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Institutional investors and corporate carbon emissions

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Abstract. There is debate about whether institutional investors reduce corporate carbon emissions. This paper reviews the theoretical and empirical arguments about the emissions-reducing and greenwashing roles of institutional investors, such as mutual funds, private equity, and pension funds. On the other hand, other studies have found the impact of institutional investors to be limited or symbolic. It has been suggested that institutional investors are more inclined to rebalance their portfolios or divest their shares rather than directly influence firms' emissions. In some cases, the reported reductions in emissions by firms may result from asset transfers, outsourcing, and disclosure strategies rather than from actual emissions reductions. In addition, the green image of firms, which is a major concern among institutional investors, could lead them to focus more on disclosure and branding rather than actual efforts in reducing emissions. Therefore, the impact of institutional investors is highly heterogeneous. Emissions reduction is more likely to be achieved by institutional investors when they have a high level of ownership, a long investment horizon, governance expertise, and a conducive regulatory framework. In contrast, passive investors, who have limited divestment power and are subject to strong benchmarking pressure, are more likely to rely on rhetoric rather than actual pressure to achieve their goals. Overall, the discussion above indicates that institutional investors can reduce firms' carbon emissions under specific institutional and regulatory conditions. However, the impact of institutional investors is conditional rather than absolute. Understanding the heterogeneity of institutional investors and the channels of corporate governance is critical in assessing the overall capacity of financial markets to mitigate the effects of climate change.

Keywords: climate finance, institutional ownership, greenwashing, sustainability

1. Introduction: background and literature review

In the backdrop of the broad dual carbon objectives and the Environmental, Social, and Governance (ESG) transition in global capital markets, the ability of institutional investors to push firms to attain actual emissions reductions appears as an essential issue at the intersection of corporate finance and environmental economics. Institutional investors, including mutual funds, pension funds, insurance capital, sovereign wealth funds, index fund managers, and private equity funds, share similar traits, such as higher ownership concentration, longer investment horizons, and greater potential to participate in corporate governance. From a theoretical perspective, institutional investors can push firms to achieve actual emissions reductions by influencing factors such as the cost of capital, reputational pressure, shareholder proposals, private engagements, and divestment, thereby improving firms' carbon performance. However, firms can engage in "compliance-

oriented disclosure", "asset transfers", and "supply chain outsourcing", which can lead to "carbon leakage"; hence, it cannot be assumed that reductions in emissions at the firm level translate into actual global emissions reductions.

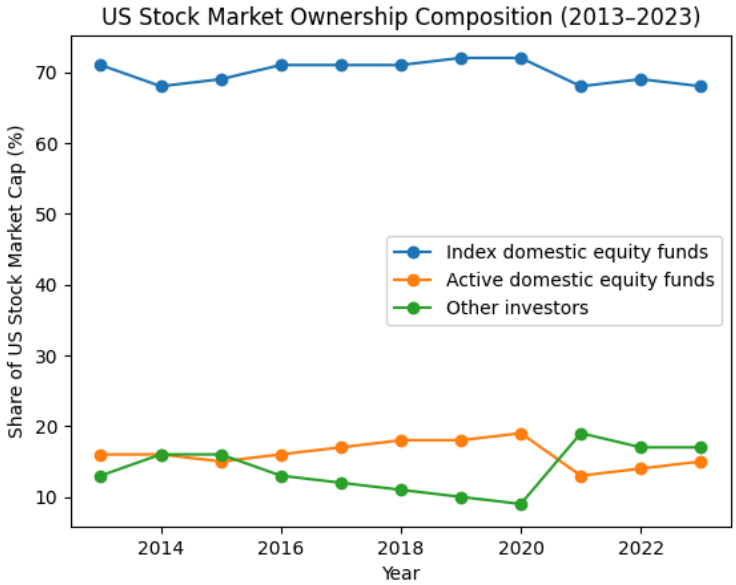

Figure 1. US stock market ownership composition (2013–2023)

Index domestic equity funds consistently account for the largest share of U.S. stock market capitalization, while active funds and other investors hold comparatively smaller proportions over time (Figure 1).

