International ownership of brown shares and economic development

Abstract

Using global share-ownership data for 2002–2021, we study how carbon-intensive firms come to be owned across countries at different levels of economic development and how this affects environmental outcomes. Richer countries tilt away from carbon-intensive firms more than poorer countries do. Because shares must be held, market clearing leaves more of these firms in poorer-country hands. This poorer-country ownership predicts higher subsequent emissions and ESG incidents. We show that rich-country fossil-fuel divestment pushes firms toward such ownership, followed by worse environmental outcomes. Climate-motivated exit, by reallocating these firms toward less environmentally inclined owners, can work against the goal it serves.

Keywords: Sustainable investing; Divestment; Economic development; International equity ownership; Carbon emissions.

JEL classification: F21, G11, G15, Q54

I. Introduction

A large literature studies how climate-conscious investors tilt away from carbon-intensive firms (Bolton and Kacperczyk 2021, Gibson Brandon et al. 2022, Heath et al. 2023, Starks et al. 2026). Yet any investor group is only one part of a market that clears. A firm's owner base at any point in time is the equilibrium outcome of the actions of all investors together, and studying one group in isolation therefore misses where ownership settles. This matters since the owners of a firm influence its environmental conduct (Chen et al. 2020, Dyck et al. 2019, Kahn et al. 2025, Naaraayanan et al. 2021, Shive and Forster 2020). For carbon-intensive firms, the environmental consequences of divestment depend not only on who exits, but also on who replaces them. We therefore study how

carbon-intensive firms come to be owned across the world, and how their owners' income levels and preferences shape the environmental outcomes of these firms.

We consider ownership at the investor country level. This level of aggregation is suitable to capture meaningful equilibrium ownership outcomes after netting out the intra-market trades. A country's characteristics shape how its investors incorporate environmental values into their financial decisions (Breuer et al. 2018, Dyck et al. 2019, Liang and Renneboog 2017). Here, we examine how the level of investor-country economic development affects the ownership of more polluting firms.[1]

Figures 1 and 2 provide some motivating evidence. Across 123 countries in 2017, the emissions intensity of national equity portfolios declines with GDP per capita, for both the overall portfolio and the foreign shares-only portfolio. Motivated by this, we examine how variation in economic development affects how carbon-intensive firms are owned internationally, and whether the resulting ownership pattern matters for firm-level environmental outcomes. Our central hypothesis is that there is systematic ownership sorting at the individual-firm level: investors in more developed countries tilt away from carbon-intensive firms, so that market clearing leaves such firms relatively more in the hands of investors in less developed countries.

[Insert Figures 1 and 2 about here]

Using global ownership information for individual public firms over 2002–2021, we construct the share held by each investor country in each firm-year. We regress this share on the interaction of a firm's emissions intensity in revenue (*EIR*, computed as emissions over revenue) with investor-country log GDP per capita, including firm-year and investor-country-year fixed effects. The estimated interaction term is negative, implying that investors in richer countries display a greater avoidance of carbon-intensive firms in their portfolio selection. Comparing investor countries at

[1]Economic development has previously been shown to affect the location of polluting activities, as such activities migrate from more developed economies toward less developed ones (Copeland and Taylor 1994, Peters et al. 2011), a pattern usually associated with the stricter environmental rules of richer countries (Babiker 2005, Ben-David et al. 2021).

the 25th and 75th percentile of the income distribution, we find that the richer country holds about 0.33% less of the ownership of a firm per one-standard-deviation increase in *EIR*. In our baseline estimation, we control for investor-country stock market development and a firm's recent stock return.

Our estimation implies an international ownership pattern of carbon-intensive firms that depends on economic development. If richer-country investors demand relatively less of a stock, market clearing requires that other investors hold relatively more. We interpret the relatively green portfolios of investors in richer countries as reflecting a willingness to contribute more to the green transition. This is consistent with models of private provision of public goods to which richer agents tend to contribute more (Bergstrom et al. 1986, Murdoch and Sandler 1997). This interpretation does not require purely nonpecuniary motives of individual investors, because societal preferences also shape the institutional environment and the forward-looking perception of carbon-transition risk, which in turn affect portfolio decisions. Consistent with this interpretation, narrower proxies of green preferences (rule of law, self-expression values, and observed fossil-fuel divestment commitments) each capture part of the observed investment pattern, but none subsumes economic development.

We address two main endogeneity concerns in our empirical design. First, the ownership of domestic firms could in principle drive the observed ownership pattern: stricter climate policy lowers the emissions of firms in rich countries, and the predominant ownership by investors in rich countries of domestic firms then makes their portfolios greener. However, our main finding persists when we exclude domestic holdings. Second, access frictions to investments internationally could affect our estimation: poorer-country investors might hold fewer clean foreign firms not by preference but because cleaner firms are inaccessible to them. Addressing this concern, we find that poorer countries' tendency to invest in brown foreign firms strengthens, not weakens, when we restrict the estimation to relatively large foreign firms, where such frictions are least binding.

The richer-country avoidance of brown firms varies across investor types and firms. It is strongest among strategic and long-horizon investors, whose large and committed stakes make

carbon exposure especially salient (Kim et al. 2019, Starks et al. 2026). It is also sizable among delegated managers, who translate their clients' and home-country environmental norms into their portfolio decisions (Gantchev et al. 2022, Gibson Brandon et al. 2022). It is weakest for stewards, such as pension and sovereign-wealth funds, which may keep shares in order to engage with firms (McCahery et al. 2016). Across firms, it is most pronounced for firms in brown industries and for large firms, which draw the most scrutiny (Azar et al. 2021, Bolton and Kacperczyk 2021). Moreover, it fades for MSCI World index constituents that experience passive investor demand that is less sensitive to environmental concerns.

Reverse causality is unlikely to explain the effect of economic development, since an investor country's ownership in any one firm is not going to affect its GDP per capita. The relation between ownership and *EIR* is more subtle. If richer-country ownership improves environmental performance, then persistent ownership could itself contribute to a pattern whereby richer countries invest relatively more in greener firms. However, we find that the tendency for rich countries to hold green stocks became much stronger with the entry into force of the Paris Agreement in 2016. We interpret this as evidence that greener portfolio preferences in richer countries explain their relatively greener portfolios. The Paris Agreement likely affected these preferences more directly than it affected richer-country investors' ability to improve the environmental performance of their portfolio firms.

Nevertheless, the international ownership pattern of brown firms potentially affects their environmental performance, and this raises the question of whether the relatively higher ownership of brown firms by investors in poorer countries worsens their environmental performance. We contribute evidence on this question in two different ways.

First, we relate a firm's ownership composition across investor-country income groups to its next-year emissions intensity and RepRisk incident intensity. We show that greater ownership by richer countries predicts lower next-year emissions and fewer RepRisk incidents, especially for firms in brown industries and large firms.

Second, to obtain plausibly exogenous variation, we exploit the waves of fossil-fuel divestment

commitments. Divestment commitments are concentrated in rich countries and work through this margin: they make brown firms less desirable to rich-country investors, whose shares others must absorb. We build a shift-share measure that interacts firms' predetermined 2002–2005 cross-border ownership weights with the later accumulation of rich-country divestment commitments (Goldsmith-Pinkham et al. 2020, Greenstone et al. 2020). Relative to non-exposed firms, a one-standard-deviation increase in divestment-pressure exposure is followed by declines of 2.5 percentage points in the next year and 4.4 percentage points three years later in the rich-country share of foreign ownership. Non-exposed firms show no such move and no differential pre-trend. The ownership reallocation is followed by worse outcomes for the target firms. The exposed firms' emissions intensity rises and environmental incidents increase, whereas non-exposed firms with comparable shareholders do not deteriorate and, if anything, improve. This divestment setting therefore provides additional evidence that richer-country environmental pressure shifts ownership away from targeted firms, and is followed by worse environmental outcomes.

The results of this paper speak to whether climate-minded investors should exit or engage. In a market setting, divestment does not retire ownership but transfers it, and its environmental effect depends on who absorbs the shares. When the buyer has weaker preferences and less governance capacity, the transfer can undo the intended gains.

Our results connect several strands of work on finance and the low-carbon transition. A theoretical literature shows how investors' nonpecuniary preferences shape equilibrium asset prices, holdings, financing, and corporate behavior (Chowdhry et al. 2019, Heinkel et al. 2001, Hong et al. 2023, Oehmke and Opp 2025, Pástor et al. 2021, Pedersen et al. 2021). Such preferences are well documented (Hartzmark and Sussman 2019, Hong and Kacperczyk 2009, Riedl and Smeets 2017), and carbon and transition risk are priced and shape institutional behavior (Bolton and Kacperczyk 2021, 2023, Pástor et al. 2022, Zhang 2025). Much of this literature examines investor demand and asset prices, with little evidence on equilibrium ownership reallocation and its environmental consequences. We bring the issue of market clearing to the international level, and we provide evidence on who ends up owning carbon-intensive firms across countries.

Our work is related to Duchin et al. (2025), who find that, using US data, investor pressure can lead firms to sell polluting assets to less scrutinized owners. Berg et al. (2026) show that firms headquartered in many countries divest their polluting assets abroad. Our setting is different in that we study the international reallocation of the ownership of polluting firms rather than of polluting assets.

Also related is the literature that studies carbon leakage through the international migration of polluting production (Babiker 2005, Ben-David et al. 2021) or the cross-border reallocation of lending to polluting firms (Benincasa et al. 2022, Laeven and Popov 2023).

Several papers have examined whether and how investor divestment affects firms. Selling can raise targeted firms' cost of capital or discipline managers through the threat of exit, but these effects depend on the responsiveness of capital and whether firms rely on external finance (Berk and Van Binsbergen 2025, Broccardo et al. 2022, Chowdhry et al. 2019, Davies and Van Wesep 2018, Edmans et al. 2023, Heinkel et al. 2001, Hong et al. 2023, Oehmke and Opp 2025). Empirical evidence is mixed: selling pressure and carbon-firm devaluation can induce operational adjustment (Choi et al. 2025, Gantchev et al. 2022), while mutual-fund decarbonization need not reduce corporate emissions and responsible funds may select firms with stronger pre-existing environmental performance without changing their conduct (Heath et al. 2023, Rohleder et al. 2022). A related literature shows that institutional and engaged owners can improve environmental performance through voice while retaining their shares (Azar et al. 2021, Chen et al. 2020, Dyck et al. 2019, Kim et al. 2019, Naaraayanan et al. 2021, Shive and Forster 2020), and that governance travels across borders with ownership (La Porta et al. 1998, Liang and Renneboog 2017).

To date, the literature on divestment tends to focus on the selling investor, the target firm's financing conditions, or the incumbent owner's influence, leaving whoever absorbs divested shares an anonymous residual. Our contribution is to turn the attention to the residual owner by country and income. Specifically, we document that carbon-intensive firms come to be held relatively more by poorer countries, and that this ownership predicts worse subsequent emissions and incidents. Exploiting the climate-motivated exit from fossil-fuel firms, we provide causal support for this new

mechanism.

The remainder of the paper proceeds as follows. Section II describes the data. Section III sets out the empirical approach. Section IV reports the international ownership allocation results, robustness, and heterogeneity across investors and firms. Section V examines the environmental implications, including the divestment pressure design. Section VI concludes.

II. Data and variables

A. Ownership data

We consider the international ownership of the ordinary shares of public companies globally from 2002 to 2021 obtained from the London Stock Exchange Group's Refinitiv Workspace. We restrict ourselves to shares for which price information is available. Ownership data availability varies over time and across countries because of differences in reporting.

In our analysis, we only include firms with a single class of ordinary shares to be able to calculate ownership shares unambiguously.[2] We restrict ourselves to firms for which at least 75% of the ownership is known to ensure that the ownership information is representative of the firm's owners. The ownership threshold of 75% balances having comprehensive ownership data and having broad sets of investor and host countries in the sample.[3] We require that a firm has at least three consecutive years of ownership information, and we only include continuous ownership spans.[4] Firms that are subsidiaries of other firms in the sample are excluded.

Ownership share is calculated as the sum of the ownership shares of all investors with a reported address in a particular country, implying that we consider direct ownership. In practice,

[2]Nearly all firms (96.9%) have issued only one class of ordinary shares.

[3]The Internet Appendix elaborates on this and shows the robustness of our results, reporting estimates using higher minimum coverage levels.

[4]For a firm with multiple ownership spans of at least three years, we keep the longest one. If there are multiple ownership spans of equal length, we keep the most recent one.

many investors channel their investments through an offshore financial center (OFC) to reduce their tax liability or to hide their identity, in which case the country of direct ownership differs from the country of ultimate ownership. For this reason, we exclude OFCs as investor countries in our main analysis. We identify the following countries as OFCs: the Bahamas, Barbados, Cyprus, Gibraltar, Hong Kong, Ireland, Luxembourg, Marshall Islands, Netherlands, Singapore, Switzerland, and the United Kingdom.[5]

A concern with this exclusion is that OFC holdings of brown firms may disproportionately represent unobserved ultimate ownership by investors from richer countries, leading us to understate rich-country ownership in polluting firms. Figure 3 plots OFC and non-OFC average ownership shares in brown firms using two firm weightings: equal weight (Panel A) and current-year market capitalization (Panel B). Under both weightings, the OFC share is low, fluctuating over the first few years and then staying relatively flat. This stability alleviates the concern that excluding OFCs qualitatively changes the rich–poor ownership pattern examined in this paper.

