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Common Institutional Ownership and Corporate Carbon Emissions

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There has been a growing interest in comparative work exploring when and why firms embark on green paths. It has been concluded that in national contexts where inter-firm ties are stronger, progress has been stronger. In turn, this raises questions about the impact of inter-firm ties within, rather than between, national contexts, and in settings where progress towards renewables has been uneven and contested. Accordingly, we explore how common institutional ownership may foster collaboration among firms within the same industry against climate change. Using a sample of US-listed firms from 2006 to 2019, we obtain robust evidence that firms with industrial peers that are owned by the same institutional investors have lower carbon emissions. In addition, we find that a threshold exists for which the impact on carbon emissions holds only when firms are commonly connected with a substantial number of peers. The existence of this threshold suggests potential free-riding issues and highlights the beneficial role of investors in promoting cross-industry collaboration. Overall, our results highlight the role played by institutional investors in tackling climate issues, with important implications for both climate- and antitrust-related regulations.

Introduction

Undeniably, climate change has posed significant challenges across societal and economic landscapes, strongly necessitating collective action, particularly from the corporate sector and its investors (Deschênes and Greenstone, 2007; Bernstein, Jayaraman and Nagar, 2019; Baldauf, Garlappi and Yannelis, 2020). Institutional investors are increasingly focused on the impacts of climate change on their portfolios (Bolton and Kacperczyk, 2021; Hansen, 2022). This growing awareness is motivating a shift towards actively promoting sustainability in investment strategies, with a particular emphasis on reducing corporate carbon emissions.

However, the transition towards more sustainable practices is fraught with complexities. Despite a general consensus on the need for action, the public goods nature of climate change mitigation often leads to a discrepancy between corporate commitments and actual efforts to reduce emissions (Marquis, Toffel and Zhou, 2016; Si *et al.*, 2023). The costs associated with such initiatives are significant, and the benefits are broadly shared, making it challenging for individual firms to justify the necessary investments in the absence of collective action (Graham, Harvey and Rajgopal, 2005; Greenstone, List and Syverson, 2012; Hall and Soskice, 2001; Jackson and Deeg, 2019; Widmer, 2011). Martin Brudemuller, the chairman and CTO of BASF, therefore stated that, 'A collaborative effort is needed within the sector … All of us share the goal of dramatically reducing our industry's carbon footprint … Collaboration within the industry will increase the chances of this happening'.

This raises the question of the role of common institutional investors in fostering collaborative efforts between firms to tackle climate change. Given the capacity of institutional investors to influence corporate behaviour, this study examines whether a shared common ownership structure can encourage firms within the same industry to overcome the public goods dilemma and collectively reduce carbon emissions. Previous studies have found that common institutional ownership makes firms less adversarially competitive and more inclined to collaborate with their peers (Azar, 2017; He and Huang, 2017; Park *et al.*, 2019). Moreover, institutional investors may have been incentivized to encourage firms to engage in pro-environmental activities as a result of both financial and non-financial preferences (Ariel, Bracha and Meier, 2009; Dellavigna, List and Malmendier, 2012; Krueger, Sautner and Starks, 2020).

Hence, we explore the relationship between common ownership and corporate carbon emissions based on a US sample from 2006 to 2019. Our findings indicate that firms with a higher number of commonly owned peers are more likely to engage in concerted efforts to address climate change issues, resulting in lower carbon emissions. This effect is particularly significant when a substantial number of peers are commonly connected, suggesting that collaboration through common ownership can promote significant environmental improvements.

This paper makes important contributions to the literature in two ways. First, this study adds to the growing literature on climate change and market behaviour (Addoum, Ng and Ortiz-Bobea, 2020; Azar *et al.*, 2021a; Lin, Schmid and Weisbach, 2020). It differs from previous studies by moving beyond the individual firm and studying whether and how institutional investors can foster collaboration within the entire sector to combat climate change. Second, this paper adds to the ongoing debate over the economic implications of common ownership. Many studies conclude that common ownership fosters cooperation among firms and reduces competition (Brooks, Chen and Zeng, 2018; He and Huang, 2017), while others argue that the observed effect is not substantial (Koch, Panayides and Thomas, 2021; Lewellen and Lowry, 2021). We provide evidence that, despite the controversy over the effects on corporate product markets, common ownership generates environmental benefits.