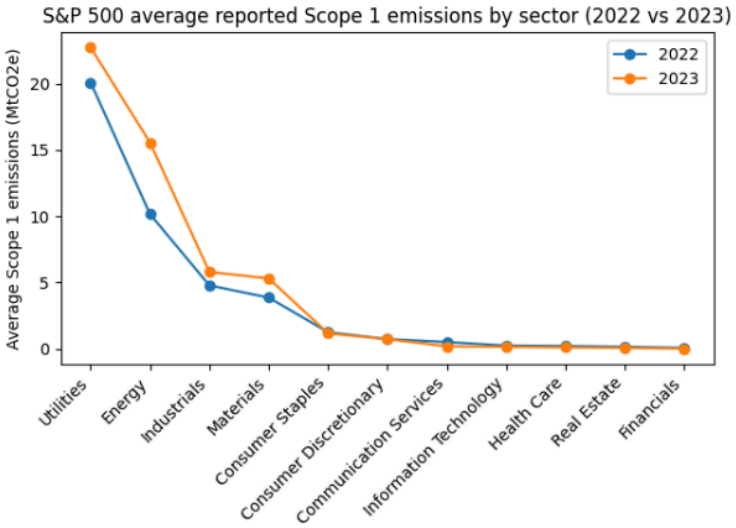

Figure 2. S&P 500 average Scope 1 emissions by sector (2022–2023)

Average reported Scope 1 emissions ($MtCO_2e$) across S&P 500 sectors in 2022 and 2023. Utilities and Energy remain the highest-emitting sectors, while most other sectors report comparatively low direct emissions (Figure 2).

The degree of unevenness in corporate carbon emissions is considerable, as indicated by the fundamental differences across industries. Emission-intensive sectors, such as utilities, energy, materials, and heavy industry, account for a disproportionate share of Scope 1 emissions, while sectors like financial services, information technology, and real estate contribute little in absolute terms. This implies that the general trends in corporate emissions are largely driven by a small number of high-emitting sectors rather than overall behavioral change in the broader economy. This also implies that while overall emissions are reducing, there could be considerable sector-specific variation, with improvements in carbon efficiency in low-emitting sectors having little impact on overall emissions. Additionally, high-emitting sectors tend to face higher abatement costs and technological constraints, implying that their emissions are likely to respond differently to market-based pressures and investor engagement than those of service-oriented or asset-light sectors. The industrial concentration of emissions is thus critical for interpreting results on corporate decarbonization and for determining whether changes in emissions are driven by mitigation or by shifts in industrial composition.

Institutional ownership has a nonlinear distribution across industries due to differences in their risk profiles, capital intensities, and regulatory environments. Institutional investors are found to have higher levels of ownership concentration in capital-intensive, mature industries, such as the utilities, energy, and industrials sectors, because these industries have more firms in major market indices. On the other hand, the level of institutional ownership concentration in industries that are highly volatile or have a fragmented firm base is lower. The distribution of institutional ownership concentration across industries has significant implications for the relationship between institutional investors and the carbon footprint of the firms in which they invest. Since institutional investors are found to have higher exposure to industries with high carbon footprints, their effect on the carbon footprints of the firms in which they invest is mechanically amplified. Moreover, the effect of institutional investors on the carbon footprints of the firms in which they invest may not be uniform across industries, given the differential distribution of institutional ownership. Therefore, the distribution of institutional ownership concentration across industries suggests that the effect of institutional investors on the carbon footprint of the firms in which they invest might operate through sector-specific channels, with higher effects in industries that have higher institutional ownership concentration and a higher potential to influence the management decisions of the firms in which they invest.

Whether institutional investors induce emission reductions depends, in the first place, on their environmental preferences and incentive constraints. Safiullah emphasize significant diversity in institutional investors' environmental preferences: not all impose sanctions on high-emission firms, and only certain types exhibit strong environmental preferences and governance motivations [1]. This, in turn, suggests that studies that only focus on the share of institutional ownership as a control variable in the model may miss the diversity in the preferences of institutional investors. Some types of institutional investors, such as those that exhibit climate awareness, signatory status to responsible investment principles, and long-term liability structures, such as pension funds, are more likely to induce emission reduction in firms, while other types of institutional investors, such as those that exhibit short-termism and focus on index tracking, may not.