[Insert Figure 3 about here]

Our final firm-level sample has ownership information for 3,559 firms held by investors with addresses in 111 nations and special administrative regions. On average, we observe ownership from 20 investor countries per firm-year. *Ownership share* is winsorized at the 0.01 level, and the final regression sample consists of 298,803 observations (Table 1, Panel A). As an alternative ownership variable, we use *Holding value*, the value of an investor country's collective position in a firm divided by investor-country GDP.

[Insert Table 1 about here]

We construct investor-type-specific ownership by aggregating holdings within each investor country–firm–year. Using LSEG's classification, we group investors into three categories: *Delegated* investors that manage capital for external clients; *Stewards* such as pension funds whose

[5] We use the list of conduit-OFCs from Garcia-Bernardo et al. (2017), see Table S4 (the column of Threshold 100).

primary channel of influence is voting and engagement; and *Strategic* investors that hold concentrated positions for ownership or control. We separately classify investors into high-, medium-, and low-turnover groups, corresponding to average holding periods below one year, one to two years, and above two years.[6]

We also construct ownership variables by GDP-per-capita quartile grouping (groups 1–4, bottom to top), expressed as fractions of total reported ownership so that they add up to one. Countries in the bottom and top quartiles own 3% and 82% of a firm's shares on average (Table 1, Panel C).

B. Fossil-fuel divestment commitments and targets

We obtain data on publicly announced institutional fossil-fuel divestment commitments from Stand.earth's Global Divestment Commitments Database. We assign each commitment to the country in which the committing institution is domiciled. Because the registry does not report commitment dates, we identify the commitment year from public announcements and archived versions of the registry. Of the 1,731 commitments in the registry, 1,576 (91.0%) have a verifiable commitment year and enter our country-year construction. We exclude the remaining 155 commitments.

For each investor country and year, we count the cumulative number of dated commitments through year-end and construct *Div. commitment* as $\log(1+\text{cumulative commitments})$. We interpret this variable as a proxy for the pressure within an investor country to incorporate environmental concerns into portfolio decisions. This pressure can arise from institutions' own preferences, public attention, or related policy and mandate pressures. It does not separately identify the underlying sources of this pressure, and it does not assume that all investors in a country have committed to divest.

Observable commitments are strongly concentrated in richer investor countries. By 2021, among the 921 country-attributed commitments recorded for investor countries represented in our ownership sample, 863 (93.7%) originate from countries in the upper two GDP-per-capita quartiles.

[6]The Internet Appendix provides more details for category mapping and sample composition.

Thus, restricting our later analysis to rich-country commitments does not materially narrow the observable divestment pressure captured in our sample.

To identify firms targeted by fossil-fuel divestment campaigns, we use Urgewald's Global Oil and Gas Exit List (GOGEL), the Global Coal Exit List (GCEL), and the Metallurgical Coal Exit List (MCEL). We construct a time-invariant classification because firms' underlying fossil-fuel activities are expected to be persistent over our sample period. We match firms in our sample to the Urgewald data using Refinitiv organization identifiers, equity ISINs, and normalized firm names and countries. Using fossil-fuel revenue and power shares, coal production, coal-power capacity, and related Urgewald indicators, we classify firms into four tiers of divestment-targeting risk: Heavy, Moderate, Low, and No risk.[7] Table 2 summarizes the classification criteria and the distribution of firms across tiers. It also reports how many firms in each tier enter the divestment-pressure sample, which requires sufficient 2002–2005 bilateral ownership shares and at least one post-2008 observation. The tier shares are similar across the two samples, indicating that conditioning on pre-divestment ownership data broadly preserves the representation of each tier. In the divestment-pressure analysis, *FF-exposed* firms are those classified as Heavy or Moderate, while *non-FF* firms are those classified as No risk.[8]

[Insert Tables 2 and 3 about here]

[7]The Internet Appendix provides details on the matching procedure, tier-assignment criteria, and fallback classification of firms without a unique Urgewald match. In May 2026, we used Claude Opus (Anthropic), accessed through Claude Code, to generate candidate classifications based on firm names, countries of incorporation, and available business descriptions. We reviewed all candidate classifications and made the final decisions.

[8]We exclude Low-risk firms because their peripheral fossil-fuel exposure makes them unlikely to be direct divestment targets, while including them with No-risk firms would introduce partially exposed firms into the comparison group. Because Low-tier firms account for only 2.5% of the environmental-outcome firm sample and 2.1% of the divestment-pressure sample, this exclusion has little effect on sample size.

C. Emission and incident data

We obtain emissions data by combining firms' self-reported disclosures from the Carbon Disclosure Project (CDP) with reported and estimated data from Refinitiv Workspace. We use a firm's sum of Scope 1 and 2 emissions relative to its revenues, denoted *Emissions intensity in revenue (EIR)*, as the main carbon intensity variable. This emissions intensity measures emissions relative to the total value of production.[9] The mean of *EIR* is 0.41 tonnes of CO_2 equivalent per thousand USD of revenue (Table 1, Panel A).

In an additional test, we distinguish between brown and non-brown industries using industry groups within the 10 sectors of the Refinitiv Business Classification (TRBC). We identify brown industries as the industries with consistently high yearly median emission measures.[10]

We supplement our firm-level sample with environmental, social, and governance (ESG) incident data collected by RepRisk. Incidents refer to documented ESG controversies, events, or violations associated with specific companies, capturing the extent of ESG pressures or shocks to their reputation (Duchin et al. 2025). We calculate total and environmental incident intensities as the log of the ratio of a firm's relevant incident count to its total assets, reflecting that larger firms are likely to experience more incidents. Summary statistics for the incident intensity variables are provided in Panel C of Table 1 and Table 3. Table A1 of Appendix A details all variables and their sources.

[9]This captures all the productive inputs. In contrast, emissions intensity in terms of assets measures emissions relative to capital inputs as proxied by assets. Table A3 in Appendix A reports robustness to alternative emissions variables.

[10]Brown industries: Oil and Gas, Metals and Mining, Construction Materials, Paper and Forest Products, Freight and Logistics Services, Passenger Transportation Services, Electric Utilities and IPPs, Natural Gas Utilities, Multiline Utilities, Chemicals, Containers and Packaging, Consumer Goods Conglomerates, Healthcare Providers and Services, Food and Tobacco, and Homebuilding and Construction Supplies. See the Internet Appendix for construction details.

III. Empirical approach

A. Collective portfolios and economic development

Our main hypothesis is that the propensity of investors in a country to own shares of carbon-intensive firms declines with its economic development. In the case of equity investments in individual firms, we estimate the following specification,

$$\begin{aligned} Ownership\ share_{fct} = \alpha + \beta\, EIR_{ft} \times Log\ GDP\ per\ capita_{ct} + \mu\, EIR_{ft} \times Market\ Cap._{ct} \\ + \theta\, Return_{ft} \times Log\ GDP\ per\ capita_{ct} + Foreign_{fc} + \gamma_{ft} + \delta_{ct} + \varepsilon_{fct}, \end{aligned} \tag{1}$$

where $Ownership\ share_{fct}$ is the total ownership share of firm f held by investors in country c at time t, and EIR_{ft} denotes the emissions relative to revenues of firm f in year t.

We focus on ownership share, which represents a quantity outcome in general equilibrium. For this ownership share specification, a concern is that firms' emission intensities may be systematically correlated with returns (Bolton and Kacperczyk 2021, 2023, Pástor et al. 2021). This issue is especially relevant here. Prior evidence suggests that carbon-related return patterns vary systematically across markets and with economic development (Bolton and Kacperczyk 2023, Zhang 2025). Hence, cross-country differences in ownership of high-emission firms could partly reflect return-driven portfolio sorting. We therefore include $Return_{ft} \times Log\ GDP\ per\ capita_{ct}$ to separate this return-seeking channel from the decarbonization channel. Relatedly, economic development is correlated with financial development, which can affect investors' ability to diversify internationally, process environmental information, and price carbon-related risks (Breuer et al. 2018, De Haas and Popov 2023). We include $EIR_{ft} \times Market\ Cap._{ct}$ to control for the role of investor-country financial development.[11] Separating financial development from economic development helps to

[11] Appendix Table A2 reports the variable selection exercise behind this choice. We consider additional investor-country controls along three dimensions: financial development; resource exposure and commodity trade, which may shape national exposure to brown industries; and climate risk exposure, which may affect demand for green portfolios. The relation between EIR_{ft} and $Log\ GDP\ per\ capita_{ct}$ remains negative and economically strong across these specifications, while most added controls are not significant. The exception is indices of financial development.

isolate the relation between GDP per capita and portfolio decarbonization that we interpret as preference-driven.

We include a $Foreign$ dummy to distinguish between domestic and foreign portfolio choices. We also include time-varying firm fixed effects (γ_{ft}) to control for firm characteristics including perceived financial risk and return, actual stock price fluctuations, and the firm's carbon intensity. In addition, we include time-varying investor-country fixed effects (δ_{ct}), which control for time-varying investor-country characteristics, including overall portfolio size.[12] Standard errors are clustered at the firm level.

The key parameter β measures how the carbon gradient of investment $\left(\frac{\partial\, Ownership\ share_{fct}}{\partial\, EIR_{ft}}\right)$ varies with economic development as proxied by $Log\ GDP\ per\ capita_{ct}$.[13] With firm-year and investor-country-year fixed effects, β is identified by comparing the ownership–EIR gradient across investor countries with different levels of economic development. A more negative estimated value of β implies that the carbon sensitivity of investment increases with economic development, meaning that investors in richer countries have a weaker tendency to hold carbon-intensive firms.

A simple reverse-causality interpretation is unlikely: an individual investor country's ownership share in a given firm-year cannot reasonably determine either the firm's emissions intensity or the investor country's level of economic development. However, two endogeneity concerns remain.

First, domestic ownership pairs create a possible confounding link because the investor country is also the firm's home country. If countries hold disproportionately large stakes in their own firms, and firms in poorer countries are more carbon-intensive, the negative interaction could partly

We retain stock-market capitalization rather than bank assets because it materially affects the key estimated coefficient while being less strongly correlated with GDP per capita.

[12] We do not include bilateral country-pair fixed effects in the benchmark regressions because they would shift the comparison from cross-country portfolio allocation to deviations within a given investor–host country pair. This restriction is too narrow for our setting in which some cross-border ownership links appear only in recent years and primarily in brown firms.

[13] As a descriptive diagnostic, the unconditional correlation between *EIR* and *Log GDP per capita* in our firm-level sample is neither numerically nor statistically different from 0.

reflect poorer countries' domestic ownership of their own brown firms rather than richer countries' lower ownership of carbon-intensive firms. We address this concern through a foreign-holdings specification that removes domestic ownership pairs and includes the variable *Distance* to account for bilateral information costs in cross-border portfolio choice.

Second, investor countries may differ in the set of firms they can effectively access. If poorer-country investors are less likely to hold low-EIR firms because those firms are concentrated in markets or segments with greater access, information, or investability barriers, the estimated interaction could partly reflect these frictions rather than carbon-sensitive portfolio allocation. To address this concern, we re-estimate the foreign holdings specification for large firms that are more visible, widely held, and more likely to have reliable ownership, emissions, and trading information. Finally, we extend the benchmark specification in several ways to examine investor heterogeneity and sector- and firm-level heterogeneity.

B. Ownership allocation and corporate environmental outcomes

Our baseline estimates imply that richer-country investors' stronger avoidance of carbon-intensive firms shifts their ownership toward poorer-country investors. We examine the environmental implications of this reallocation through two complementary tests. Section III.B.1 relates realized ownership composition to subsequent environmental outcomes across the broad firm sample. Section III.B.2 focuses on one observable force behind this reallocation, i.e., fossil-fuel divestment pressure, and it provides causal evidence that this pressure moves the international ownership composition and that this reallocation is followed by worse environmental outcomes.

B.1. Ownership composition and subsequent environmental outcomes

We relate a firm's ownership distribution across investor-country income groups to its subsequent emissions intensity and ESG incident counts by estimating the following specification:

$$(2)\quad Y_{f,t+1} = \alpha + \beta_1 Ownership_{ft}^{2q} + \beta_2 Ownership_{ft}^{3q} + \beta_3 Ownership_{ft}^{4q} + \gamma_f + \delta_t + \Theta X_{ft} + \varepsilon_{f,t+1},$$

where $Y_{f,t+1}$ denotes one of two firm-level outcomes measured in year $t+1$: $\log(EIR)_{f,t+1}$, the log emissions intensity of firm f, or $\log(\textit{incident intensity})_{f,t+1}$, computed as the log of the total count of incidents divided by assets. $Ownership_{ft}^{2q}$, $Ownership_{ft}^{3q}$ and $Ownership_{ft}^{4q}$ are the adjusted ownership fractions of country groups 2 to 4 (representing countries in the second to fourth quartiles of the distribution of GDP per capita). The ownership fraction for countries in group 1, i.e., in the bottom quartile of the distribution of GDP per capita, is omitted from the regression. The controls X_{ft} include a firm's size measured by the log of assets, leverage measured by total liabilities divided by total assets, return on assets, and Tobin's Q. Firm and year fixed effects are included, absorbing time-invariant firm-specific characteristics as well as year-specific shocks.