The rest of this paper is organized as follows. In the next section, we illustrate the analytical framework based on existing literature and construct our hypothesis that common institutional ownership fosters collaboration against climate change. We then explain the samples and definitions of key variables. The main empirical results are reported in the subsequent section, and then additional issues are discussed. The final section offers some conclusions.

Literature review and hypothesis development

Coordination, renewables, and common ownership

The literature on comparative institutional analysis has been extended to explore the relationship between context and relative progress away from oil and gas (Allen *et al.*, 2021; Tarim, Finke and Liu, 2021). This work highlights how firms in more coordinated markets are more likely to make progress towards renewables (Tarim, Finke and Liu, 2021; Wood *et al.*, 2020). This reflects the extent to which adversarial competition makes for short-termism (Hall and Soskice, 2001; Wood *et al.*, 2020). In coordinated markets, dense or thick ties between firms enable a longer-termist view, with incremental innovations being diffused across sectors (Farrell, 2009; Jackson and Deeg, 2019). It is held that this reflects institutional arrangements that encourage cooperative practices, and the greater availability of patient capital (Kellard *et al.*, 2023). Yet, whilst the Anglo-Saxon liberal market economies appear to be less conducive towards progress to renewables (Kellard *et al.*, 2023; Wood *et al.*, 2020), there is little doubt that there are many exceptions to this general tendency. Moreover, uncertainty may make collaboration more challenging (Buvik and Gronhaug, 2000). Hence, it could be argued that relative progress is bound up with the ability to coordinate the efforts of firms and promote greater cooperation between them, yet short-term investors and the legacies of adverserialism make this more challenging (Buvik and Gronhaug, 2000). This raises questions regarding the nature of other sources of inter-firm coordination, and, more specifically, the role and potential of institutional investors, given their relative prominence in the liberal market ecosystem (Jahnke, 2019).

Although it is commonly held that inter-firm collaboration may be adversarial to the public, based on the potential for price-fixing and, hence, a strong case can be made for anti-trust legislation, the existing literature highlights the merits of such coordination in non-price-related matters. More specifically, it may facilitate the sharing of new technological information and associated solutions in operationalization, promoting growth and efficiency (Baumol, 2001). This raises questions regarding mechanisms other than national or regional institutions for promoting such collaboration (Lehoux, D'Amours and Langevin, 2014; Propris, 2002). Although inter-firm coordination can emerge on a bottom-up basis through many mechanisms (Jambou *et al.*, 2022), overlapping ownership can play a driving role (Kogut and Walker, 2001). However, research on the effects of common ownership yields no consensus; this may be because of the intrusion of events, or simply the phenomenon explored (Lewellen and Lowry, 2021). For example, price coordination is quite different from cooperation around new technologies or reducing greenhouse gas emissions. Hence, this study focuses specifically on the effects of shared ownership on relative progress towards environmental sustainability.

Previous studies show that a firm tends to internalize certain externalities imposed by industry rivals and reduces competition with them when the firm and its rivals are commonly owned peers (Azar, 2017; Gilo, Moshe and Spiegel, 2006; Anton *et al.*, 2023). Theoretically, this is because institutional investors with multiple stakes in many firms do not consider only the likely benefits from individual firms; they are more concerned with maximizing the value of their portfolios (Azar and Vives, 2021; Ederer and Pellegrino, 2022). Therefore, the benefit of firm-level profit maximization by competing aggressively has a cost for the firm's peers within the same industry, thereby decreasing industry-level profits. A common blockholder who has equal stakes in all firms in an industry will not benefit from such fierce competition, such as price undercutting, patent races, and advertising wars, if its goal is portfolio maximization. Thus, as common ownership increases, cross-blockholders will be less likely to support the intensive competition strategy.

