	(1.32)	(1.48)	(2.04)
N	26,243	22,516	18,985	15,844
Clusters	3,040	2,691	2,355	2,043
Panel B. Governor	One year	Two years	Three years	Four years
$\overline{Green}$	-1.20**	-1.34	-2.83***	-3.34**
	(0.55)	(0.85)	(1.10)	(1.32)
$\overline{Non\text{-}green}$	0.70	0.12	-0.24	-1.04
	(0.67)	(1.02)	(1.16)	(1.44)
N	26,243	22,516	18,985	15,844
Clusters	3,040	2,691	2,355	2,043

Note. This table reports regressions in which the dependent variable is the percentage change in emissions from the current year t to another year $t + s$ 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 non-green funds, using coefficient estimates from column (2) in Table 4. Green and non-green funds are defined according to the party of the trustees or governor, as indicated in the panel titles. Bootstrapped standard errors clustered at the company-year level are in parentheses. All regressions include year fixed effects. The data cover 2010 to 2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Another concern is that companies that are held more by green pension funds may be attractive to institutional investors more generally, and that institutional investors as a group may lean green. To address this possibility, we include a control variable for the share of the parent firm's stock held by other institutional investors (recall that the unit of observation is a facility but ownership is measured at the parent level).

Table 6 reports the results. Including these controls does not materially change the coefficients on green ownership. The coefficient on the governor dummy itself is negative and statistically significant, implying that facilities cut emissions more in states with Democratic than Republican governors. Ownership by other institutional investors is not significantly related to emissions.[11] These results lend support to a causal interpretation of the baseline relationship, and suggest that it is not caused by state-level politics or institutional ownership in general.

[11] We also estimated the regressions controlling for ownership by the "big three" of BlackRock, State Street, and Vanguard, with similar null findings.

Table 6. Change in GHG Emissions with Additional Control Variables

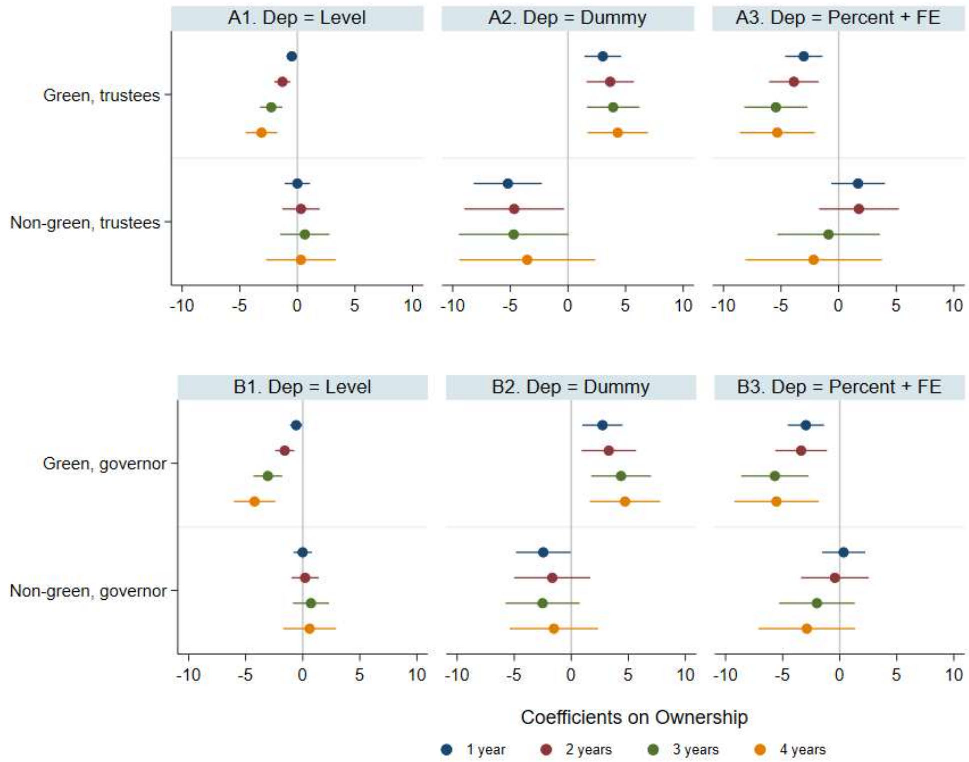
Panel A. Trustees	One year	Two years	Three years	Four years
$\overline{Green}$	-1.67***	-1.78*	-2.87***	-3.85***
	(0.63)	(0.91)	(1.11)	(1.27)
$\overline{Non\text{-}green}$	2.22***	2.79***	2.05	2.10
	(0.79)	(0.98)	(1.27)	(1.60)
Dummy = 1 if facility's governor	-0.73	-0.82	-1.48*	-2.26**
was Democrat	(0.47)	(0.66)	(0.83)	(0.96)
Other institutional ownership	0.01	-0.01	-0.01	-0.00
	(0.02)	(0.02)	(0.03)	(0.04)
N	26,220	21,676	18,287	15,213
Clusters	2,858	2,535	2,220	1,925