On the positive impact pathways, the literature typically offers supporting evidence from various perspectives, including social norms and reputational mechanisms, common ownership and systemic risk perspectives, private equity incentives in contexts with heightened responsibility risk, and disruption from disclosure regimes. Dyck et al. offer cross-country evidence that institutional investors can influence corporate social responsibility through social norms and reputational mechanisms, thereby making ownership structure a key determinant of firms' environmental and social outcomes [2]. The main implication is that corporate environmental actions cannot be explained solely in terms of the firm's intrinsic preferences, but rather the structure of capital markets effectively determines the boundaries for corporate actions. For the current

research, this means that the relationship between institutional investors and emission reductions can be seen in the context of the broader literature on "ownership structure and the governance of corporate externalities".

The literature on common ownership and institutional concentration offers a further potential explanation for the relationship between institutional investors and emission reductions. Azar find that ownership by large index fund managers is positively correlated with reductions in corporate carbon emissions [3]. The literature typically views this relationship as offering support for the view that when institutional investors have a stake in a diverse set of corporations, they are more likely to pressure corporations for emission reductions from a systemic risk perspective (for example, climate change risk), thereby offsetting portfolio-wide losses. Qiang argue that the literature supports the view that the behavior of groups is influenced not only by the characteristics of the members but also by the structure of the network, thereby highlighting the importance of network structure in influencing the incentives facing corporations in terms of the environment [4].

From the perspective of private equity, Bellon provides evidence that private equity ownership can lead to lower emissions for firms in settings in which the salience of environmental liability risk is high [5]. This finding, in turn, points to the role of the broader institutional environment in which disclosure and emission reduction occur. If the potential for legal liability, fines, and other costs related to emissions is predictable and legally enforceable, then investors are likely to perceive emission reduction as a value-enhancing and risk-reducing strategy. On the other hand, in settings in which the institutional environment is weaker, the incentives for emission reduction may be lower. The shocks to the disclosure regime provide the second major channel through which disclosure can lead to actual emission reduction. Downar find that mandatory disclosure of carbon emissions can lead to emission reduction for firms, even when operating performance is not compromised [6]. Tomar points out that the requirement for benchmarking and disclosure affects both disclosure and emission reduction [7]. As the emission reduction performance of firms becomes comparable to that of other firms in the same industry, and the potential for negative sanctions through the "name and shame" approach or the "pricing mechanism" becomes salient, firms will be incentivized to change both disclosure and emission reduction practices to avoid negative sanctions. As such, the causal chain from disclosure to emission reduction becomes complete when combined with the disclosure pricing approach by Ilhan, in which disclosure becomes more likely to lead to actual emission reduction [8].

Institutional investors shape the carbon emissions of firms through a number of identifiable economic mechanisms. First, from a governance perspective, institutional investors, especially large and long-term investors, may pressure firms to adopt cleaner technologies and reduce their carbon emissions. Second, institutional investors, through their assessment of climate risk, impose a higher cost of capital on firms, which may then force these firms to reduce their carbon emissions. Third, institutional investors, through their social image concerns, may be motivated to act on the demand from investors for ESG-labelled funds, which may then be invested in firms with lower carbon emissions.

However, these mechanisms may also produce superficial outcomes. For instance, institutional investors may reduce the carbon emissions of firms through a process of divestment rather than through a process of engagement. In a similar manner, firms may reduce their carbon emissions through a process of asset transfer, outsourcing, or reclassification. In other words, the reduction in firm-level, boundary-defined carbon emissions may not necessarily be equivalent to a reduction in overall global carbon emissions. In fact, the overall carbon emissions may be transferred from one firm to another, thereby highlighting the distinction between sustainability performance and actual impact. This is because firms may resort to superficial reductions in emissions by divesting assets, shifting production to other locations, or outsourcing in the supply chain. In fact, Ecker and Keeve show that firms may manage their reported emissions by divesting assets, raising concerns about whether reported emission reductions are superficial [9]. From a capital markets

perspective, Duchin distinguish between "real improvements" and "cosmetic improvements/greenwashing", arguing that different pricing mechanisms may be applied to these types of abatement [10]. In aggregate, these studies imply a critical testable implication: If firms improve emission indicators by reshuffling assets, but markets are able to distinguish between "cosmetic abatement" and "real abatement", then valuation effects should be lower in the case of "cosmetic abatement" than in the case of "real abatement". However, if markets are unable to distinguish between the two, firms are more likely to pursue lower-cost "reporting improvements", which translate into "greenwashing" strategies in response to investor pressure.