Consistent with the theoretical prediction, empirical evidence shows that common institutional ownership promotes clear forms of collaboration. For example, He and Huang (2017) find that firms' market share increases with common ownership and that innovation productivity and operating profitability also improve. Azar, Schmalz and Tecu (2018) find that product prices increase with increases in institutional cross-holdings, whereas Azar, Qui and Sojourner (2021b) show that wages and employment rates both decrease with increases in common ownership. Brooks, Chen and Zeng (2018) study the institutional cross-ownership in M&A transactions and find that better outcomes are achieved when the parties to a merger are commonly held by institutional investors. Along the supply chain, Deng and Li (2022) show that common ownership makes suppliers conduct more relationship-specific innovations. Eldar and Grennan (2021) further complement the literature by providing evidence from the venture capital market, and show that common ownership helps create opportunities for the entry of innovative and high-growth startups.

Other studies have shown that common ownership reduces information asymmetry and promotes information sharing among same-industry peers. As illustrated by Schmalz (2021) on page 17, one basic logic for this argument is that 'disclosure can hurt an individual firm because it gives away secrets, but it benefits competitors and can facilitate product market coordination and therefore benefit the industry overall'. Consistent with this view, Park *et al.* (2019) find that cross-ownership promotes information sharing by reducing concerns about the proprietary cost of disclosure and incentivizing firms to internalize the external benefits of their disclosure for peers with common ownership. Jung (2013) and Pawliczek, Skinner and Zechman (2022) also examine firm decision-making in providing more voluntary information when investor overlap increases. Jang, Kang and Yezegel (2022) provide direct evidence that stock prices are more informative if a firm is commonly owned by institutional investors, partly because of an increase in disclosure. Furthermore, Ramalingegowda, Utke and Yu (2020) show that corporate earnings management decreases with increases in common ownership, and Gao *et al.* (2022) obtain a similar pattern along the supply chain.

Overall, common ownership can foster coordination among firms for at least two reasons. First, because of incomplete contracting, firms considering cooperation with competitors might worry about the risk of being held up or expropriated by their rivals; thus, firms might avoid collaboration in the first place. The presence of common blockholders, whose objective is portfolio maximization, can mitigate the frictions related to incomplete contracting through the monitoring of firm behaviour. Second, common ownership promotes information sharing, reduces information asymmetry, and thus makes it easier for firms to reduce coordination costs along with adopting a low-carbon strategy.

Institutional investors and carbon emissions

Carbon emissions directly impact firm valuation. Corporate carbon emissions can generally be considered a typical societal cost and a negative externality, as all emissions collectively contribute to global warming. Therefore, as corporate carbon emissions cannot be fully internalized, the firm lacks an incentive to reduce them. However, as common blockholders are attentive to portfolio maximization, they could internalize some of the costs and benefits from their firms' collaborative efforts at reducing the carbon emissions in their portfolio.

Theoretically, Hansen and Lott (1996) prove that shareholders with a diversification strategy could make a portfolio firm internalize some externalities imposed on other portfolio firms. Therefore, as long as carbon emissions affect firm valuation, reducing them will make cross-ownership better off. Indeed, Matsumura, Prakash and Vera-Muñoz (2014) provide direct evidence that corporate carbon emissions affect firm valuation, as the value of a firm decreases by $212,000 for every extra 1000 metric tons in its carbon emissions. Empirically, Kacperczyk and Peydro (2021) show that carbon-intensive firms have significantly higher costs of debt owing to a reduction in bank lending. Therefore, Azar *et al.* (2021a) and Benlemlih, Arif and Nadeem (2023) find that institutional investors urge firms to reduce their carbon emissions. Cao *et al.* (2021) document that bonds issued by a carbon-intensive firm have much lower liquidity than those from others because of herd selling by institutional investors. It is recognized that evidence regarding this is mixed and that some studies differ on these conclusions (Das Gupta, 2022; Wang, Li and Zhang, 2021). However, Krueger, Sautner and Starks (2020) conclude that a substantial number of investment managers consider that climate risks are important factors and have increasingly significant impacts on corporate operations and valuations. Overall, these findings suggest that investors have an incentive to integrate carbon emissions into their decision-making and investment strategies.