Negative estimates of β_1, β_2 and β_3 would indicate that, relative to ownership by investors in the poorest country group, larger ownership shares by investors from richer country groups are associated with lower subsequent emission or incident intensity. Such a pattern would be consistent with the notion that investors in richer countries are more likely to monitor and influence portfolio firms toward greener practices, and hence that a reallocation of brown-firm ownership toward poorer-country investors could generate negative spillovers in pollution and ESG-related incidents. We acknowledge two limitations. First, although we introduce a one-year lead of the outcome variables relative to the ownership variables to mitigate potential reverse causality, this specification cannot fully rule out a selection effect. Richer-country investors may select firms that already plan to improve environmentally. The divestment-pressure setting in Section III.B.2 provides an additional advantage in this respect. It allows us to test whether observable divestment pressure predicts subsequent environmental outcomes in a setting where exposure is determined by pre-campaign shareholder composition rather than by contemporaneous environmental performance. Second, because the ownership variables include domestic shares, the estimated associations could partly reflect home-country confounding factors that do not always relate to the international ownership composition. The divestment-pressure test addresses this domestic confounding link by focusing on the foreign shareholder base.

B.2. Fossil-fuel divestment pressure and environmental outcomes

We exploit the country-specific fossil-fuel divestment pressure as a source of variation, using an interacted shift-share design that combines firms' pre-campaign ownership shares with subsequent country-level divestment commitments (Goldsmith-Pinkham et al. 2020). In this design, we compare the responses of firms with substantial fossil-fuel exposure (FF-exposed) and firms with no identified fossil-fuel exposure (non-FF) to the pressure measure. Specifically, we test whether greater exposure to this pressure predicts both a relative movement away from richer foreign owners among fossil-fuel-exposed firms and generally worse subsequent environmental outcomes. By focusing on the foreign shareholder base throughout, this test also removes the domestic confounding factor present in Section III.B.1, where ownership variables include positions held by investors from the firm's home country. This test necessarily narrows the focus from the broad comparison across firms with different emission intensities to the setting of fossil-fuel firms, because the divestment commitments we observe primarily target fossil-fuel holdings. However, we do not interpret this fossil-fuel focus as implying that environmentally motivated portfolio reallocation is confined to these firms. The divestment commitments identifiable in our data target fossil-fuel holdings, while the environmental preferences underlying such commitments may also shape investors' holdings outside the fossil-fuel sector.[14]

To measure how much divestment pressure a firm's shareholder base faces, we construct a firm-level shift-share ("Bartik") exposure measure similar to the credit-supply shift-share design of Greenstone et al. (2020). Countries in the upper half of the investor-country GDP-per-capita distribution account for 93.7% of dated divestment commitments. Including the few commitments from relatively poorer countries has little effect on the measure but makes its interpretation less clear. We therefore construct the exposure measure using commitments from richer investor countries

[14] Some portfolio decarbonization commitments extend beyond fossil-fuel holdings: the Portfolio Decarbonization Coalition (PDC) mobilizes institutional investors to decarbonize their portfolios through approaches ranging from engagement to divestment.

only.[15]

Our exposure measure is constructed as follows:

$$\text{(3)} \qquad \textit{Divestment pressure}_{f,t} = \sum_{c \in \textit{Richer countries}} w_{f,c}^{2002\text{–}2005} \cdot \textit{Div. commitment}_{c,t},$$

where f indexes firms, c indexes investor countries, and t indexes year. Here, as pre-period exposure shares, we use firm f's average bilateral ownership share by country c across its earliest (up to) three observations during the 2002–2005 pre-treatment window, denoted $w_{f,c}^{2002\text{–}2005}$. The country-year-specific variable *Div. commitment* is computed based on the cumulative commitments by institutions domiciled in richer country c through year-end t. Due to the lasting nature of the divestment commitments, the shift component is the cumulative stock of divestment pressure rather than a per-period shock.

We do not use divestment pressure as an instrument for realized ownership changes. Such an interpretation would require divestment pressure to affect environmental outcomes only through measured year-end ownership, whereas it may also affect firm behavior through stock-price pressure and managerial incentives (Choi et al. 2025, Gantchev et al. 2022). We therefore examine ownership composition and environmental outcomes as separate responses to divestment pressure. First, we examine whether divestment pressure changes the composition of fossil-fuel-exposed firms' foreign shareholder bases. We measure ownership reallocation using two outcomes: the fraction of foreign ownership held by rich investor countries and the ownership-weighted average log GDP per capita of foreign owners.[16] For horizons $h = 1, 2, 3$, we estimate

(4)

$$\begin{aligned} OC_{f,t+h} = \alpha &+ \beta_1 \textit{Divestment pressure}_{f,t} + \beta_2 \textit{Divestment pressure}_{f,t} \times \textit{FF-exposed}_f \\ &+ \beta_3 \textit{Divestment pressure}_{f,t} \times EIR_{f,t} + \rho\, OC_{f,t-1} + \Theta X_{ft}^{O} + \gamma_f + \delta_{C,t} + \eta_{FF,t} + \varepsilon_{f,t+h}, \end{aligned}$$

[15] We classify richer investor countries once, based on each investor country's average GDP per capita over the sample period, and use the same country group in all years.

[16] The outcome is required to have a foreign shareholder base of at least five percentage points at both $t-1$ and $t+h$ to mitigate the accessibility concern. Moreover, to avoid mechanical effects from time-varying country reclassification, we again use a fixed rich-country classification.

where $OC_{f,t+h}$ denotes one of the two ownership-composition outcomes measured at $t + h$. Each specification includes the corresponding lagged outcome $OC_{f,t-1}$, so the estimates compare subsequent ownership composition among firms with similar pre-existing ownership composition. The control vector X^O_{ft} contains firm size, leverage, Tobin's Q, return on assets, stock return, *EIR*, and an indicator for MSCI World index inclusion. We include a rich set of fixed effects. Firm fixed effects γ_f absorb time-invariant firm characteristics, and firm country × year fixed effects $\delta_{C,t}$ absorb country-level shocks in the firm's location country. We also include FF-exposed × year fixed effects $\eta_{FF,t}$ to absorb common year-specific changes in the ownership composition of FF-exposed firms, such as those associated with commodity-price fluctuations or broad shifts in policy and market sentiment toward fossil fuels. The coefficient of interest is β_2, which tests whether FF-exposed firms facing greater divestment-pressure exposure through their pre-treatment shareholder base subsequently have a lower rich-country presence among foreign owners. Specifically, β_2 captures whether FF-exposed firms facing greater divestment-pressure exposure have differential subsequent ownership composition beyond common sector-wide changes and their own lagged ownership composition. We additionally interact divestment pressure with *EIR* to control for the possibility that some divestment pressure spills over to carbon-intensive firms regardless of their fossil-fuel exposure. Standard errors are clustered at the firm's location country level, accounting for potential correlation in ownership composition across firms within a given country.

In the second step, we test whether the divestment pressure that a firm experiences through its shareholder base also predicts subsequent environmental outcomes. We estimate this relation separately for FF-exposed and non-FF firms:

$$Y_{f,t+h} = \alpha + \beta\, Divestment\, pressure_{f,t} + \gamma_f + \delta_{C,t} + \Theta X^E_{ft} + \varepsilon_{f,t+h}, \tag{5}$$

where $Y_{f,t+h}$ denotes one of the three dependent variables: *Log EIR*, *Log total incident intensity*, or *Log environmental incident intensity*, each measured at year $t + h$, with $h = 1, 2, 3$. The control vector X^E_{ft} contains lagged firm size, leverage, Tobin's Q, return on assets, the MSCI World index indicator, lagged annual log price return, and lagged ownership shares held by investor-country

quartiles Q2, Q3, and Q4, expressed in percentage points, with Q1 omitted. We control for these lagged ownership shares, as these can affect environmental outcomes independently from the ownership-weighted divestment pressure variable, as is reflected in specification (2). The coefficient β captures the relation between divestment-pressure exposure and firms' subsequent environmental paths, but its interpretation differs across the two groups. For FF-exposed firms, the observed commitments directly target holdings in their stocks. A positive β for these firms would indicate that this pressure is followed by worse environmental outcomes, consistent with divestment pressure operating through channels that need not be fully captured by measured year-end ownership changes. For non-FF firms, the same exposure is not based on direct fossil-fuel targeting and may capture broader portfolio-reallocation or spillover effects, so we report these estimates as a comparison rather than as a strict placebo. In both specifications, the estimation sample begins in 2008, the first year with an observed divestment commitment, and standard errors are clustered at the firm's location country level.

IV. International ownership allocation of carbon-intensive firms

A. Economic development and carbon-sensitive ownership

We report our basic estimation results based on specification (1) in Table 4. Column 1 shows baseline estimates for 2002–2021 using investor-country ownership shares in each firm as the dependent variable. With firm-year and investor-country-year fixed effects, the interaction *EIR* $\times$ *Log GDP per capita* captures whether firms with higher carbon intensity have a different distribution of ownership across richer and poorer investor countries. The estimated coefficient is -4.47 (significant at 5%), indicating that, relative to investors from poorer countries, investors from richer countries account for smaller ownership shares in firms with higher carbon intensity. For a given year, comparing investor countries at the 25th and 75th percentiles of GDP per capita, the relatively richer country on average holds about 33.26 basis points less ownership for a one-

standard-deviation increase in the portfolio firm's *EIR*.[17]

[Insert Table 4 about here]

The baseline estimate is conditional on two financial channels that may otherwise confound the interpretation. First, because carbon intensity may be correlated with returns and associated risks that differ across markets (Bolton and Kacperczyk 2021, 2023, Zhang 2025), we include *Return* × *Log GDP per capita*. This control separates carbon-sensitive ownership allocation from ownership sorting associated with realized firm returns. The estimated coefficient is 0.642 (significant at 1%), indicating that, relative to poorer-country investors, richer-country investors hold larger ownership shares in higher-return firms.

Second, we include *EIR* × *Market cap.* to separate the economic-development gradient from differences in investor-country financial-market development. The estimated coefficient is −5.79 (significant at 5%), indicating that countries with deeper stock markets tilt relatively more toward greener firms.

The result is also robust to alternative measures of holdings in columns 2 and 3, in which we rescale ownership shares by coverage and measure holdings in value terms. Thus, the baseline relation is not specific to the ownership-share measure. As ownership shares abstract from share prices, we retain *Ownership share* as the dependent variable in our subsequent firm-level analysis.

Columns 4–8 address sample and data restrictions. Because part of a firm's ownership may be unobserved, the estimated gradient could reflect selective reporting if rich-country holdings are disproportionately missing for high-EIR firms. Columns 4 and 5 therefore split the sample by the ownership coverage of their headquarters country. The interaction *EIR* × *Log GDP per capita* is negative in both groups: it is significant in high-coverage countries (column 4) and larger but imprecisely estimated in low-coverage countries (column 5). The high-coverage estimate shows that the result is not driven by selective missing holdings in low-coverage markets.

[17] This can be calculated as follows: $33.26 = 4.47 \times 4.617 \times 1.612$. The value 1.612 is the average 25th-to-75th percentile difference in *Log GDP per capita* when investor countries are ranked within each year.

A further concern is that firms headquartered in countries with high national fossil-fuel dependence may have fundamentally different ownership patterns. In columns 6 and 7, we therefore split the sample by whether the firm's headquarters country is a "petro-state".[18] The estimate is insignificant for petro-state firms and remains negative and significant for firms from the other countries. In column 8, we start from the non-petro-state firm sample and additionally exclude petro-state investor countries. The estimate remains negative and significant.

Finally, columns 9 and 10 examine whether carbon-sensitive ownership allocation shifts after the Paris Agreement by extending specification (1) with *EIR* × *Log GDP per capita* × *PostPA*. In the full sample in column 9, the triple interaction is negative and larger in magnitude (−8.48), but insignificant. To alleviate the selection concern that more firms, and potentially greener firms, are observed in the post-Paris period than in the pre-Paris period, we re-estimate the triple interaction in a balanced-window sample that requires firms to be present at least once in both the pre- and post-Paris windows. In this sample, the triple interaction is −17.92, significant at 10%. These results are consistent with a stronger carbon-sensitive ownership pattern in the post-Paris period. The estimates in column 10 imply that, in the post-Paris period, the same 25th-to-75th percentile comparison across investor countries is associated with an ownership differential of −160.0 basis points for a one-standard-deviation increase in the portfolio firm's *EIR*.[19] This difference equals 30.5% of the mean *Ownership share* (523.94).

B. Economic development versus alternative measures of preferences

Our focus on the negative interaction between *EIR* and *Log GDP per capita* is motivated by the theory of the private provision of public goods (Bergstrom et al. 1986). We view greener

[18] We classify countries as petro-state if average oil, natural gas, and coal rents account for at least 7% of GDP over 2000–2021, where rents follow the World Bank definition, i.e., the value of resource production at world prices net of extraction cost. The countries in this group represented in our sample are Bahrain, Egypt, Kazakhstan, Kuwait, Norway, Oman, Qatar, Russia, Saudi Arabia, and the United Arab Emirates.