A second, supply chain-based perspective further heightens this concern. In their discussion of climate outsourcing and the transfer of emissions through the supply chain, Dai note that in the context of institutional environments that are characterized by partial regulation and partial disclosure, firms are incentivized to outsource high-emitting activities to their suppliers or to overseas firms [11]. In such contexts, the emissions within the firm's boundaries (Scope 1 and 2 emissions) decrease, but the overall emissions within the firm's value chain do not change or even increase. This implies that the debate over whether institutional investors decrease emissions is, in fact, dependent on the scope and boundary definitions used in the measurement of the emissions: firms are, in the narrow sense, "greener" in that they are improving their disclosure or reducing their Scope 1/2 emissions, but in the broader sense, the overall emissions are not actually decreasing, as the relocation of emissions is not actually reducing the overall emissions, but rather moving it "out of the frame" of the measurement. Shive and Forster, in their comparison of pollution externalities between public and private firms, note that the structure of the capital markets and the governance systems does not necessarily result in environmental improvements, but rather that, in certain contexts, it could even result in the worsening of pollution externalities [12]. This macro-level discussion offers a unifying framework to the discussion of the two narratives of greenwashing and outsourcing: in the context of the capital markets' emphasis on quantifiable, comparable, and discloseable indicators, firms are incentivized to optimize these indicators, but in the context of the failure of the regulatory and disclosure systems to account for the full value chain, firms are incentivized to outsource the emissions "out of the frame".

When combined in a unified approach, a more insightful conclusion is reached: whether or not institutional investor influence leads to actual emission reductions depends on a number of interacting conditions. On one hand, regarding institutional investor influence, more climate-conscious, long-term, and coordinated institutional investors are more likely to drive both disclosure and abatement [8, 13]. Differentiate common ownership from general institutional ownership. Common ownership and its network effect may amplify a systemic risk approach and governance incentives [4], and coordinated engagement and collective action are more effective in governance [14, 15]. On the other hand, regarding firms, asset type and supply chain position affect firms' strategic options. For asset-intensive industries where emissions are concentrated in fixed assets, abatement is costly, and firms are more likely to divest and relocate. Firms shift Scope 3 emissions along the supply chain [11]. Third, regarding the institutional environment, comparability, regulatory reach, and liability risk determine whether greenwashing is economically attractive. Where mandatory disclosure improves comparability, strengthens enforcement, and increases liability risk, disclosure becomes more likely to lead to actual emission reductions [5-7]. On the other hand, when disclosure focuses primarily on firm boundary emissions and does not impose significant constraints on transfer or outsourcing, firms will tend to optimize disclosure metrics by strategic actions, and the outcome will be that disclosure emissions fall while actual value chain emissions remain unchanged [9-11]. Fourth, in the information infrastructure, the role of carbon accounting systems is to make emissions visible, comparable, and governable. Reichelstein suggests the following more systematic approach to corporate carbon accounting, in which emissions are integrated into a system analogous to balance sheets and cash flow statements [16]. The significance of the system is that, by

standardizing the measurement of emissions, the opportunities for boundary arbitrage are reduced, and the credibility and comparability of disclosures and the effectiveness of investor voting, engagement, and cost of capital mechanisms can be improved. The significance of advances in carbon accounting, therefore, lies in the fact that it is a foundational institutional condition for the effectiveness of governance mechanisms.