Panel B. Governor	One year	Two years	Three years	Four years
$\overline{Green}$	-1.50**	-1.10	-2.66**	-3.59**
	(0.65)	(1.04)	(1.33)	(1.50)
$\overline{Non\text{-}green}$	0.85	0.54	0.22	-0.12
	(0.67)	(0.99)	(1.16)	(1.30)
Dummy = 1 if facility's governor	-0.72	-0.79	-1.45*	-2.21**
was Democrat	(0.47)	(0.66)	(0.83)	(0.96)
Other institutional ownership	0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.03)	(0.04)
N	25,220	21,676	18,287	15,213
Clusters	2,858	2,535	2,220	1,925

Note. Each column in each panel is a regression in which the dependent variable is the percentage change in emissions from the current year t to another year $t + s$ as indicated at the top of each column, winsorized at the 5 percent level in the right tail. Explanatory variables include the predicted percentage of shares owned by green funds and non-green funds, using coefficient estimates from regression (2) in Table 4. The coefficient on the facility-state governor dummy is multiplied by 100 for ease of interpretation. Bootstrapped standard errors clustered at the company-year level are in parentheses. The data cover 2010 to 2021. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

We also consider whether the results are robust to several alternative specifications of the dependent variable and to the inclusion of additional controls. Figure 2 shows the dot plots of the coefficients on green and non-green ownership. First, we express emissions in levels rather than percentages to address the possibility that percentages mechanically produce larger magnitude changes for facilities with low baseline emissions. Second, we express the dependent variable as a dummy equal to 1 if a facility's emissions decline, in effect removing scale effects entirely. Third, we include facility fixed effects. Across these

Figure 2. Robustness to Alternative Outcome Measures and Specifications



Note. The figure shows the coefficients on predicted green and non-green ownership for alternative specifications of (1). In A1 and B1, the dependent variable is changes in emission levels, winsorized at 1 percent in each tail; in A2 and B2, the dependent variable is a dummy = 1 if the faculty cut emissions; in A3 and B3 the dependent variable is percentage change in emissions. All regressions include year fixed effects; A3 and B3 also include facility fixed effects. 95 percent confidence intervals are indicated.

specifications, increases in green ownership are consistently associated with reductions in emissions, while increases in non-green ownership are not.

4. Influence without Activism

The evidence to this point shows that increases in green ownership are followed by cuts in carbon emissions. A natural follow-up question is why these changes in ownership matter. One possibility is that green investors exert pressure on managers through shareholder proposals and voting, that is, through conventional activism. Alternatively, managers may respond to ownership even without activism. In this section, we show that green ownership is not associated with greater activism, and suggest that non-adversarial engagement with managers may account for the response.

A. Does Green Ownership Increase Shareholder Activism?

If the type of green ownership we study operates through shareholder activism, increases in green ownership should be associated with more shareholder proposals and greater opposition to management in corporate voting.

We first consider shareholder proposals. In American corporations, shareholders can submit proposals that are voted on by shareholders collectively, subject to meeting certain conditions (Matsusaka et al. 2021). Although these proposals are typically non-binding, firms often feel compelled to respond to them (Ertimur et al. 2010; Matsusaka and Ozbas 2017), making them an effective tool for activists. We focus on environmental proposals, which call on firms to report on emissions, reduce emissions, set emissions targets, or advance other environmental goals.[12] Environmental proposals are not rare in our sample, with about 15 percent of firms receiving one in a given year. These proposals are usually opposed by management and can therefore be viewed as adversarial in nature.

To examine whether green ownership is associated with increased proposal activity, we estimate a linear probability model:

$$(4) \qquad Proposal_{c,t} = \beta_1 \cdot \overline{Green}_{c,t} + \beta_2 \cdot \overline{Non\text{-}green}_{c,t} + \beta_3 X_{c,t} + \gamma_t + \lambda_c + e_{c,t},$$

where the dependent variable is an indicator for whether company c receives an environmental proposal in year t, or whether such a proposal is approved. The control variables include firm size and the level of greenhouse gas emissions.

Table 7 reports the results. For both outcomes – receiving a proposal and having a proposal pass – the coefficient on green ownership is small in magnitude and statistically insignificant. The coefficient on non-green ownership is also statistically insignificant. These results provide no evidence that green ownership is associated with more frequent or more successful environmental proposals.

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[12] Environmental proposals are those classified by ISS Voting Analytics as carbon, climate change, coal, energy, environment, environmental, fossil fuel, GHG, global warming, greenhouse, methane, pollution, sustainability.