Investors favour environmentally friendly actions. In addition to the fact that carbon emissions can affect firm value, institutional investors urge firms to reduce carbon emissions if they or their investment clients have environmental concerns. For example, hundreds of investors with more than $100 trillion in Aseets Under Managements (AUM) are signatories to the Principles of Responsible Investments (PRI), which tackles issues related to climate change. During the 2023 UN climate ambition summit, Oliver Bäte, the CEO of Allianz, addressed the company's commitment to expand its investments in renewable energies, through focusing on climate and cleantech, as a means of reducing emissions in its investment and underwriting portfolios.

Previous literature also suggests that investors care about sustainability for more reasons than just pecuniary motives. For instance, Riedl and Smeets (2017) and Hartzmark and Sussman (2019) find that investors would like to make investments based on their social preferences, even if doing so sacrifices financial performance. Ceccarelli, Ramelli and Wagner (2024) document that mutual funds compete with one another to attract investment flows that have climate change-related awareness, whereas Bennett (2019) shows that pension funds may be under pressure from their members. Starks, Venkat and Zhu (2019) provide evidence that institutional investors with a longer investment horizon are more likely to invest in firms with better environmental, social and governance (ESG) performance, suggesting a strong preference for non-financial performance. Dyck *et al.* (2019) document that institutional investors care about corporate environmental and social performance worldwide, not just because of financial concerns but also because of social returns. Moreover, institutional investors face increased stakeholder scrutiny and hence may be more inclined towards business-case arguments for green energy (Alda, 2019). MaCahery, Pudschedl and Steindl (2022) survey institutional investors to understand why they care about ESG factors in their investment management and show that one important reason for this behaviour is to respond to clients' demand for sustainability.

Individual firms have fewer incentives to initiate carbon reduction. Managers face short-term pressures on financial performance, such as achieving or exceeding earnings expectations. For instance, Graham, Harvey and Rajgopal (2005) conducted surveys and interviews with more than 400 executives and found that nearly 80% of the respondents admitted to sacrificing long-term value to meet earnings targets. They also document that CFOs are less willing to consider investments that can increase long-term value if their acceptance of these investments will cause them to miss earnings forecasts. Empirically, previous literature confirms that short-term pressures make managers sacrifice long-term benefits in exchange for better short-run performance on earnings. For example, Liu *et al.* (2021) find direct evidence that firms with earnings pressure have more intense pollutant emissions, whereas Xu and Kim (2022) document that financial constraints increase firms' toxic emissions. Caskey and Ozel (2017) assess the relationship between managers' efforts to meet earnings expectations and safety in the workplace and find that the injury/illness rates are significantly higher at firms that just beat analyst forecasts. Bhojraj *et al.* (2009) investigate the influence on performance of certain forms of earnings management to beat analyst forecasts and find that managers behave myopically to outperform benchmarks.

Therefore, the substantial cost of emissions abatement in the short term ultimately puts a firm that initiated decarbonization at an economic disadvantage when compared with its rivals, especially in a highly competitive market. Given the conflicts between achieving long-term environmental and short-term financial goals, we argue that not all firms are willing to initiate actions aimed at reducing carbon emissions. Consistent with our argument, previous studies show that firms often engage in cheap talk instead of taking real action (Hawn and Ioannou, 2016; Hiatt, Grandy and Lee, 2015). Thus, collaboration is important for combating climate change, and individual companies cannot transform the sector alone.

How can institutional investors affect carbon emissions? Institutional blockholders can have a substantial influence on firm decision-making through two mechanisms: voice and the threat of exit. For example, a direct intervention might be to suggest an adaptation to climate change via private communications with managers, a public shareholder proposal, or voting against directors during elections. The threat of exit might be that if the manager does not take action to combat climate change, then investors will sell their shares and, thus, punish the manager ex post. Ex ante, this threat might make managers pay attention to climate change. Flammer, Toffel and Viswanathan (2021) find that investors actively engage with firms to report more climate change risks through their shareholder proposals. Aretz, Banerjee and Pryshchepa (2019) also show that creditor control could prohibit firms that are severely damaged by climate disasters from taking additional risks. Therefore, because these situations are not rare, ignoring climate-related requests from institutional investors can be costly for managers. Common ownership may, in turn, increase firm accountability to investor agendas (Edmans, Levit and Reilly, 2019).