[19] This can be calculated as follows: $-160.0 = (-3.58 - 17.92) \times 1.612 \times 4.617$.

equity allocation as a form of private contribution to an environmental public good, and argue that countries at higher levels of economic development may collectively be more willing to support such an allocation. We therefore interpret economic development as reflecting a broader preference toward a low-carbon transition. This lens does not require every investor to act from a purely nonpecuniary motive: broader societal preferences may also shape the policies, institutions, and investor beliefs that make carbon-related characteristics important for forward-looking risk assessment.

A natural alternative is to use more conventional country-level proxies for the preferences that may underlie the economic-development gradient. Table 5 considers three such measures.[20] *Rule of law* captures an institutional dimension of the country environment, which prior work links to responsible investment and cross-country differences in firms' cost of equity (Breuer et al. 2018). *Self-expression* captures a cultural-values dimension related to non-financial preferences, in line with evidence that investor-country social norms and environmental preferences matter for institutional ownership (Dyck et al. 2019, Gantchev et al. 2022). *Div. commitment* captures investor-country exposure to the use of divestment as an environmental-finance tool and is more directly linked to the ownership pattern we study.

[Insert Table 5 about here]

Panel A shows that these alternatives are closely related to GDP per capita, especially *Rule of law* and *Self-expression*, which have correlations with *Log GDP per capita* of 0.78 and 0.76. These two measures are also highly correlated with each other, at 0.79. *Div. commitment* is positively correlated with *Log GDP per capita*, with a full-sample correlation of 0.16. This lower full-sample correlation mainly reflects the recent emergence of divestment campaigns and the resulting mass of earlier zero-commitment country-years. Among country-years with at least one commitment, the correlation between *Div. commitment* and *Log GDP per capita* rises to 0.48.

[20] This test is distinct from the control-selection exercise in Appendix Table A2, which considers additional country characteristics that could affect ownership sorting through channels not captured by economic development.

Panel B examines whether these alternative measures can account for the economic-development gradient. We add each alternative measure to the baseline specification in column 1 and report the resulting joint specifications in columns 2, 3, and 4. We also estimate a corresponding replacement specification that uses the alternative measure in place of *Log GDP per capita*, and report these results next to the joint specifications in columns 2′, 3′, and 4′.

We find that the alternatives can capture pieces of the same ownership-sorting pattern in isolation, but none provides an independent negative gradient once GDP per capita is included. Specifically, the replacement specifications show that *Rule of law* and *Div. commitment* each generate a negative ownership gradient similar to the baseline GDP-per-capita gradient, although their coefficients are significant only at the 10% level. *Self-expression* does not generate a significant negative gradient. In the joint specifications, the GDP-per-capita interaction remains negative and statistically significant in all three columns. By contrast, *Rule of law* and *Div. commitment* lose significance when included with GDP per capita, while *Self-expression* reverses sign and becomes positive. This weaker result associated with *Self-expression* is perhaps because self-expression is a broad mass-cultural measure rather than a preference measured close to financial decision-makers.

These results indicate that the alternative measures capture part of the ownership sorting associated with economic development, but do not subsume it. This pattern is consistent with our argument that GDP per capita captures a broader country-level preference environment than any one of these alternatives. The alternatives help locate possible components of this environment, including institutional conditions, cultural values, and climate-finance preferences expressed through divestment, but each captures only a particular component. In richer economies, carbon-related preferences may be expressed directly through nonpecuniary portfolio choices and indirectly through regulation, mandates, client demand, and forward-looking assessments of carbon risk. Interpreting economic development as a summary measure of this broader preference environment therefore matches our focus on the general-equilibrium ownership outcome, which reflects the net result of these various channels in the allocation of firm ownership across investor countries.

C. Robustness and extensions

We next examine the robustness of the baseline pattern and then extend the analysis to examine heterogeneity across investors and across firms. In particular, we first address two endogeneity concerns for the baseline estimates, namely the domestic ownership confounding factor and selection into the ownership choice set, as outlined in Section III.A. We report the results in Table 6.

[Insert Table 6 about here]

Columns 1 and 2 restrict the sample to foreign investor–firm pairs and control for bilateral distance that proxies for cross-border information frictions. The coefficient on *EIR* × *Log GDP per capita* remains negative and significant after removing the domestic holdings, supporting our baseline result. Moreover, this estimated coefficient becomes more negative from −3.11 in the full foreign sample to −7.76 in the post-Paris period. The stronger post-Paris estimate indicates that the carbon-income ownership gradient is more pronounced after the Paris Agreement, consistent with carbon-related considerations becoming more salient in cross-border portfolio allocation.

Columns 3 and 4 further restrict the foreign-holdings sample to large firms, addressing accessibility and investability concerns. The estimated coefficient is more negative in both the full sample and the post-Paris period, with a smaller increase in effect size between the two columns. The larger magnitude is informative: when the comparison is limited to firms that are more visible and broadly investable, the carbon-income ownership gradient becomes stronger rather than weaker. This pattern alleviates the concern that the baseline result is created by access bias, whereby poorer-country investors are less likely to hold low-EIR foreign firms because those firms are harder for them to access. Instead, the large-firm result suggests that better international investability may intensify, rather than weaken, the general-equilibrium sorting pattern: as poorer-country investors gain better access to foreign stocks, their relative ownership of browner firms may become even more pronounced.

We next examine where the negative relation between firm carbon intensity and richer-country ownership is most pronounced across investors and firms. Panel A of Table 7 examines whether

the carbon–ownership gradient differs across investor types in columns 1–3 and alternatively by portfolio turnover in columns 4–6. Prior work provides grounds to expect variation across investor categories. Home-country environmental values shape how institutional investors engage with portfolio firms (Dyck et al. 2019, Gantchev et al. 2022), and the home location of responsible investors predicts whether responsible investment commitments translate into greener portfolio holdings (Gibson Brandon et al. 2022).

[Insert Table 7 about here]

We classify investors into three types: delegated investors, who manage capital on behalf of external clients; stewards, large institutions whose primary channel of influence is voting and engagement rather than exit; and strategic investors, who hold concentrated long-term positions for ownership or control purposes. We aggregate each investor country's holdings in a firm-year separately for each investor-type category. If a country holds a firm but not through all three types, we assign zero to the absent types rather than omitting those observations, since the absence of a type's holding is itself informative about how that type allocates across firms. Our investor-type heterogeneity test uses the sample of large foreign-held firms to mitigate the concerns related to coverage and selection.[21]

The estimated coefficients on *EIR* × *Log GDP per capita* are negative and significant for all three investor types. These results indicate that the income gradient in carbon-intensive ownership varies in magnitude but is not confined to a single mandate type.

The magnitude difference across types is informative. The larger coefficient for strategic investors is consistent with concentrated, long-term positions creating stronger sensitivity to carbon risk in foreign target firms. The significant coefficient for delegated investors is consistent with evidence that investment managers, who allocate capital on behalf of clients, implement their home-country environmental norms through portfolio choices (Gantchev et al. 2022, Gibson Brandon

[21] Splitting by investor type in the full sample risks conflating genuine cross-type differences in carbon preferences with the domestic-investment or disclosure patterns. For example, strategic investors may hold positions in their home country more than other types of investors.

et al. 2022). The smaller coefficient for stewards is expected: institutions such as pension funds and sovereign wealth funds are more likely than other investor types to use engagement and voting to induce brown firms to become greener (Broccardo et al. 2022, Dyck et al. 2019, McCahery et al. 2016), which requires continued ownership of such firms.

Columns 4–6 split the sample by portfolio turnover. The estimated coefficients on *EIR* × *Log GDP per capita* are negative and significant across all three turnover groups, with magnitude increasing monotonically from high- to low-turnover investors. This increasing gradient is consistent with evidence that long-horizon investors tilt their portfolios more strongly toward firms with stronger environmental profiles (Kim et al. 2019, Starks et al. 2026).

Panel B turns to firm-level heterogeneity, removing the large foreign firm restriction. Columns 1–3 split the sample by industry, estimating the baseline specification separately for brown and non-brown firms. Column 2 further excludes upstream fossil-fuel energy firms from the set of brown firms to test whether the gradient persists across other brown firms. Columns 4–6 augment the baseline with triple interactions of *EIR* × *Log GDP per capita* with firm size and MSCI World index inclusion.

The estimated coefficient on *EIR* × *Log GDP per capita* is negative and significant for brown industries. The result is not limited to upstream fossil-fuel energy firms, as it remains when these are excluded. The estimate for non-brown industries is negative but insignificant. This is consistent with evidence that investors pay particular attention to carbon risk in high-emission sectors (Bolton and Kacperczyk 2021, 2023). In columns 4–6, the triple interaction with firm size is negative, indicating a stronger gradient for larger firms that attract greater investor scrutiny (Azar et al. 2021). The triple interaction with MSCI World index inclusion is positive and significant, indicating a weaker gradient for index constituents. This result suggests that index inclusion may generate passive demand that is unresponsive to carbon intensity, shifting the equilibrium ownership composition. Both patterns remain when the two interactions are included together.

V. Environmental implications of international ownership allocation

Section IV documents that investors from richer countries hold smaller shares of more carbon-intensive firms. As environmental preferences continue to shape this sorting, the general-equilibrium implication is that ownership of carbon-intensive firms may increasingly be concentrated among investors from poorer countries.

A growing literature suggests that shareholders can influence firm environmental outcomes (Chen et al. 2020, Dyck et al. 2019, Kim et al. 2019), raising the question of whether the cross-country ownership sorting we document carries implications for firms' environmental performance. In this section, we test whether a firm's ownership pattern across the national income distribution impacts its environmental performance. Subsection A establishes an association between a firm's ownership composition by investor-country income group and its subsequent emission and ESG outcomes. Subsection B provides more causal evidence by exploiting divestment pressure events to examine whether ownership reallocation toward poorer-country investors is followed by environmental backtracking.

A. Ownership composition and subsequent environmental outcomes

We relate firms' subsequent environmental outcomes to their ownership composition across investor-country income groups. This exercise connects to studies linking shareholder monitoring and engagement to firms' environmental and social policies (Chen et al. 2020, Dyck et al. 2019, Kim et al. 2019), and to the exit-versus-voice literature emphasizing that divestment may remove investors who could otherwise press firms to improve (Broccardo et al. 2022, Edmans et al. 2023). The estimates in Table 8 should nevertheless be read as associations: country group 1 is omitted, so negative coefficients on groups 2–4 indicate lower subsequent environmental intensity when a larger share of ownership is held by investors from richer country groups rather than from the poorest group.

[Insert Table 8 about here]

Panel A uses next-year *Log EIR* as the dependent variable. In the all-firm sample, ownership by each richer country group is associated with lower subsequent emissions intensity (column 1). The association is stronger for firms in brown industries (column 2) and for firms above the median size (column 4). Moreover, in the large-firm regression the coefficients increase in magnitude from country group 2 to group 4 (-1.480, -1.652, -1.806), suggesting that the strength of the association rises with investor-country economic development. Taking country group 4 as an example, its coefficient implies that a large firm with a one-percentage-point higher richest-country ownership share experiences an approximately 1.8% lower next-year emissions intensity. For non-brown firms and smaller firms, the estimates are weaker and imprecise.

Panel B reports analogous estimates for total ESG incident intensity. The coefficients are negative across all richer-country groups, and they increase monotonically from group 2 to group 4 in both the all-firm sample and the large-firm subsample, reinforcing the pattern in Panel A. Taking country group 4 as an example, its coefficient implies an approximately 1.7% lower next-year incident intensity for a large firm with a one-percentage-point higher richest-country ownership share. The regressions for the firms within both brown and non-brown industries show similar results.

Overall, Table 8 shows that greater ownership by richer-country investors is associated with better subsequent environmental outcomes, especially among brown and large firms. It should be noted that these are the same subgroups for which we show that the carbon-income ownership gradient is strongest. Our results in this subsection are in line with the view that shareholder composition is relevant for firms' environmental paths. Richer-country investors may, however, favor firms already on improving environmental trajectories. We acknowledge that leading outcomes by one year does not fully resolve this selection concern. A second concern is that the ownership variables include domestic shares, so the association may partly reflect home-country confounding factors rather than the impact of the broader ownership composition. Section III.B.2 addresses both concerns by considering plausibly exogenous variation in divestment pressure and by focusing on

foreign shareholder holdings.

B. Divestment pressure, ownership reallocation, and environmental outcomes

Do the environmental preferences that underlie richer-country investors' portfolio sorting also affect how they act as shareholders? If so, their presence should be positively associated with firms' environmental outcomes. We examine this in two steps using the cross-sectional variation in firms' exposure to rich-country fossil-fuel divestment campaigns. In the first step, we ask whether greater divestment pressure shifts FF-exposed firms' foreign investor base away from richer countries. In the second step, we ask whether FF-exposed firms subsequently exhibit worse environmental outcomes. Both tests use an interacted shift-share design for identification (Goldsmith-Pinkham et al. 2020). The pressure variable is constructed using pre-treatment bilateral ownership weights and is therefore predetermined with respect to subsequent outcomes.