2. Analysis

Following the above review, further research and manuscript development can unpack the concept of "institutional investor influence" into testable propositions and tackle the identification issues that are most salient to reviewers, particularly endogeneity and greenwashing. At the hypothesis level, there is a testable overarching proposition that institutional investor influence, as measured by increasing institutional ownership, is associated with lower levels of corporate emissions or emission intensity, with the effect particularly pronounced for Scope 1 and 2 emissions. This follows from social norms and reputational pressures [2]; internalization of externalities under common ownership [3]; and governance tools, voting, and engagement [17, 18]. Additional heterogeneity propositions include that institutional investor with more strongly expressed climate preferences or governance capabilities have a stronger effect on emission reductions [8, 13] and that network structures of common ownership amplify these effects [4]. At the institutional environment level, when mandatory disclosure regimes, higher liability risk, and more stringent regulations are in place, emission reductions induced by institutional investors are more likely to be "genuine" abatement [6-8]. Conversely, if regulations only apply to emissions within the firm boundary or there are no regulations on transfer and outsourcing, the induced abatement by institutional investors will be "emission relocation" via asset divestiture or outsourcing, with the consequence that emissions reported by the firms will decrease, but overall emissions will be unchanged [9, 11]. Additionally, market ability to distinguish between real and cosmetic abatement affects valuation gains from firms' strategic responses [10]. Several identification concerns emerge as a natural consequence of such research designs. The first is endogeneity: institutional investors might prefer to invest in firms that are already more "green", implying that a negative correlation between institutional ownership and emissions does not necessarily imply causality. This is where exogenous shocks, difference-in-differences, and IV methods become relevant. Among the studies reviewed, mandatory disclosure and benchmarking [6, 7] are more appropriate for a quasi-exogenous approach and therefore more relevant as a reference for identification strategies. A second set of concerns pertains to measurement boundaries and scopes: emissions might decrease in Scope 1 and 2 due to a relocation effect, and therefore, Scope 3 emissions, supply chain emissions, asset transactions, and geographic relocations need to be considered to address the issue of "where do the emissions go?" [9, 11]. The third set of concerns is about disclosing quality: institutional investors might drive better disclosure [8, 19], yet better disclosure does not necessarily translate to better emissions outcomes. Therefore, a clear distinction is needed in empirical analysis and narrative presentation to avoid confusing better disclosure as a precondition and a driver for abatement rather than an outcome in its own right.

Under this framework, disclosure infrastructures such as CDP referenced in the notes can be thought of as a critical entry point for analysis via the mechanisms. By standardizing corporate disclosure and improving both comparability and visibility, these disclosure infrastructures may actually improve the overall effectiveness of investor governance instruments. In this way, investor "preferences" may be more likely to become actual "constraints".

The overall implication of the existing literature is a relatively robust but conditional one: institutional investors appear to be correlated with lower corporate carbon emissions in a wide range of contexts and may

actually influence corporate climate-related behavior via a variety of mechanisms, including disclosure pricing, voting, engagement, and common ownership [2, 3, 8, 17, 18]. However, this is neither a linear process nor is it a guarantee of actual reductions in global emissions. If the existing rules and disclosure practices have blind spots, then the firm might succeed in lowering its emissions in an apparent way through asset divestiture, capacity relocation, or outsourcing its supply chains, thereby leading to the problem of greenwashing or carbon leakage [9, 11]. The capital market's ability to distinguish between real and apparent emission reductions also influences incentives for strategic behavior [10].

Institutional investors differ in their motivations to address climate issues and their ability to engage in effective governance. For example, investors with an ESG mandate, long investment horizon, and high ownership concentration, such as PRI signatories or public pension funds, are more likely to engage in real decarbonization efforts through active engagement and voting practices. In contrast, investors with short investment horizons, benchmarks, or return-focused mandates might address climate issues through portfolio reallocation or disclosure-based approaches instead of operational abatement. Understanding this differentiation is essential to evaluate the presence of genuine climate commitment or symbolic actions in institutional ownership.

The Table 1 and Figure 3 show the annual number of 13F institutional investors who became PRI signatories from 2007 to 2021.