Furthermore, as illustrated by Azar *et al.* (2021a), large institutional investors could also exert influence over individual firms without explicit engagement. They can make public statements that simultaneously share their environmental preferences and concerns with the other firms in their portfolios without communicating with each firm. For example, BlackRock makes public statements to CEOs, urging them to take more action and move quickly in dealing with climate-related issues.[1] Each firm could respond to these public statements in exchange for support from institutional investors on key voting events. For instance, as documented by Condon (2020), BlackRock, the largest shareholder of Exxon, voted against the firm's re-election of two board members during its 2017 annual meeting, in disagreement over a 'non-engagement' policy that prevented directors from disclosing the firm's strategic response to climate change to its shareholders. Following the vote, Exxon modified its policy to allow directors to meet with shareholders and discuss climate risk.

Lastly, institutional investors can polish the corporate governance structure, reduce agency costs, and make the firm more responsive to investor demands. Carleton, Nelson and Weisbach (1998) study the procedure of private negotiations between financial institutions and the firms that they try to influence and find that a majority of the firms subsequently engage in actions aimed at complying with the agreements. Aggarwal *et al.* (2011) provide international evidence that institutional ownership helps firms form better corporate governance structures. Appel, Gormley and Keim (2016) also show that passive investors are not passive owners and take action to enable firms to achieve better long-term performance. Overall, through changes in the governance structure, firms can be more responsive to climate change concerns and risks owing to recent and increasing pressure from investors.

Hypothesis development

Our first hypothesis seeks to probe whether common ownership facilitates collaborative behaviour among firms, particularly in the domain of carbon reduction. The public goods nature of climate change mitigation efforts poses a challenge, as previous literature has shown that individual firms lack the incentive to reduce carbon emissions independently owing to the substantial costs involved and the distributed nature of benefits (Liu *et al.*, 2021; Xu and Kim, 2022). Therefore, collaborative efforts are required to achieve the goal of reducing emissions. Previous studies have shown that common institutional investors could foster collaboration among their holding firms, and institutional investors nowadays care about climate change and carbon emissions from both monetary and socially responsible motivations (Dyck *et al.*, 2019; He and Huang, 2017). Therefore, common ownership has the potential to foster corporate collaboration on reducing carbon emissions.

Other work highlights that the collaboration that comes with common ownership serves economic goals (Azar, Schmalz and Tecu, 2018). Common institutional investors have the incentive to exert their influence on climate-related issues, because climate risks (including both transition and physical risks) faced by firms pose a threat to their portfolio values, including the risk of stranded assets (Kacperczyk and Peydro, 2021; Sautner *et al.*, 2023). It is recognized that short-term competitive advantage – and returns – might be enhanced through acting otherwise. Moving towards lower carbon emissions requires upfront costs, and less principled firms may seize advantages by doubling down on polluting technologies. However, existing research concludes that interlocking boards make for greater long-termism (Benton and Cobb, 2019); inter alia, this may be because it is easier to reign in freeriding behaviour. Common ownership may have similar effects. Hence, common institutions have both an ability and a motivation to foster collaboration on carbon reduction. Accordingly, we conjecture that the more firms are connected by common ownership, the more firms could be influenced by the common institutions, and, thus, the collaboration will be more effective (also see Figure 1).

Hypothesis 1. Firms whose industry peers are commonly owned by institutional investors will have lower carbon emissions.

Furthermore, previous literature has shown that common ownership could promote corporate cooperation (Park *et al.*, 2019). Given that decarbonization represents a substantial cost for individual firms, common ownership may reduce information asymmetry (Edmans, Levit and Reilly, 2019), facilitate the operationalization of innovations on an incremental basis (c.f. Persoon, Bekkers and Alkemade, 2020), and reduce each firm's comparative cost of adopting a low-carbon strategy, without necessarily centralizing production facilities. Therefore, common ownership could make firms reduce carbon emissions by promoting collaborative efforts.

Hypothesis 2. Common ownership makes firms reduce carbon emissions through fostering inter-corporate cooperation.