[Insert Tables 9 and 10 about here]

The first test compares how FF-exposed and non-FF firms' foreign shareholder composition responds to a shift-share measure of richer-country divestment pressure. Results for the case where the dependent variable is the rich-country fraction of foreign ownership are reported in columns 1–3 of Table 9. The estimated coefficient on *Divestment pressure* × *FF-exposed* is −1.290 (significant at 5%) in the first year ($h = 1$), −1.715 (significant at 5%) in the second year ($h = 2$), and −2.264 (significant at 1%) in the third year ($h = 3$). As implied by these estimates, a one-standard-deviation increase in divestment pressure reduces the rich-country fraction of foreign ownership by 2.5 percentage points in the next year ($h = 1$), enlarging to 4.4 percentage points in the third year afterward ($h = 3$). This effect is economically significant, accounting for 15%–25% of the standard deviation of the rich-country foreign ownership fraction.

These results are robust to using the alternative outcome measure of ownership-weighted average log GDP per capita of foreign owners in columns 4–6. The estimated coefficient is −0.025

(significant at 5%) in the first year ($h = 1$) and −0.043 and −0.042 (significant at 1%) in the second and third years ($h = 2$ and $h = 3$), consistent with the rich-country fraction result and of similar economic magnitude (15%–24% of a standard deviation).

The uninteracted *Divestment pressure* variable, which captures any effect on non-FF firms, receives coefficients that are indistinguishable from zero throughout, confirming that the reallocation is specific to fossil-fuel-exposed firms. Furthermore, the estimated coefficient on *Divestment pressure* × *EIR* shows no clear pattern. As a pre-trend check (Goldsmith-Pinkham et al. 2020), we regress the 2003–2007 pre-period change in rich-country ownership on future Bartik exposure interacted with FF-exposed. The estimated coefficient is statistically indistinguishable from zero, confirming no differential pre-existing trend in rich-country ownership for more-exposed firms. Overall, Table 9 shows that FF-exposed firms with greater exposure to rich-country divestment pressure undergo a shift in their foreign shareholder base away from richer-country investors, consistent with a general-equilibrium reallocation toward poorer-country investors.

Divestment is usually intended as pressure on firms to become greener (Heinkel et al. 2001, Pástor et al. 2021). But ownership identity matters for firm outcomes as well: investors from different countries govern the firms they hold differently (La Porta et al. 1998, Liang and Renneboog 2017), including regarding environmental matters (Dyck et al. 2019). When divestment reallocates ownership from richer- to poorer-country investors, the divested firms could lose effective environmental governance. Given the estimated associations in Section III.B.1, we expect divestment pressure reaching FF-exposed firms through their rich-country shareholders to worsen subsequent environmental performance. As non-FF firms are not targeted by divestment, we expect them to be overall unaffected. However, there is also a possibility that non-FF firms may benefit from a general equilibrium reallocation of richer-country capital, which would yield a positive impact. We estimate the effects of rich-country divestment pressure on subsequent environmental outcomes for both groups of firms.

Table 10 reports the estimates for FF-exposed firms in columns 1–3 and for non-FF firms in columns 4–6 concerning three environmental outcomes: *Log EIR*, *Log total incident intensity*,

and *Log environmental incident intensity*. Panel A shows that for FF-exposed firms the estimated coefficient on *Divestment pressure* for *Log EIR* is positive and increases across horizons, from 0.332 in the first year ($h = 1$) to 0.478 and 0.541 in the second and third years. The estimate becomes significant at 1% from the second year following the strengthening of divestment pressure. For non-FF firms, the coefficient is small and statistically insignificant at all horizons, in line with our expectation that they are not targeted and so remain unaffected.

Panel B and Panel C consider the incident intensities. For FF-exposed firms, Panel B shows positive coefficients across all horizons. In the second year, the coefficient is statistically significant (0.609, at 1%). The non-FF coefficient is negative and significant at all horizons.

Focusing on environmental incidents specifically, Panel C shows a compelling pattern. For FF-exposed firms, the coefficient is 0.733 (significant at 1%) in the first year ($h = 1$), persisting at 0.722 (significant at 1%) in the second year and 0.421 (significant at 5%) in the third year, while for non-FF firms, the coefficient is again negative and significant at all horizons. The results suggest that divestment pressure from the owner countries drives an increase in environmental incidents for FF-exposed firms, while non-FF firms with a comparable shareholder base experience an improvement in the same outcome. Our estimation is consistent with a possible interpretation through an impact of general equilibrium ownership reallocation. That is, while FF-exposed firms go through a shift in ownership away from richer-country investors, non-FF firms may benefit from a reallocation of ownership.

Together, Tables 9 and 10 are consistent with richer-country ownership having a positive impact on firm environmental outcomes, as they show that divestment pressure reduces richer-country ownership of fossil-fuel firms, but worsens the environmental outcomes of these firms.

VI. Conclusion

We show that equity portfolios become greener with economic development. That is, richer countries hold relatively greener equity portfolios. The pattern is consistent with environmental

quality as a normal public good, to which richer agents contribute more as incomes rise (Murdoch and Sandler 1997) by making greener portfolio choices (Dyck et al. 2019). Our finding is robust to cross-country differences in return-sorting, and it holds for the subsample of foreign holdings, where domestic investment bias is not a concern. Our findings are stronger for firms that are more accessible to foreign investors. This pattern is present across investor types. It is particularly strong among delegated investors, whose portfolios reflect client preferences, and among strategic investors, whose holdings reflect real business or control interests. This pattern is also more pronounced among long-horizon investors.

Sorting matters because ownership patterns shape corporate environmental behavior. Firms' sustainability performance is positively related to the ownership held by richer-country investors. This is consistent with poorer-country investors being less able or willing to push portfolio firms toward greener practices.

A shift-share analysis provides causal evidence that increased share ownership by investors in poorer countries worsens a firm's environmental performance. We build a firm-level divestment pressure index using predetermined ownership weights and information on the rising intensity of rich-country divestment commitments. Divestment pressure reduces rich countries' ownership share of fossil-fuel-exposed firms, and at the same time it increases these firms' emissions intensity and environmental incidents. Firms that are not fossil-fuel-exposed show no such deterioration and, if anything, improve their environmental performance, possibly because richer-country capital is reallocated toward them.

Our findings speak to whether climate-minded investors in richer countries should pursue their goals through exit or voice. The conventional case for divestment holds that selling pressure forces firms to reform. But in an integrated equity market, exit does not remove ownership; it transfers it. When divestment reallocates ownership from richer to poorer countries, the divested firms perform worse on the environment, so divestment can be counterproductive. The more productive path may be to remain invested and exercise voice, using stronger governance capacity to improve firm behavior from within.

Because emissions are a global externality, the environmental deterioration we document has distributional consequences beyond the affected firms and their owners. Prior evidence shows that higher temperatures reduce growth more strongly in poorer countries and have already widened global income inequality (Burke et al. 2015, Dell et al. 2012, Diffenbaugh and Burke 2019). In poorer countries, where dispersed investors may exert limited climate discipline, policy and institutional safeguards may become especially important to mitigate environmental backsliding (Bergstrom et al. 1986, Murdoch and Sandler 1997).

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Table 1: Summary statistics.

This table presents descriptive statistics for the variables used in the regression analyses. Panel A reports variables used in Tables 4–6. Unless otherwise indicated, summary statistics are reported for the estimation sample in column 1 of Table 4. *Self-expression* is reported for its available sample in Table 5, and the two foreign-ownership rows are reported for the estimation sample in column 1 of Table 6. *Ownership share* is measured in basis points (bps); *Ownership share, scaled* divides this share by firm-year reported ownership coverage; *Holding value* is the value of the position scaled by investor-country GDP. The Paris Agreement indicator equals one in 2016–2021.
Panel B reports the additional variables used in Table 7. *Ownership shares by investor group* are constructed by aggregating holdings within the corresponding investor group and treating missing group ownership within observed firm-year investor-country cells as zero; these statistics are reported for the large foreign-firm sample used in Panel A of Table 7. *Firm size* is log total assets, and *MSCI World* is an index-membership indicator, reported for the full bilateral samples used in the continuous-interaction columns of that table. Panel C reports the variables used in Table 8. *Ownership by country group* is the share of a firm's reported ownership held by investors from each quartile of the investor-country GDP-per-capita distribution, normalized so that the group shares sum to one in each firm-year. *Log EIR* and *Log incident intensity* are measured with a one-year lead. See Table A1 for variable definitions.

Variable	N	Mean	Median	SD	Min	Max
Panel A: Baseline variables, used in Tables 4–6						
Ownership share, bps	298,803	523.94	6.64	1,828.46	0.02	8,676.79
Ownership share, scaled, bps	298,803	589.43	7.52	2,044.54	0.02	10,000
Holding value, USD per million GDP	298,803	124.28	3.88	549.67	0.00	4,891.05
EIR, ton CO2e per thousand USD	298,803	0.413	0.036	4.616	0	725.433
Log GDP per capita	298,803	3.590	3.791	0.700	−0.771	4.755
Market cap., fraction of GDP	298,803	0.959	0.861	0.549	0.001	3.227
Return, percentage points	298,803	6.438	9.097	37.634	−122.854	108.705
PostPA	298,803	0.553	1	0.497	0	1
Rule of law	298,803	1.325	1.530	0.657	−1.139	2.125
Self-expression	275,756	1.460	1.458	1.065	−1.513	3.113
Div. commitment	298,803	1.477	0.693	1.730	0	6.080
Ownership share, bps (foreign)	281,078	79.77	5.32	306.62	0.01	2,461.41
Log distance (foreign)	281,078	8.542	8.752	0.978	1.806	9.885
Panel B: Additional variables, used in Table 7						
Ownership share by delegated investors, bps	139,877	56.03	2.34	416.24	0	7,534.70
Ownership share by stewards, bps	135,925	9.03	0	34.36	0	433.82
Ownership share by strategic investors, bps	138,970	24.49	0	325.12	0	5,832.74
Ownership share by high-turnover investors, bps	139,016	4.33	0	35.54	0	727.45
Ownership share by medium-turnover investors, bps	139,007	14.16	0.48	97.19	0	1,964.02
Ownership share by low-turnover investors, bps	139,063	70.72	0.93	478.31	0	7,013.37
Firm size	294,803	8.620	8.609	1.472	1.339	13.838
MSCI World	213,256	0.260	0	0.439	0	1
Panel C: Firm-level variables, used in Table 8						
Ownership by country group 1, fraction	19,183	0.03	0	0.16	0	1
Ownership by country group 2, fraction	19,183	0.08	0.000	0.25	0	1
Ownership by country group 3, fraction	19,183	0.07	0.000	0.22	0	1
Ownership by country group 4, fraction	19,183	0.82	0.999	0.34	0	1
Log EIR	16,243	3.68	3.603	3.56	−69.08	19.39
Log incident intensity	6,656	−1.143	−1.125	1.287	−6.607	3.811

Table 2: Fossil-fuel firm divestment and eligible targets.

This table reports the time-invariant fossil-fuel(FF) tier assignment used in the divestment-pressure tests. We classify the firms using Urgewald's Global Oil and Gas Exit List (GOGEL), historical GOGEL files, Global Coal Exit List (GCEL), and Metallurgical Coal Exit List (MCEL). In the first column, we summarize the tier distribution of our firm universe, as in the Table 8 sample. The second column reports the tier distribution after the shift-share eligibility restriction, which requires valid 2002–2005 pre-treatment bilateral ownership weights and at least one post-2008 observation. Heavy and Moderate firms constitute the FF-exposed group in Tables 9–10. No-risk firms form the non-FF comparison group in Table 10. Low-risk firms are excluded from that comparison because their fossil-fuel links are peripheral.

Tier and definition	Firm universe (Table 8 sample)	Shift-share eligible
Heavy risk: firms with a business centered on fossil fuels. *Fossil-fuel or coal revenue share* $\geq$ 50%*, fossil-fuel or coal power share* $\geq$ 50% *for power or oil-and-gas firms, or coal production* $\geq$ 30 *Mt/yr.*	202 (7.0%)	66 (6.2%)
Moderate risk: firms with material fossil-fuel exposure. *Fossil-fuel or coal revenue share between 10% and 50%, fossil-fuel or coal power share* $\geq$ 10%*, own coal mining, coal-power capacity* $\geq$ 500 *MW, or fossil-fuel expansion exposure.*	64 (2.2%)	23 (2.2%)
Low risk: firms with peripheral fossil-fuel links. *Fossil-fuel revenue share below 10%, finance or holding-company exposure, services-only links, or weakly documented fossil-fuel exposure.*	71 (2.5%)	22 (2.1%)
No risk: firms without identified fossil-fuel exposure. *Firms not classified as Heavy, Moderate, or Low under the Urgewald matching and hand-curated review.*	2,558 (88.4%)	950 (89.5%)
Total	2,895 (100%)	1,061 (100%)

Table 3: Summary statistics for divestment-pressure tests.

This table presents descriptive statistics for the variables used in Tables 9–10. Panel A reports the divestment-pressure regressors and the ownership-composition outcomes used in Table 9. For the divestment-pressure regressors, we report summary statistics using the $h = 1$ estimation sample. The ownership-composition outcomes are measured in levels at $t + h$ and are reported for all horizons $h = 1, 2, 3$. Rich investor countries are the upper half of investor countries by sample-period mean GDP per capita, fixed over time. Panel B reports Table 10 outcomes on the corresponding horizon-specific estimation samples, pooling the displayed FF-exposed and non-FF samples. See Table A1 for variable definitions.