Table 7. Green Ownership and Shareholder Proposals

Panel A. Trustees	Dummy = 1 if company received an environmental proposal (1)	Dummy = 1 if an environmental proposal passed (2)
$\overline{Green}$	1.06	-0.94
	(1.74)	(3.31)
$\overline{Non\text{-}green}$	-0.06	6.04
	(3.45)	(7.16)
Assets (log)	0.049***	-0.001
	(0.006)	(0.008)
Emissions (trillion tons)	5.22***	-0.06
	(0.51)	(0.40)
N	1,837	279
Panel B. Governor		
$\overline{Green}$	0.85	-1.20
	(1.83)	(2.99)
$\overline{Non\text{-}green}$	0.55	4.49
	(2.37)	(4.04)
Assets (log)	0.049***	-0.001
	(0.006)	(0.008)
Emissions (trillion tons)	5.22***	-0.06
	(0.51)	(0.39)
N	1,837	279

Note. Each column of each panel is a regression in which the unit of observation is a company-year. Dependent variables are indicated in the column headings. Column (1) covers all companies with emissions in the EPA data, and the data in column 2 cover companies with environmental proposals. All regressions include year fixed effects. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

We also examine activism at the level of individual fund votes. Shareholders can oppose management by voting in favor of shareholder proposals and by voting against candidates for director positions. To assess whether green funds are more likely to oppose management, we estimate:

(5) $$D(yes)_{f,p,c.t} = \beta_1 \cdot D(Green)_f + \lambda_p + e_{f,c,p,t},$$

Table 8. Yes Votes by Pension Funds on Shareholder Proposals and Director Elections

	Environmental Proposals	Nonenvironmental Proposals	Director Elections
Panel A. Trustees	(1)	(2)	(3)
Dummy = 1 if Green	-13.3***	-0.2	-6.5***
	(3.9)	(1.8)	(1.8)
N	4,138	21,997	329,405
Cluster	197	203	206
Panel B. Governor			
Dummy =1 if Green	9.0*	4.4**	0.0
	(4.8)	(1.8)	(1.7)
N	4,370	23,207	344,734
Clusters	210	216	219

Note. Each column in each panel is a regression in which the unit of observation is a public 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 ownership is a dummy if a majority of trustees or the governor were Democrats, as show in the panel titles. 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. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

where the dependent variable is an indicator equal to 1 if fund f votes in favor of election item p at company c in year t.[13] The explanatory variable is an indicator for green public pension funds, with non-green public pension funds the omitted category. Funds are classified as green if a majority of their trustees are Democrats or if the governor is a Democrat. We include fixed effects for each election item to control for its underlying merit.

Table 8 presents the results. Across specifications, the estimates do not reveal a consistent pattern of voting behavior by green funds. Depending on how green funds are defined, they are sometimes more likely and sometimes less likely to support environmental proposals, and the results for non-environmental proposals and director elections are similarly mixed. Overall, the voting evidence does not provide consistent support for the view that green funds exert greater pressure on management.

13 For shareholder proposals, we include votes "for" and "against", excluding all other options such as abstention. For director elections, we code votes "for" as 1 and votes "against", "withheld", abstain", and "did not vote" as 0.

B. If Not Activism, What?

The absence of evidence for increased shareholder activism suggests that the relationship between green ownership and emissions reductions does not operate through adversarial pressure. Instead, the findings point to a more passive or collaborative form of influence.

One possibility is that managers choose to adjust firm policies to align with the preferences of investors. As employees of the company's owners, managers may feel a "responsibility to conduct the business in accordance with their desires" (Friedman 1970). They may seek to accommodate investor preferences without being pressured to do so. For this to occur, managers must be able to infer the preferences of their shareholders. For large institutional investors, this may occur through "engagement," a process in which fund managers meet with corporate executives informally to express their views on policy issues, share their principles and beliefs, and work toward resolution of their concerns. There is anecdotal evidence that some institutional investors communicate with firms in this way and that these interactions can influence corporate decisions (Carleton et al. 1998; Dimson et al. 2015).[14]

C. Heterogeneity Across Investors

We next investigate whether the relationship between green ownership and emissions is broadly present across investors or concentrated among the largest funds. This distinction is potentially relevant because large funds may have more resources to engage companies and may be more visible to managers, making their preferences easier to

[14] Carleton et al. (1998) study private engagement by TIAA-CREF, finding that most interactions resulted in agreement without resorting to shareholder votes. Dimson et al. (2015) describe several forms of direct engagement between an unnamed institutional investor and firms on environmental and social issues, showing that such interactions can influence corporate decisions.

Table 9. Large versus Small Pension Funds

	Emissions Changes Over Four Years
$\overline{Green}$, largest funds	-5.93**
	(1.88)
$\overline{Green}$, smaller funds	-0.33
	(2.23)
$\overline{Non\text{-}green}$	0.40
	(1.69)
N	15,844
Clusters	2,043

Note. The table reports 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 four years ahead, winsorized at the 5 percent level in the right tail. Green ownership is measured based on trustees. Standard errors clustered at the company-year level are in parentheses. The regression includes year fixed effects. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

identify.[15] We estimate the relationship between emissions and two separate types of green ownership, one for the three largest funds and one for all other funds.