Data and measurement

Data and sample construction

Our initial sample includes the universe of US-listed firms with common shares traded on the NYSE, NAS-

[1]See https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter

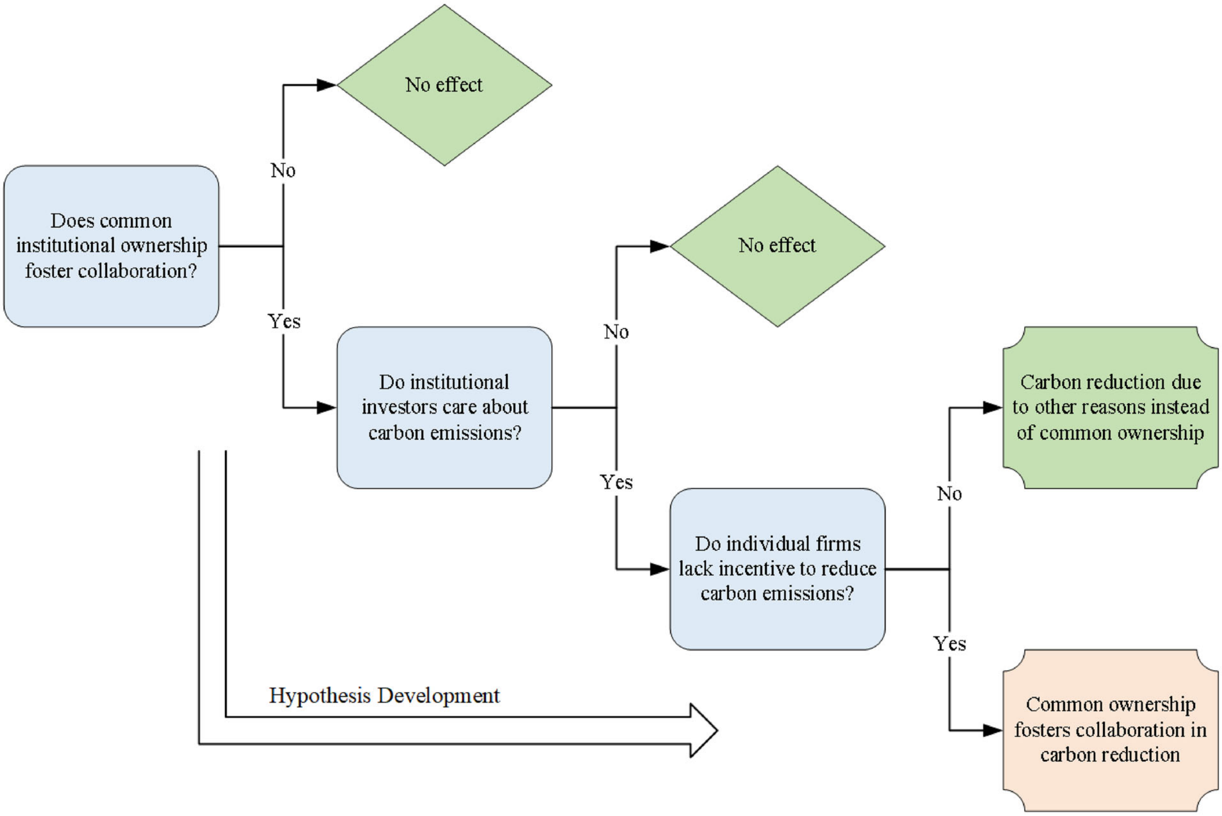


Figure 1. Hypothesis development

DAQ and AMEX from 2006 to 2019. We then merge this sample with Compustat to obtain corporate financial information and with Thomson Reuters/Refinitiv to obtain data on corporate carbon emissions. We obtain the institutional holdings (Form 13F) data from Wharton Research Data Services (WRDS) and further restrict firm participation by requiring that non-missing industry classification information (two-digit SIC codes) be included in the sample. The final sample includes 13,041 firm–year observations with 2376 distinct firms.