Variable	N	Mean	Median	SD	Min	Max
Panel A: Variables used in Table 9						
Divestment pressure	3,000	2.644	2.887	1.959	0	6.160
FF-exposed	3,000	0.097	0	0.296	0	1
EIR	3,000	0.338	0.031	1.774	0	40.717
Rich-country share of foreign ownership$_{t+1}$	3,000	95.806	99.843	16.643	0.006	100.000
Rich-country share of foreign ownership$_{t+2}$	2,468	95.592	99.818	17.092	0.006	100.000
Rich-country share of foreign ownership$_{t+3}$	2,013	95.408	99.808	17.552	0.006	100.000
Avg. log GDPpc of foreign owners$_{t+1}$	3,000	3.889	3.941	0.335	1.956	4.589
Avg. log GDPpc of foreign owners$_{t+2}$	2,468	3.887	3.940	0.342	1.956	4.589
Avg. log GDPpc of foreign owners$_{t+3}$	2,013	3.885	3.937	0.350	2.176	4.589
Panel B: Variables used in Table 10						
Log EIR$_{t+1}$	6,210	3.479	3.450	4.064	−69.078	19.394
Log EIR$_{t+2}$	5,196	3.468	3.438	4.008	−69.078	19.394
Log EIR$_{t+3}$	4,300	3.455	3.428	4.026	−69.078	19.394
Log incident intensity$_{t+1}$	3,036	−1.295	−1.244	1.258	−6.607	3.258
Log incident intensity$_{t+2}$	2,711	−1.313	−1.253	1.252	−6.607	3.258
Log incident intensity$_{t+3}$	2,379	−1.337	−1.270	1.247	−6.607	3.258
Log environmental incident intensity$_{t+1}$	1,463	−1.836	−1.826	1.263	−6.805	3.033
Log environmental incident intensity$_{t+2}$	1,316	−1.852	−1.822	1.236	−6.805	2.566
Log environmental incident intensity$_{t+3}$	1,176	−1.883	−1.854	1.226	−6.805	2.566

Table 4: Ownership share and holding value with firm-level data.

This table reports OLS estimates of *Ownership share* on *EIR* interacted with investor-country characteristics. The dependent variable is *Ownership share* (bps) except in column 2, where it is *Ownership share, scaled* (*Ownership share* divided by firm-year coverage), and column 3, where it is *Holding value* (position value scaled by investor-country GDP). *EIR* is emissions divided by revenue. *Log GDP per capita* is the log of investor-country per-capita GDP in thousands of U.S. dollars. *Market cap* is investor-country stock-market capitalization as a fraction of GDP. *Return* is the firm's lagged annual log price return. The *Foreign* dummy is included but omitted from the table. Columns 4–5 split firms by ownership coverage in the firm's headquarters country, measured before emissions data enter the sample and split at the cross-country median. Columns 6–7 split by whether the firm is headquartered in a petrostate; column 8 additionally excludes petrostate investor countries. Columns 9–10 augment column 1 with the interaction between *EIR*, *Log GDP per capita*, and the post-Paris indicator; column 10 uses a balanced-window subsample (firms present in both 2010–2014 and 2016–2021). All columns include firm-year and investor-country-year fixed effects. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4	5	6	7	8	9	10
				Split by firm's headquarters country					*Post-Paris shift*	
	Own. share	*Own., scaled*	*Holding value*	*Coverage*		*Petrostate*		*Own. share*	*PostPA interaction*	*Balanced*
				High	*Low*	*Yes*	*No*			
EIR	−4.47**	−5.52***	−2.79**	−3.41**	−5.32	74.04	−4.94**	−5.34**	−3.73***	−3.58**
× Log GDP per capita	(1.79)	(2.03)	(1.15)	(1.70)	(3.42)	(47.34)	(1.98)	(2.11)	(1.41)	(1.44)
EIR × Log GDP per capita × PostPA									−8.48	−17.92*
									(7.38)	(9.33)
EIR ×	−5.79**	−6.85**	−2.66***	−6.55**	−5.40	−56.06	−5.99**	−5.84**	−5.10**	−4.72**
Market cap.	(2.32)	(2.67)	(0.93)	(2.75)	(3.93)	(32.22)	(2.42)	(2.38)	(2.06)	(2.12)
Return	0.642***	0.744***	0.404***	0.486***	1.371***	3.475*	0.650***	0.732***	0.637***	0.675***
× Log GDP per capita	(0.106)	(0.123)	(0.082)	(0.102)	(0.322)	(1.754)	(0.106)	(0.117)	(0.105)	(0.153)
N	298,564	298,564	298,564	251,607	46,835	3,832	294,595	273,807	298,564	163,563
Adjusted R^2	0.855	0.854	0.343	0.898	0.627	0.697	0.858	0.859	0.855	0.847

Table 5: Economic development and proxies for collective preferences in carbon-sensitive ownership.

This table reports OLS estimates of *Ownership share* on *EIR* interacted with investor-country characteristics, augmented with additional investor-country controls. Panel A reports Pearson correlations at the investor-country-year level (n = 1,222); parentheses in the *Div. commitment* column give the correlation restricted to country-years with at least one commitment (n = 221). Panel B reports coefficient estimates. The dependent variable is the ownership share (basis points) of a given firm held by investors domiciled in a given country in a given year. Column 1 presents the baseline, which interacts *EIR* with *Log GDP per capita* and *market cap.* and additionally includes the *Foreign* dummy and *Return*×*Log GDP per capita*. Columns 2, 3, and 4 augment the baseline by adding one further *EIR* interaction with, respectively, *Rule of law*, *Self-expression*, and *Div. commitment*. Columns 2′, 3′, and 4′ repeat the preceding column on the same sample but omit *EIR*×*Log GDP per capita*. *Rule of law* is the World Bank Worldwide Governance Indicators estimate. *Self-expression* is the country-period mean of the self-expression values index from the World Values Survey, with pre- and post-Paris periods captured by different waves. *Div. commitment* is the log of one plus cumulative commitments for the investor country-year. Each regression includes firm-year and investor-country-year fixed effects, as well as a foreign dummy. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively; * at the 5% level for correlations.

Panel A: Pairwise correlations

	Rule of law	*Self-expression*	*Div. commitment*
Log GDP per capita	0.78*	0.76*	0.16* (0.48*)
Rule of law		0.79*	0.24* (0.44*)
Self-expression			0.35* (0.48*)

Panel B: Ownership regressions

	1	2	2′	3	3′	4	4′
	Baseline	*Rule of law*		*Self-expression*		*Div. commitment*	
EIR × Log GDP per capita	−4.47**	−4.79**		−7.53**		−3.60**	
	(1.79)	(2.00)		(3.02)		(1.49)	
EIR × Rule of law		0.523	−3.717*				
		(2.438)	(2.044)				
EIR × Self-expression				3.270**	−0.999		
				(1.301)	(0.704)		
EIR × Div. commitment						−3.04	−3.79*
						(1.97)	(2.10)
EIR × Market cap.	−5.79**	−5.78**	−3.98**	−6.64***	−2.39	−4.27**	−1.04
	(2.32)	(2.34)	(1.97)	(2.51)	(1.77)	(1.72)	(0.90)
Return × Log GDP per capita	0.642***	0.642***	0.647***	0.688***	0.697***	0.639***	0.648***
	(0.106)	(0.106)	(0.106)	(0.120)	(0.120)	(0.106)	(0.106)
N	298,564	298,564	298,564	275,548	275,548	298,564	298,564
Adjusted R^2	0.855	0.855	0.855	0.866	0.866	0.855	0.855

Table 6: Cross-border ownership: pre- vs. post-Paris gradient, by firm subsample.

This table reports OLS estimates of *Ownership share* on *EIR* interacted with investor-country characteristics, restricting to foreign investor-firm pairs. The dependent variable is the ownership share (basis points) of a given firm held by investors domiciled in a given country in a given year, winsorized at 1% and 99%. Foreign pairs are those in which the investor country differs from the firm's headquarters country. All columns include, as controls, *EIR*×*Log GDP per capita*, *EIR*×*Market cap.*, *Return*×*Log GDP per capita*, and the log bilateral distance between investor and host country. Columns 1–2 use the full foreign-pair sample. Columns 3–4 further restrict to *Large firms*, defined at the firm level as firms whose mean firm size across observed years is at or above the median of firm-level means in the analysis sample. Within each sample cut, odd columns pool all years (2002–2021) and even columns restrict to the post-Paris years (2016–2021). Each regression includes firm-year and investor-country-year fixed effects. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4
	Full foreign		*Large firms*	
	All	*Post-PA*	*All*	*Post-PA*
EIR × Log GDP per capita	−3.11*	−7.76***	−6.73**	−9.83***
	(1.67)	(2.84)	(2.99)	(2.95)
EIR × Market cap.	−3.60*	−9.53***	−5.35*	−10.47***
	(1.95)	(2.52)	(3.00)	(2.24)
Return × Log GDP per capita	0.153***	0.127**	0.182***	0.203***
	(0.039)	(0.054)	(0.041)	(0.064)
Log distance	−41.19***	−41.07***	−44.35***	−43.79***
	(3.16)	(3.13)	(4.18)	(4.17)
N	280,716	154,354	200,053	98,439
Adjusted R^2	0.359	0.344	0.335	0.318

Table 7: Investor and firm heterogeneity.

This table reports OLS estimates of *Ownership share* across heterogeneity cuts in investor type, portfolio turnover, and firm characteristics. Panel A splits investors by investor type, restricting to large foreign firms. All regressions control for *EIR×Market cap.* and *Return×Log GDP per capita*. Panel B additionally includes the *Foreign* dummy. Panel B columns 1–3 split firms by industry, where *Brown* comprises TRBC energy, materials, utilities, and heavy industrials; [a] drops upstream fossil-fuel energy firms (TRBC sector 5010) from the brown subsample. Column 4 interacts *EIR×Log GDP per capita* with *Firm size* (mean-centered log total assets, i.e., log assets minus its sample mean), full 2002–2021 sample. Columns 5–6 interact with a firm-year *MSCI World* indicator and restrict the sample to 2013–2021. Each regression includes firm-year and investor-country-year fixed effects. The petrostate-headquartered firms are excluded. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Investor heterogeneity (large foreign firms)

	1	2	3	4	5	6
	By investor type			*By portfolio turnover*		
	Delegated	*Stewards*	*Strategic*	*High*	*Medium*	*Low*
EIR × Log GDP per capita	−8.97***	−0.90***	−14.14*	−0.53***	−1.61***	−22.98***
	(1.98)	(0.26)	(7.63)	(0.12)	(0.31)	(7.47)
N	139,772	135,880	138,865	138,929	138,931	138,962
Adj. R^2	0.300	0.402	0.049	0.187	0.250	0.177

Panel B: Firm heterogeneity

	1	2	3	4	5	6
	By industry			*Continuous interactions*		
	Brown	*Brown*[a]	*Non-brown*	*Size* ×	*MSCI* ×	*Both* ×
EIR × Log GDP per capita	−2.98**	−3.08*	−11.92	−7.75**	−18.00**	−18.83***
	(1.26)	(1.78)	(8.28)	(3.85)	(7.86)	(6.82)
EIR × Log GDP per capita × Firm size				−2.76*		−9.24***
				(1.50)		(3.01)
EIR × Log GDP per capita × MSCI World					26.12***	37.84***
					(8.43)	(7.72)
N	60,696	48,561	233,792	294,580	213,115	213,100
Adj. R^2	0.828	0.824	0.869	0.858	0.851	0.852

Table 8: Emission and incident intensity and international ownership by income levels.

This table reports OLS estimates of next-year emission and incident outcomes on the income-group composition of firm ownership. Panel A reports regressions where the dependent variable is *Log EIR*, the log of Scope 1 plus Scope 2 GHG emissions divided by revenue, with a one-year lead. Panel B reports regressions where the dependent variable is *Log incident intensity*, computed as log(count/assets) using all incidents, with a one-year lead. Countries are divided into four quartile groups based on each year's GDP per capita distribution. Ownership variables are fractional shares adjusted so the four groups sum to one, and country group 1 (poorest) is omitted. Controls are log assets, leverage, ROA, and Tobin's Q. All regressions include firm and year fixed effects. Columns 2–3 split by brown and non-brown industries; columns 4–5 split by firm size above and below the log-assets median of 8.67. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4	5
	All firms	*Firms in brown industries*	*Firms in non-brown industries*	*Firms of size above the median*	*Firms of size below the median*
Panel A: Dependent variable: Log EIR$_{t+1}$					
Ownership by country group 2	-0.726**	-1.160*	-0.545	-1.480**	0.242
	(0.366)	(0.617)	(0.419)	(0.604)	(0.671)
Ownership by country group 3	-0.764*	-1.508**	-0.338	-1.652**	0.523
	(0.393)	(0.648)	(0.464)	(0.641)	(0.700)
Ownership by country group 4	-0.697*	-1.606**	-0.185	-1.806***	0.806
	(0.415)	(0.675)	(0.500)	(0.648)	(0.737)
N	16,243	3,609	12,634	8,412	7,831
Adjusted R^2	0.687	0.809	0.631	0.683	0.741
Panel B: Dependent variable: Log incident intensity$_{t+1}$					
Ownership by country group 2	-0.517***	-0.820***	-0.311**	-1.289***	-0.198
	(0.186)	(0.285)	(0.155)	(0.270)	(0.147)
Ownership by country group 3	-0.802***	-1.116***	-0.622***	-1.580***	-0.260
	(0.226)	(0.339)	(0.237)	(0.299)	(0.343)
Ownership by country group 4	-0.923***	-1.047***	-0.867***	-1.688***	-0.599
	(0.258)	(0.395)	(0.277)	(0.327)	(0.447)
N	6,656	2,071	4,585	4,849	1,807
Adjusted R^2	0.776	0.676	0.803	0.734	0.644

Table 9: Ownership reallocation under divestment pressure.