Table 9 reports the results from a specification that includes both types of green ownership. The coefficient on ownership by the largest funds is negative and statistically significant (−5.93), while the coefficient on ownership by other funds is much smaller in magnitude and not statistically significant (−0.33). Because ownership by large and smaller funds is highly correlated, it is difficult to separately identify their independent relationships. Even so, the results suggest that ownership variation among large funds is more strongly associated with emissions reductions than ownership variation among other funds. This is consistent with the view that engagement can bring investor preferences to the attention of managers. The table uses the trustee measure to classify green funds; the governor measure yields in similar findings.

[15] In our sample, large funds appear to be more likely to communicate with other shareholders. The three largest funds – CalPERS, CalSTRS, and NYSCRF – were the only funds in our sample period that filed SEC Form PX14A6G, which allows communication with other shareholders about voting matters without engaging in a proxy contest. Splitting the sample by PX14A6G filing yields similar results for Table 9: firms appear to respond more strongly to funds that actively engage.

5. How Firms Reduce Emissions

The results to this point show that firms respond to green ownership by reducing carbon emissions. Green investors are likely to care not only that emissions are cut, but how companies achieve those cuts. In particular, they are likely to prefer facility-level operational changes that reduce emissions rather than corporate-level reductions achieved simply by selling off polluting assets. This section provides evidence that companies do not sell off dirty assets in response to green investors. Instead, we find that some emissions cuts (those from electricity-generating facilities) are achieved by reducing output. We find little evidence of increased innovation. We also find little evidence that companies reduce emissions of chemicals that investors rarely focus on, consistent with the idea that companies respond to the expressed and visible preferences of investors.

A. Sell-Offs of Polluting Facilities

Companies can reduce their reported carbon emissions by selling polluting facilities to another company or spinning them off as stand-alone entities. Such transactions are often described as "greenwashing," and appear to earn divesting companies higher ESG ratings, even though the divested facilities do not reduce emissions (Duchin et al. 2024). Sell-offs cannot account for our main finding of emission cuts because we follow the same facilities over time, regardless of whether they are retained or divested. Nevertheless, we are interested in whether companies respond to green ownership by selling off their polluting assets.

Table 10 reports regressions of an indicator for whether a facility is sold or spun off over a four-year period on green ownership, including year and facility fixed effects. For both measures of green ownership, the coefficients are small and statistically insignificant, providing little evidence that green or non-green ownership leads to more asset sales.

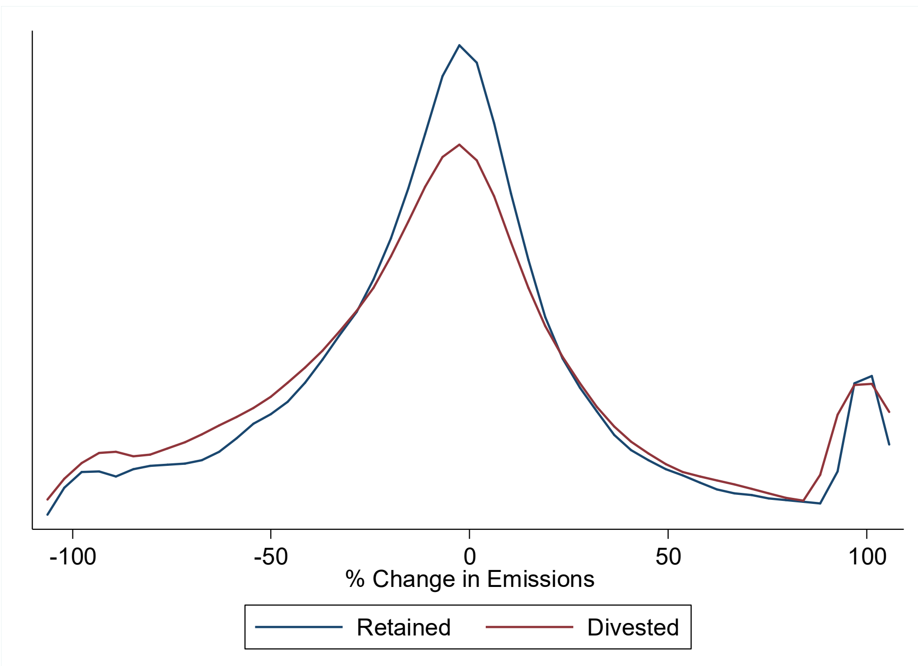
Figure 3 offers additional perspective by comparing emission changes at retained and divested facilities over four years (winsorizing observations with greater than 100 percent changes.) Emission reductions are similar across the two groups, with retained

Table 10. Divestiture of Polluting Facilities over Four Years

	Trustee measure	Governor measure
$\overline{Green}$	0.40	-0.88
	(1.19)	(1.62)
$\overline{Non\text{-}green}$	-0.51	0.84
	(1.67)	(1.40)
N	13,102	13,102
Clusters	1,893	1,893

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 a facility was divested within four years. Green ownership is measured as indicated in the column headings. Standard errors clustered at the company-year level are in parentheses. All regressions include year and facility fixed effects. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Figure 3. Density of Emission Changes for Retained and Divested Facilities



facilities modestly more likely to reduce emissions than divested units. This suggests that divestitures are not systematically shifting emissions to other owners.