Table 1. Principles for Responsible Investment (PRI) signatories

Signature Year	Number of Institutions
2007	14
2008	15
2009	22
2010	19
2011	15
2012	26
2013	26
2014	22
2015	25
2016	27
2017	38
2018	59
2019	80
2020	120
2021	94

The three main channels through which institutional investors shape the carbon footprint of their portfolio companies are voting, engagement, and disinvestment. Voting enables institutional investors to support shareholder proposals related to climate change, vote against directors who lack a credible transition plan, or vote in favor of directors contingent on their adoption of quantified greenhouse gas reduction targets. Engagement enables institutional investors to privately encourage their portfolio companies to enhance their climate-related disclosure, adopt science-based targets, and implement operational decarbonization strategies. When institutional investors engage in a coordinated manner, they can mitigate collective action problems. Finally, disinvesting from or exiting their portfolio companies enables institutional investors to redirect their

capital to other companies with lower carbon footprints, thereby increasing the cost of capital for their disinvested companies.

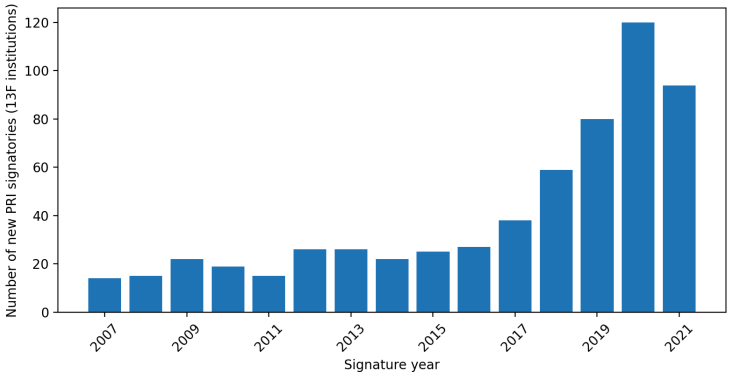

Figure 3. Number of new PRI signatories (13F institutions)

The relevance and importance of these channels differ depending on the type of institutional investors. Passive institutional investors have less ability to disinvest from their benchmark portfolio companies but retain their voting power. Active institutional investors have both engagement and disinvestment options. Another key issue to be noted is that improvements in the carbon footprint of their portfolio companies, resulting from institutional investors' engagement, might be because of disinvestments and boundary shifting rather than operational improvements in their carbon footprints.

Institutional investors can affect portfolio firms' carbon footprints through three main channels. First, through voting, investors can support climate-related shareholder proposals, vote against directors, or condition support for management on credible transition plans. Second, through engagement, investors can privately negotiate with firms, request improved disclosure and target-setting, and coordinate with other shareholders to increase pressure; coordinated engagement can mitigate collective-action problems. Third, through exit or portfolio reallocation (including divestment), investors can potentially raise the cost of capital for high-emitting firms, although the effectiveness of exit depends on market segmentation and the availability of replacement capital. Importantly, the relative importance of these channels varies across investor types: passive investors are typically more exit-constrained but may have persistent voting power, while active investors may combine engagement with exit threats.

Synthesizing the literature suggests that the key empirical question is not only whether institutional ownership is associated with lower reported emissions, but when this association reflects real abatement (e.g., process improvements, clean investment, and technology adoption) versus apparent abatement driven by boundary shifting (e.g., divestitures, relocation, or supply-chain outsourcing). This distinction motivates testable predictions that jointly incorporate investor heterogeneity, institutional and liability environments, and emissions accounting boundaries.

The documented negative association between institutional ownership and corporate carbon emissions may reflect endogenous selection rather than causal governance effects. Institutions may tilt portfolios toward firms with pre-existing environmental advantages, and firms with superior managerial quality or innovation capacity may simultaneously attract institutional capital and exhibit lower emissions. Furthermore, portfolio rebalancing toward low-carbon firms can mechanically generate a negative correlation without affecting real emissions at the economy-wide level. Establishing causality, therefore, requires identification strategies that address reverse causality, omitted variables, and portfolio sorting.

3. Conclusion

Overall, the literature supports a conditional role for institutional investors in shaping corporate carbon outcomes. Ownership can matter through disclosure pricing, voting, engagement, and common-ownership incentives, but observed reductions in firm-reported emissions do not automatically imply reductions in total pollution. Future empirical work should therefore jointly model investor heterogeneity, institutional environments, and emissions accounting boundaries, and explicitly test for relocation and outsourcing channels using asset-transaction and supply-chain data.

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