This table reports OLS estimates of ownership-composition outcomes on firm-level *Divestment pressure*. The estimation sample is restricted to years since 2008, the year of the first divestment commitment in the Stand.earth database, and excludes Low-risk firms from the comparison sample. The dependent variables are levels measured at $t + h$, and each specification controls for the corresponding lagged dependent variable at $t - 1$. Columns 1–3 use the share of firm f's foreign ownership held by rich investor countries. Columns 4–6 use the ownership-weighted average log GDP per capita of firm f's foreign owners. Rich investor countries are the upper half of investor countries by sample-period mean GDP per capita, fixed over time. Each dependent variable requires the foreign shareholder base to be at least 5 percentage points at both $t - 1$ and $t + h$. *Divestment pressure* is a shift-share measure, where cumulative divestment commitments from richer investor countries are weighted by firm f's 2002–2005 bilateral ownership shares before transformation. FF-exposed firms are those classified as Heavy- or Moderate-risk. Unreported controls are lagged firm size, leverage, Tobin's Q, ROA, current EIR, MSCI-World indicator, and lagged log price return (winsorized). Firm, home-country×year, and FF-exposed×year fixed effects are included. Standard errors are clustered at the firm home-country level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4	5	6
	Rich-country share of foreign ownership			*Avg. log GDPpc of foreign owners*		
	t+1	t+2	t+3	t+1	t+2	t+3
Divestment pressure × FF-exposed	−1.290**	−1.715**	−2.264***	−0.025**	−0.043***	−0.042***
	(0.577)	(0.841)	(0.576)	(0.012)	(0.013)	(0.015)
Divestment pressure	+0.275	+0.044	−0.116	+0.013	+0.009	+0.003
	(0.327)	(0.411)	(0.607)	(0.008)	(0.009)	(0.011)
Divestment pressure × EIR	−0.007	−0.012	+0.010	−0.001	−0.001*	+0.001**
	(0.015)	(0.021)	(0.017)	(0.001)	(0.001)	(0.000)
N	3,000	2,468	2,013	3,000	2,468	2,013
Home-country clusters	39	38	36	39	38	36

Table 10: Environmental backfire: rich-country divestment pressure and fossil-fuel firms' emissions and incidents.

This table reports OLS estimates of firm-level environmental outcomes on firm-specific *Divestment pressure*. Coefficients are from separate regressions of firm f's environmental outcome at year $t+h$ on firm-specific divestment pressure. The estimation sample is restricted to years since 2008, the year of the first divestment commitment in the Stand.earth database. Columns 1–3 restrict to FF-exposed firms (Heavy- and Moderate-risk); columns 4–6 restrict to non-FF firms (No risk). The three panels use log emissions intensity (Panel A), log total incident intensity (Panel B), and log environmental incident intensity (Panel C) as the dependent variable. *Divestment pressure* is a shift-share measure, where cumulative divestment commitments from rich investor countries are weighted by firm f's 2002–2005 bilateral ownership shares before transformation. Rich investor countries are the upper half of investor countries by sample-period mean GDP per capita, fixed over time. Unreported controls are lagged firm size, leverage, Tobin's Q, ROA, MSCI-World indicator, lagged log price return (winsorized), and lagged ownership shares held by investor-country income groups 2–4. All regressions include firm and home-country×year fixed effects. Standard errors are clustered at the firm home-country level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4	5	6
	FF-exposed firms			*Non-FF firms*		
	h=1	h=2	h=3	h=1	h=2	h=3
Panel A: Dependent variable: Log EIR$_{i,t+h}$						
Divestment pressure	+0.332	+0.478***	+0.541***	−0.055	+0.090	+0.065
	(0.269)	(0.128)	(0.113)	(0.067)	(0.109)	(0.097)
N	622	535	453	5,588	4,661	3,847
Adjusted R^2	0.848	0.875	0.872	0.778	0.840	0.883
Panel B: Dependent variable: Log incident intensity$_{i,t+h}$						
Divestment pressure	+0.379	+0.609***	+0.240	−0.251***	−0.209***	−0.135**
	(0.245)	(0.163)	(0.226)	(0.054)	(0.056)	(0.051)
N	445	395	344	2,591	2,316	2,035
Adjusted R^2	0.640	0.626	0.625	0.767	0.763	0.759
Panel C: Dependent variable: Log env. incident intensity$_{i,t+h}$						
Divestment pressure	+0.733***	+0.722***	+0.421**	−0.263***	−0.255***	−0.241***
	(0.051)	(0.111)	(0.171)	(0.056)	(0.046)	(0.059)
N	393	349	306	1,070	967	870
Adjusted R^2	0.625	0.619	0.630	0.819	0.802	0.804

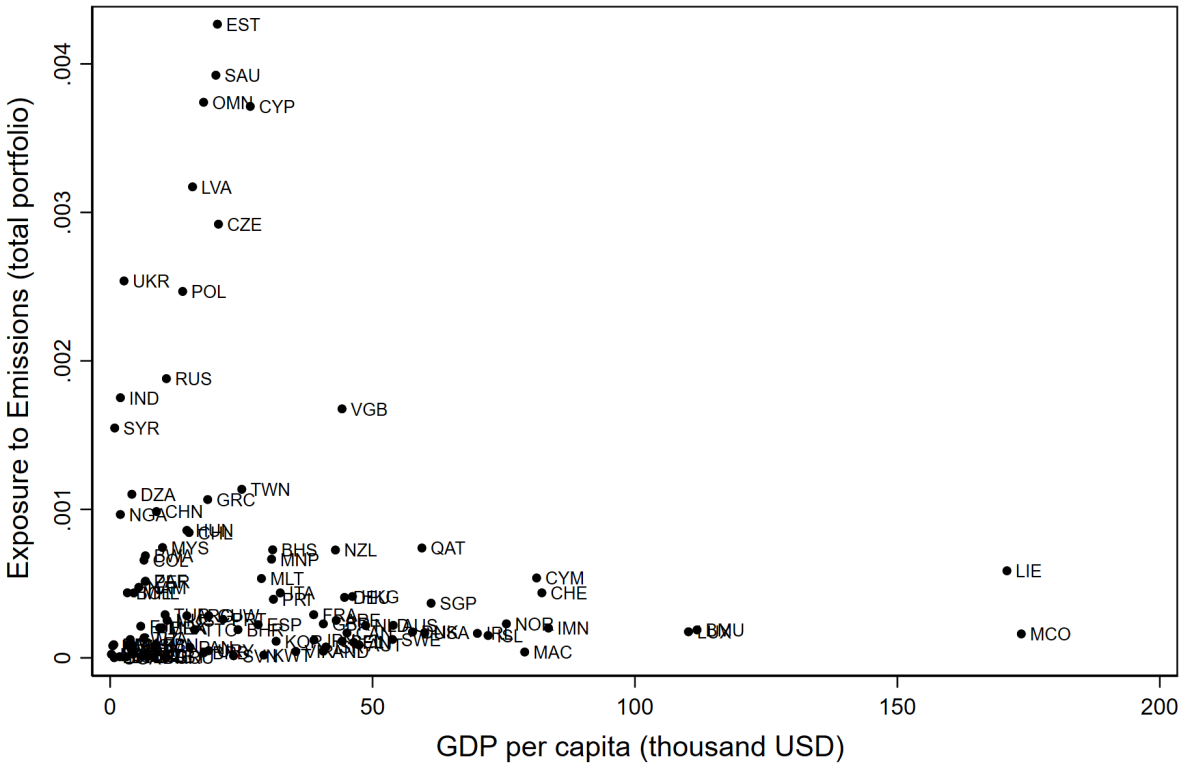

Figure 1: Full portfolio exposure to emissions scaled by revenues and GDP per capita in 2017.
This figure plots the national portfolio exposure to emissions relative to revenues against GDP per capita for countries included in the firm-level sample for the year 2017. This exposure is computed using information for all firms in the firm-level sample as follows,

$$\frac{\sum_{i \in Full\ Portfolio_t} w_{it} \times Emissions_{it}}{\sum_{i \in Full\ Portfolio_t} w_{it} \times Total\ revenue_{it}}$$

where i is a firm index, t is the year 2017, and w_{it} represents the percentage ownership held by a country in firm i at the end of 2017. Emissions are the sum of Scope 1 and Scope 2 emissions.

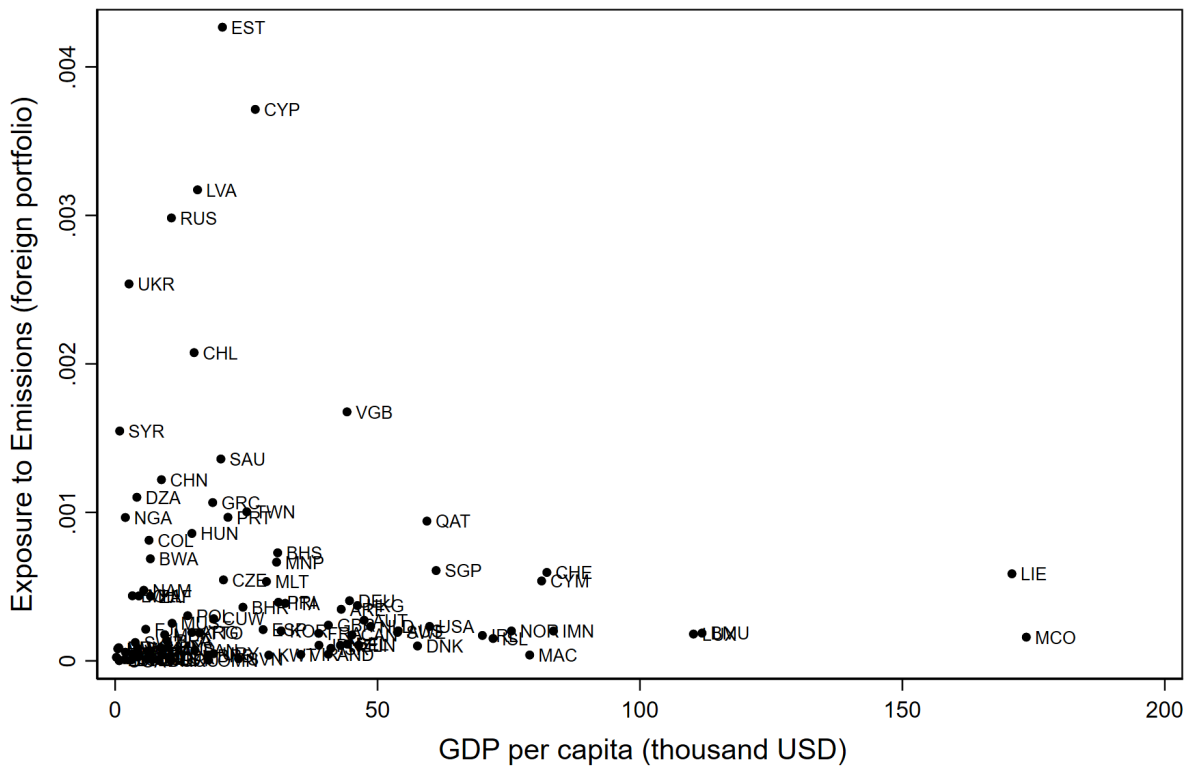

Figure 2: Foreign portfolio exposure to emissions relative to revenues and GDP per capita in 2017. This figure plots the national foreign portfolio exposure to emissions relative to revenues against GDP per capita for countries included in the firm-level sample for the year 2017. This exposure is computed using information for all foreign firms in the firm-level sample as follows,

$$\frac{\sum_{i \in Foreign\ Portfolio_t} w_{it} \times Emissions_{it}}{\sum_{i \in Foreign\ Portfolio_t} w_{it} \times Total\ revenue_{it}}$$

where i is a firm index, t is the year 2017, and w_{it} represents the percentage ownership held by a country in firm i at the end of 2017. Emissions are the sum of Scope 1 and Scope 2 emissions.