Sell-offs of facilities can cause corporate-level emissions changes to diverge from the average facility-level changes that constitute our main findings. In Internet Appendix AI3, we report corporate-level regressions and show that the relationship between green ownership and emissions cuts also appears at the corporate level, albeit less precisely estimated because there are fewer company-level than facility-level observations.

B. Emissions Reduction through Output Reduction

To gauge the importance of output reductions in cutting emissions, we examine the subset of facilities that produce electricity. Electricity-generating facilities are required to report their production, allowing us to measure their output; output data are not available for other types of facilities. If these facilities reduce output in proportion to their emissions cuts, we can infer that reductions are achieved through scale adjustments. If output does not decline proportionately, it suggests that reductions are achieved through abatement or the use of cleaner production technologies.

Figure 4 plots changes in emissions against changes in electricity generation over a two-year period for facilities that reduce emissions. If emissions were reduced entirely through output cuts, the observations would lie along the 45-degree diagonal. The figure suggests that output reductions are a common method for cutting emissions in our sample.

Table 11 confirms this pattern in a regression framework. The top panels report regressions of changes in emissions (Panel A1) and changes in electricity (Panel A2) on a dummy for facilities that reduce output, including year fixed effects. The similarity in the

Figure 4. Emission Cuts Compared to Electricity Cuts, Plants that Reduced Emissions

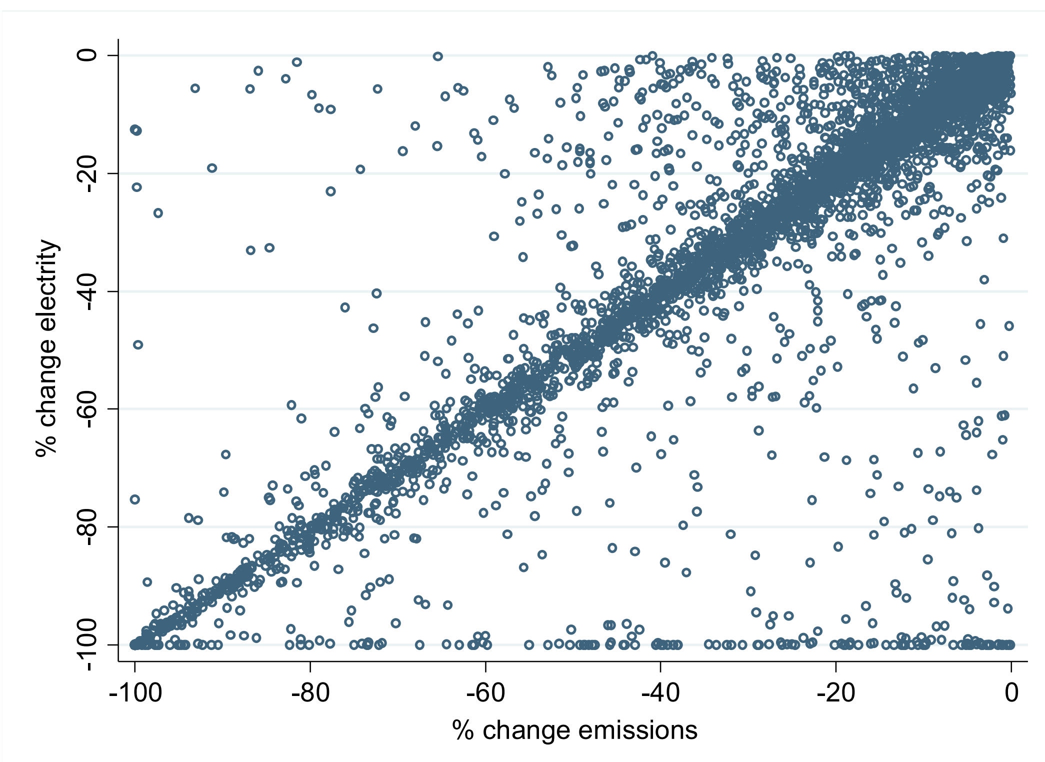


Table 11. Change in Electricity Generation at Facilities that Cut Emissions

	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 is 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 a dummy = 1 if the facility reduced emissions over the period. Standard errors clustered at the company-year level are in parentheses. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

coefficients indicates that emissions reductions are accompanied by similar output reductions. The bottom panels repeat the exercise in regressions that also include facility fixed effects, with similar results. These comparisons indicate that, on average, emissions cuts are matched by similar declines in output.

C. Emissions Reduction through Innovation

Companies can reduce emissions by innovating new, cleaner production techniques, and encouraging such innovation is an oft-stated goal of green investors (Kowalski 2023). The fossil fuel industry produces more green patents than almost every other industry (Cohen et al. 2021), suggesting that it has a substantial capacity for innovation. To explore whether green investors accelerate green innovation, we study patenting activity by major emitting firms.