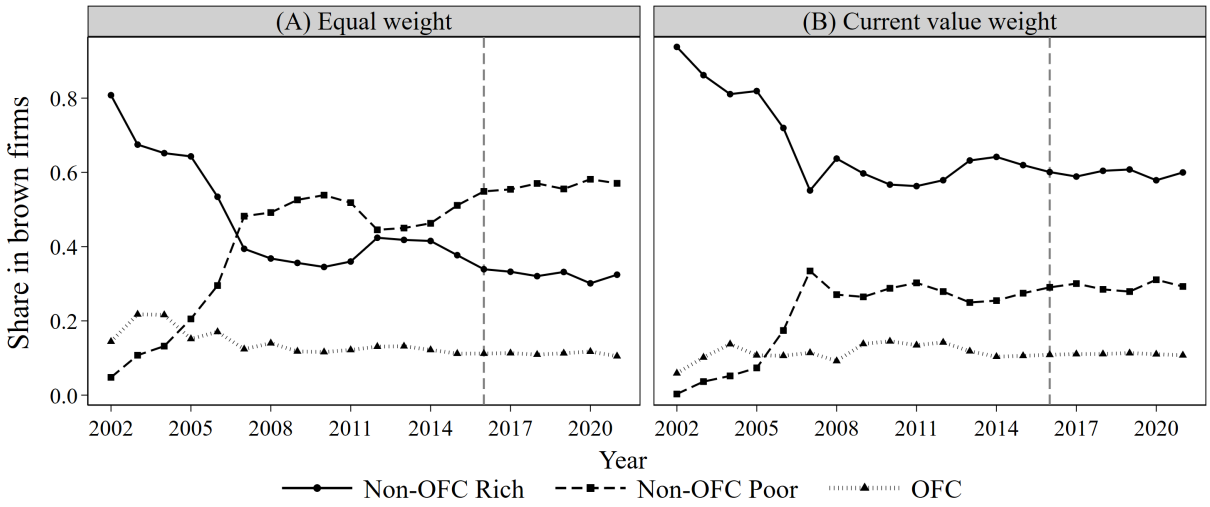

Figure 3: Country group's average share in brown firms, 2002–2021.

This figure plots each country group's average share in brown firms over 2002–2021 under two firm weightings. For each year, we average across *Brown* firms each country group's within-firm ownership share. For firm i we compute the share of its ownership held by group g, $s_{igt} = \left(\sum_{c \in g} w_{ict}\right) / \left(\sum_{c} w_{ict}\right)$, where w_{ict} is country c's ownership stake in firm i at year-end t (basis points). For group g in year t,

$$\textit{Share in brown firms}_{gt} \;=\; \frac{\sum_{i \in Brown} \omega_{it}\, s_{igt}}{\sum_{i \in Brown} \omega_{it}},$$

with firm weights ω_{it}; the three shares sum to one each year. **Panel (A)** weights firms equally ($\omega_{it} = 1$) to isolate the ownership quantities. **Panel (B)** weights firms by their contemporaneous (current-year) market capitalization, winsorized at the 99th percentile. The sample is the broad ownership universe (firms with at least 75% ownership coverage), not conditioned on emissions data. Shares use firm-years held by at least one Rich-country and one Poor-country investor, for firms with continuous coverage present in at least three such years. Non-OFC countries are fix-classified to be rich or poor at the cross-country median of their sample-average GDP per capita. Ownership-data coverage expands over the sample period. The number of qualifying firms grows over time, from 16 in 2002 to about 280 by 2008 and over 430 by 2010, which cautions the interpretation of the first few years. The vertical dashed line marks the Paris Agreement entry into force in 2016.

Appendix A: Additional tables and figures

Table A1 Variable definitions and data sources.

Variable	Description	Data Source
Ownership share	A country's collective ownership share of a stock, aggregated from the investor–firm–year holding data and winsorized at the 1st and 99th percentiles; in basis points.	Refinitiv Workspace API.
Ownership share, scaled	Coverage-rescaled ownership share, computed as the bilateral ownership share divided by aggregate reported ownership in the firm-year; in basis points.	Refinitiv Workspace API.
Holding value	Value of a country's ownership position in a stock, divided by investor-country GDP and winsorized at the 1st and 99th percentiles.	Holding data: Refinitiv Workspace API. GDP: World Bank, UN database, and official national sources.
EIR, Log EIR	EIR is Scope 1 plus Scope 2 GHG emissions divided by revenue (tons of CO2e per thousand USD); Log EIR is its logarithm.	GHG emissions: CDP and Refinitiv Workspace API. Revenues: Refinitiv Workspace API, Compustat Global, and Compustat North America.
Log GDP per capita	Log of GDP per capita in thousands of U.S. dollars for the investor country.	World Bank, UN database, and official national sources.
Market cap.	Stock market capitalization of domestic listed companies as a fraction of GDP.	World Bank.
Return	Lagged annual log price change, expressed in percentage points and winsorized at the 1st and 99th percentiles.	Refinitiv Workspace API, Compustat Global, and Compustat North America.
Foreign	Indicator equal to one if the firm is headquartered in a foreign country relative to a given investor country.	Refinitiv Workspace API.
Log distance	Log of the bilateral great-circle distance (kilometers) between the investor-country capital and the firm headquarters country capital.	CEPII GeoDist database.
Rule of law	WGI Rule of Law estimate, capturing perceptions of the extent to which agents respect and follow the rules of society.	World Bank Worldwide Governance Indicators.
Self-expression	Inglehart–Welzel self-expression values index from the World Values Survey, capturing post-materialist values such as tolerance, civil liberties, and environmental concern.	World Values Survey.
Div. commitment	Natural log of one plus the cumulative count of publicly announced institutional divestment commitments from a given investor country through the year of observation.	Stand.earth Global Fossil Fuel Divestment Commitments Database.
PostPA	Paris Agreement indicator equal to one from 2016 onward.	
Firm size	The logarithm of firm assets.	Refinitiv Workspace API, Compustat Global, Compustat North America.
Leverage	Total liabilities divided by total assets.	Refinitiv Workspace API, Compustat Global, Compustat North America.
Tobin's Q	Market value of assets divided by book value of assets.	Refinitiv Workspace API, Compustat Global, Compustat North America.
ROA	Return on assets, computed as net income divided by total assets.	Refinitiv Workspace API, Compustat Global, Compustat North America.
MSCI World	Indicator equal to one if the firm is a constituent of the MSCI World index in a given year. Yearly constituent lists are reconstructed backward from a 2022 base snapshot using annual constituent additions and deletions derived from iShares MSCI World ETF (URTH) holdings.	SEC EDGAR N-PORT and N-QUANT filings (iShares MSCI World ETF, 2013–present); Refinitiv (2022 base snapshot).
Ownership share by investor type	Collective ownership share of a stock by investor-type group, in basis points: Delegated (investment advisors, asset managers, hedge funds, banks and trusts, private equity, and venture capital), Stewards (pension funds, insurance companies, sovereign wealth funds, foundations, and endowments), and Strategic investors (corporations, holding companies, individuals, insiders, and governments).	Refinitiv Workspace API.

Continued on next page

Table A1 (continued) Variable definitions and data sources.

Variable	Description	Data Source
Ownership share by investors with high / medium / low turnover	Collective ownership share of a stock by the Refinitiv-provided investor turnover category: high turnover (< 1 year), medium turnover (1–2 years), and low turnover (> 2 years); in basis points.	Refinitiv Workspace API.
Ownership by country group (1–4)	Total ownership share held by investors from countries grouped into GDP per capita quartiles, divided by total reported ownership in the firm-year; expressed as a fraction.	Refinitiv Workspace API.
Rich-country share of foreign ownership	Share of firm f's foreign ownership held by rich investor countries, expressed in percentage points; excluding OFC investor countries. Rich investor countries are the constant upper half of investor countries by sample-period mean GDP per capita.	Refinitiv Workspace API; GDP per capita from World Bank, UN database, and official national sources.
Avg. log GDPpc of foreign owners	Ownership-weighted average log GDP per capita of firm f's non-OFC foreign owners.	Refinitiv Workspace API; GDP per capita from World Bank, UN database, and official national sources.
FF-exposed	Indicator equal to one if the firm is classified as Heavy or Moderate in the fossil-fuel tier assignment.	Urgewald GOGEL, GCEL, and MCEL workbooks; Refinitiv identifiers; calibrated hand-screened AI fallback.
Divestment pressure	Firm-specific shift-share exposure to fossil-fuel divestment pressure from richer investor countries. The measure weights each rich investor country's log cumulative divestment commitments by firm f's fixed 2002–2005 bilateral ownership share. Rich investor countries are the constant upper half of investor countries by sample-period mean GDP per capita.	Ownership weights: Refinitiv Workspace API. Divestment commitments: Stand.earth Global Fossil Fuel Divestment Commitments Database.
Log incident intensity, Log env. incident intensity	Log total incident intensity, computed as $\log(\text{count}/\text{assets})$; Log env. incident intensity uses environmental incident counts.	Incident counts: RepRisk. Assets: Refinitiv Workspace API, Compustat Global, Compustat North America.
FF rents	Sum of oil, natural gas, and coal rents as a percentage of GDP in the investor country-year. Following the World Bank definition, a resource rent is the value of production valued at world prices net of the cost of extraction, not the gross value of production.	World Bank.
CTOT index	IMF Gruss–Kebhaj commodity terms-of-trade index, measured as a weighted average of individual commodities' world-price changes, with each commodity weighted by the country's trade in that commodity (exports plus imports) relative to GDP. The weights are fixed over time (averaged over a base period) so that movements in the index reflect commodity price changes rather than changes in the country's trade volumes or composition.	IMF Commodity Terms of Trade database (Gruss and Kebhaj).
Heat index 35	Total days per year when the daily mean Heat index rose above 35°C.	World Bank.
Flood exposure	Proxy for coastal flood risk: additional share of population projected to be exposed to annual coastal floods due to sea-level rise (max projection to 2050).	World Bank.

Table A2: Variable selection: ownership share with alternative added controls to the baseline.

This table reports OLS estimates where the dependent variable is *Ownership share* (basis points). *EIR* is carbon emissions divided by revenue. The table tests, one at a time, whether candidate investor-country controls belong in the ownership specification. Column 1 is a minimal specification with only *EIR*×*Log GDP per capita*; columns 2–7 each add *EIR* interacted with one additional country-level variable and ask whether doing so materially changes the *EIR*×*Log GDP per capita* coefficient. The six candidates span three blocks. *Financial development*: *Bank assets*, domestic bank assets divided by GDP; *Market cap.*, stock market capitalization divided by GDP. *Resources and commodity trade*: *FF rents*, the sum of oil, natural gas and coal rents, divided by GDP; *CTOT index*, the IMF Gruss–Kebhaj commodity terms-of-trade index, measured as a weighted average of world commodity price changes in which each commodity is weighted by the country's trade in it (exports plus imports) relative to GDP. *Climate risk exposure*: *Heat index 35*, days per year when the daily mean heat index exceeds 35°C; *Flood exposure*, a proxy for coastal flood risk computed as the additional share of population projected to be exposed to annual coastal floods under sea-level-rise projections (max to 2050). The *Corr with Log GDP per capita* row reports the pairwise country-year correlation of each candidate with *Log GDP per capita* as descriptive context. *Return* is the firm's lagged annual log price return, winsorized at 1%/99%. The *Foreign* dummy is included in every regression but omitted from the table. All regressions include firm-year and investor-country-year fixed effects. Only *Bank assets* and *Market cap.* materially shift the *EIR*×*Log GDP per capita* coefficient. As the two variables are related and *Bank assets* are highly correlated with *Log GDP per capita*, we eventually retain only the interaction with *Market cap.* for regressions. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	1	2	3	4	5	6	7
		Financial development		*Resources and commodity trade*		*Climate risk exposure*	
EIR × Log GDP per capita	−2.39**	−4.18**	−4.47**	−2.40**	−2.31**	−2.80**	−2.55**
	(1.12)	(1.76)	(1.79)	(1.12)	(1.14)	(1.36)	(1.13)
EIR × Bank assets		0.104*					
		(0.059)					
EIR × Market cap.			−5.79**				
			(2.32)				
EIR × FF rents				−0.021			
				(0.145)			
EIR × CTOT index					1.695		
					(1.391)		
EIR × Heat index 35						−0.052	
						(0.085)	
EIR × Flood exposure							1.201
							(0.924)
Return × Log GDP per capita	0.595***	0.556***	0.642***	0.686***	0.601***	0.598***	0.649***
	(0.097)	(0.106)	(0.106)	(0.112)	(0.107)	(0.103)	(0.106)
Corr with Log GDP per capita	—	0.49	0.17	0.08	−0.06	0.02	−0.16
Observations	310,970	268,767	298,564	265,799	289,797	268,362	289,861
Adjusted R^2	0.849	0.865	0.855	0.854	0.862	0.862	0.853

Table A3: Alternative emissions variables.

This table reports OLS estimates on foreign investor-firm pairs, where the dependent variable is *Ownership share*, winsorized at 1% and 99%. Columns 1–5 use all years. Column 1 uses emissions divided by assets; column 2 uses total emissions; columns 3–5 use the log versions of emissions relative to revenue, emissions relative to assets, and total emissions. Each column also includes the emissions variable interacted with *Market cap.*, *Return×Log GDP per capita*, and a separate distance measure given the focus on foreign pairs. All regressions include firm-year and investor-country-year fixed effects. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Ownership share					
	1	2	3	4	5
	Ownership share				
Emissions variable × Log GDP per capita	−13.08*	−1.575***	−9.718***	−7.354***	−5.286***
	(6.802)	(0.349)	(1.536)	(1.396)	(1.181)
Emissions variable	Emissions divided by assets (EIA)	Total emissions (Emis)	Log EIR	Log EIA	Log Emis
Observations	280,703	280,716	280,116	280,103	280,116
Adjusted R^2	0.360	0.360	0.361	0.361	0.360