Table 12. Probability of an Increase in Green Patents (Four-Year Horizon)

	Trustees	Governor	Trustees	Governor
$\overline{Green}$	0.83	0.70	2.11	-0.11
	(3.33)	(3.51)	(5.34)	(5.91)
$\overline{Non\text{-}green}$	7.47	5.00	9.93	8.73
	(8.64)	(4.54)	(10.95)	(5.97)
Fixed Effects	Year	Year	Year, Firm	Year, Firm
N	835	835	822	822

Note. Each column reports a regression at the company-year level. The dependent variable is an indicator equal to one if the number of green patents in year $t + 4$ exceeded the number in year t. Standard errors are in parentheses. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Table 12 reports regressions of green patenting on green and non-green ownership. The dependent variable is an indicator equal to one if the number of green patents filed by a company is larger four years later than in the current year. We use an indicator because the number of patents is discrete and highly right-skewed. Across both measures of green ownership and both fixed-effects specifications, the coefficients on green ownership are statistically insignificant. The same is true for non-green ownership.

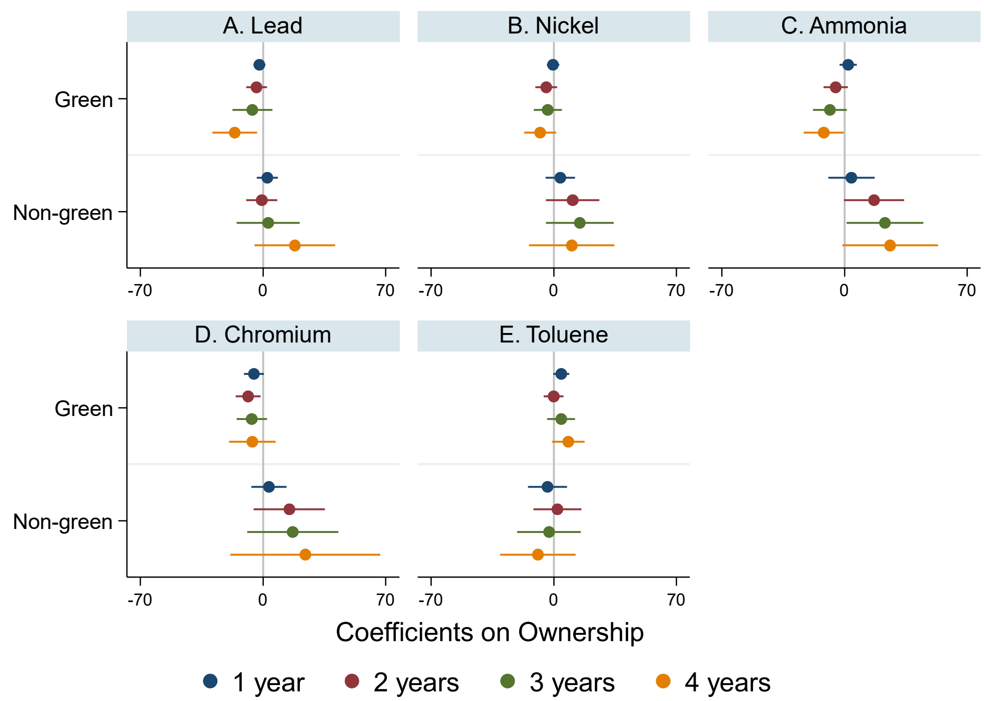
These results provide little evidence of a systematic relationship between green ownership and changes in patenting. Estimates over shorter horizons point to the same conclusion. Overall, the evidence does not offer support for the view that green investors prompt companies to develop cleaner production technologies.

D. Reductions in Emissions of Other Chemicals

Finally, we explore whether green ownership is associated with reductions in emissions of other chemicals. It is common for investors to express their views on carbon emissions, but rare for them to speak about other chemicals. Examining whether companies also reduce emissions of other chemicals provides insight into whether they respond to the specific preferences expressed by green investors, or instead adopt more environmentally friendly policies across the board when green ownership increases.

We focus on five chemicals tracked by the EPA with the highest emission levels in our sample: lead, nickel, ammonia, chromium, and toluene. Figure 5 reports coefficients on ownership from our baseline regression specification, where the dependent variable is the percentage change in emissions of each chemical, and green ownership is measured by

Figure 5. Green Ownership and Other Pollutants



Note. The figure shows the coefficients on predicted green and nongreen ownership for alternative specifications of (1) for different chemical emissions. Green ownership is classified using the trustee measure. Regressions include year fixed effects. 95% confidence intervals are indicated.

trustees. Across pollutants and time horizons the coefficients on green ownership are generally small and statistically insignificant, with no consistent pattern in signs across chemicals.

These results offer little evidence that green ownership leads to reductions in emissions of non-carbon chemicals. This fits with the idea that firms respond to the expressed preferences of investors, rather than undertaking pro-environment policies more generally.

6. Conclusion

Firms respond to the environmental preferences of their shareholders, even when those shareholders do not participate in conventional activism campaigns. Using variation in ownership by green public pension funds arising from election outcomes and portfolio rebalancing, we find that firms cut their carbon emissions by larger amounts when they have more green investors. This responsiveness is especially pronounced for funds that are visible and engage with managers to communicate their preferences. We find no evidence that green ownership is associated with increased use of shareholder proposals and anti-director voting, two prominent channels of traditional activism.

Implications for Divestment Campaigns

These findings have implications for the debate over stock divestment as a strategy to achieve climate goals. On one side, proponents of divestment argue that green investors can have the largest impact by selling fossil fuel stocks, and redirecting capital from dirty to clean energy producers. By one estimate, $40 trillion in assets have been committed to divestment, including by large state and city public pension funds and universities. On the other side, proponents of engagement argue that green investors can have more influence by acquiring fossil fuel stocks and as shareholders seeking to persuade companies to decarbonize. Some prominent institutional investors, including the green-leaning California public pension funds, have resisted pressure to divest, arguing that they are more effective when they have "a seat at the table" and engage managers.[16]

Our finding that green ownership is associated with reductions in carbon emissions lends support to the argument that engagement can be effective. Green investors make companies greener. Conversely, if companies seek to align their policies with the preferences of their investors, divestment could be counterproductive by tilting the balance of shareholders toward those without green preferences.

Implications for Using Financial Markets to Address Social Issues

Economists traditionally view financial markets as mechanisms for allocating capital to productive purposes, with government responsible for providing public goods and managing externalities. More recently, the idea has emerged that investors may be able to

[16] "[D]ivestment has little – if any – impact on a company's operations and therefore does nothing to reduce greenhouse gas emissions," according to CalPERS (2023). A joint statement from CalPERS and CalSTRS says: "active and direct engagement . . . is the best way to resolve issues . . . having a voice at the table, is an effective tool to mitigate risk such as climate change." The undated statement is available at: https://www.calpers.ca.gov/docs/corporate-engagement-climate-change.pdf.

use their investments and positions as shareholders to influence firms to address environmental problems when public regulation is weak (Egorov and Harstad 2017). Our evidence that firms respond to the preferences of their investors lends support to the view that investors can advance social goals through their portfolio choices. Doing so, however, requires maintaining ownership in the companies they wish to influence rather than divesting from them.

Implications for the Goals of the Firm

Finally, our findings speak to an ongoing discussion about the goals of the corporation. While the Friedman Doctrine holds that managers should focus entirely on profits, our findings suggest that they may in fact choose to undertake actions in support of environmental goals, even at some cost to profits, if they have sufficient green shareholders. This accords with the idea that managers take into account shareholders' social preferences and may seek to maximize shareholder welfare more broadly, as suggested by Hart and Zingales (2017).

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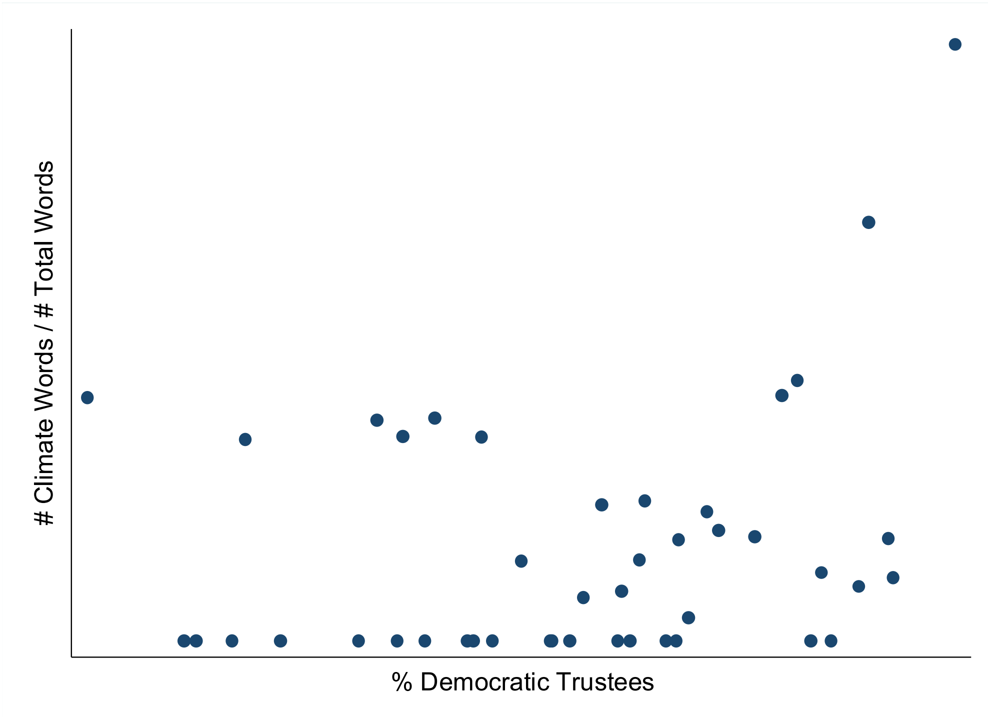
Internet Appendix 1. Climate Language Used by Pension Funds

Figure IA1. Binned Scatterplot of Green Trustees Against Climate Words in Annual Report



Internet Appendix 2. Standard Errors

The regressors in our two-step model are generated from equation (3), using coefficients produced from a first-stage regression (2). This type of procedure produces consistent estimates of the coefficients in the second stage but inconsistent standard errors because of errors in the generated regressors (Pagan 1984; Murphy and Topel 1985). This can result in standard errors that are biased downwards. To address this concern, we implemented a two-step bootstrapping algorithm adapted from Ashraf and Galor (2013) and Cameron et al. (2008).

First, we drew a random sample with replacement of pension holdings and their returns from other investments to estimate a first-stage regression. Second, we used the first-stage OLS coefficients to calculate the instrumented shareholdings using equation (3). Third, we drew a random cluster of firm-years with replacement and used the facilities of this random cluster to estimate the second-stage regression, recording the resulting OLS coefficients. Fourth, we repeated the previous steps 1,000 times. Finally, we use the standard deviation of the coefficients as the bootstrapped standard errors of our main estimates.

We also implemented block bootstrapping at the company level, which involves drawing random clusters of firms instead of firm-years in the third step. The statistical significance remains substantially unchanged in our main results.

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Internet Appendix 3. Company-Level Regressions

Table IA3. Company-Level Regressions

Panel A. Trustees, Year Fixed Effects	One Year	Two Years	Three Years	Four Years
$\overline{Green}$	-1.45	-3.95**	-3.26	-5.21*
	(0.93)	(1.59)	(2.24)	(3.04)
$\overline{Non\text{-}green}$	-2.25	-2.90	-9.67*	-13.07*
	(2.21)	(3.70)	(5.24)	(7.06)
N	2,858	2,400	1,988	1,633

Panel B. Governor, Year Fixed Effects	One Year	Two Years	Three Years	Four Years
$\overline{Green}$	-1.25	-2.56	-2.21	-4.47
	(0.97)	(1.72)	(2.53)	(3.51)
$\overline{Non\text{-}green}$	-2.29*	-5.24	-8.70	-11.09
	(1.38)	(2.27)	(3.21)	(4.39)
N	2,858	2,400	1,988	1,633

Panel C. Trustees, Year and Company Fixed Effects	One Year	Two Years	Three Years	Four Years
$\overline{Green}$	-2.67*	-6.97**	-5.63*	-7.51*
	(1.51)	(2.35)	(3.11)	(3.86)
$\overline{Non\text{-}green}$	-4.60	-2.24	-6.16	-4.47
	(3.05)	(4.64)	(6.19)	(7.40)
N	2,807	2,342	1,933	1,591

Panel D. Governor, Year and Company Fixed Effects	One Year	Two Years	Three Years	Four Years
$\overline{Green}$	-2.75*	-6.97***	-7.61**	-11.16**
	(1.57)	(2.53)	(3.49)	(4.37)
$\overline{Non\text{-}green}$	-3.79	-4.04	-3.71	-1.69
	(1.87)	(2.81)	(3.74)	(4.62)
N	2,807	2,342	1,933	1,591

Note. Each column is a regression in which the unit of observation is a company-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. Standard errors are in parentheses. Significance: * = 10 percent, **= 5 percent, *** = 1 percent.

Internet Appendix 4. Data Details

A. Partisan Affiliation

Information on partisan affiliation of pension fund trustees was hand-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 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 and state treasurer, and appointed officials such as the state's finance director. Elected officials were classified according to their self-declared party (Governor Bill Walker of Alaska, an independent, was labeled a Republican based on his historical affiliation), 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.* Members appointed by the governor – by far the most common type of appointee – were assigned 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 were trustees elected by teachers, retired workers who were beneficiaries, or by local governments. Since state and local government employees are about twice as likely to identify as Democrats than Republicans (Newport et al. 2011), we categorized members elected by government employees as Democrats, assuming selection by the median voter, unless information on their campaign contributions or self-declarations of party were available. Trustees 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 the "uncertain" category.[17]

[17] 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.

An oversimplification in our approach is treating all members of a party as if they had the same preferences, because 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.

B. Patents

We identified 3,903,010 patents for the period 2010-2021, of which 282,274 are classified as “green patents,” meaning technologies or applications for mitigation or adaptation against climate change (CPC Y02). We linked the patent filing companies to company names in the Compustat dataset using a fuzzy matching algorithm. We were able to identify 68,049 green patents associated with 1,564 publicly traded companies. Focusing on the 686 companies in the EPA GHGRP dataset, our working sample includes 185 unique companies that filed at least one green patent during our study period. The mean number of green patents filed by a company per year was 14.9 (median = 1), with a range from zero to 496.