Key variables

We obtain carbon emissions data from Thomson Reuters/Refinitiv. According to the leading greenhouse gas (GHG) protocol for corporate standards, a company's GHG emissions are divided into three scopes. We focus on Scope 1 and 2 emissions because they are owned or controlled by firms, whereas Scope 3 emissions are not controlled by firms. Two measures are defined: log_co2 is the logarithm of the total emissions (the sum of Scope 1 and 2 emissions); $scaled\_co2$ is the total emissions scaled by the firm's current total assets (in million dollars). The data provider developed sophisticated carbon data and estimation models to provide total carbon emissions when the firm does not report them.[2] Therefore, we use the estimated total carbon emissions to construct the carbon measures. Moreover, in terms of the credibility of these emissions data, previous studies show an extremely strong correlation (0.99) among the direct CO_2 emissions estimates reported by major data providers (Bolton and Kacperczyk, 2021; Busch *et al.*, 2018).

Following He and Huang (2017), we construct two measures to capture the extent to which industry peers are commonly connected. The first measure, $lNCN$, is the logarithm of the number of same-industry peers that have common institutional ownership with the firm. The second measure, lAN, is the logarithm of the number of same-industry peers cross-owned by the average common blockholder.[3] Thus, for each firm, the first measure reflects the total number of connected peers through

[2]See https://www.refinitiv.com/content/dam/marketing/en_us/documents/fact-sheets/esg-carbon-data-estimate-models-fact-sheet.pdf

[3]We add one to the raw number before obtaining the logarithm. We only consider blockholders that hold at least 5% of the firm's total outstanding shares, because such large institutional investors can sufficiently influence corporate decisions through many mechanisms, such as voice or threat of exit (see e.g. Edmans and Manso, 2011; McCahery et al., 2016).

Table 1. Summary statistics.

Variable	N	Mean	SD	Min	p25	Median	p75	Max
scaled_co2	12,893	3.38	1.72	0	2.14	3.22	4.41	8.86
log_co2	13,041	11.47	2.56	5.69	9.74	11.34	13.13	17.67
lNCN	13,041	3.18	1.58	0	2.14	3.39	4.5	5.38
lAN	13,041	2.73	1.39	0	1.77	2.89	3.9	4.78
size	13,041	8.12	1.58	1.91	7.07	8.11	9.16	11.2
che	13,041	0.22	0.33	0	0.04	0.11	0.25	2.84
lev	13,041	0.21	0.17	0	0.06	0.2	0.32	0.68
roa	13,041	0.11	0.18	−1.21	0.08	0.13	0.19	0.61
xrd	13,041	0.05	0.11	0	0	0	0.04	0.71
capx	13,041	0.05	0.07	0	0.02	0.03	0.06	0.65
aqc	13,041	0.04	0.1	−0.01	0	0	0.02	0.69
dppegt	13,041	0.14	0.37	−0.62	0.02	0.07	0.15	4.12
blkown	13,041	0.24	0.14	0	0.14	0.23	0.33	0.59
insown	13,041	0.77	0.22	0	0.69	0.83	0.92	1
blkdum	13,041	0.94	0.23	0	1	1	1	1

Notes: This table shows the number of observations, mean, standard deviation, minimum value, 25th percentile, median, 75th percentile, and maximum value for each variable used in our research. The variable definitions are shown in Table A.I. The sample period is 2006–2019.

all its common blockholders, whereas the second measure reflects, on average, the number of connected peers through each of its common blockholders. For both measures, we first derive the quarterly measures and then take the average to generate the corresponding annual measures.

Following previous literature (Azar *et al.*, 2021a; He and Huang, 2017), we include a battery of firm characteristics that can influence corporate carbon emissions, such as firm size (*Size*), the amount of acquisition (*aqc*), capital expenditures (*capx*), R&D expenditures (*xrd*), cash and short-term investment (*che*), leverage ratio (*lev*), percentage of change in property, plant, and equipment (*dppegt*), return on assets (*roa*), the total percentage of shares held by blockholders (*blkown*), the total percentage of shares held by institutional investors (*insown*), and an indicator variable that equals one when a firm is held by at least one blockholder in any fiscal quarter of the year and zero otherwise (*blkdum*).[4] We scale all the variables, except firm size, percentage and indicator variables, by the firm's total assets. To mitigate outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

Table 1 presents the summary statistics for the variables used in our main tests. On average, one firm has about 58.61 connected peers within its industry and about 32.5 same-industry peers connected through one institutional investor. There is also a large variation in terms of carbon emissions, as the scaled carbon emissions range from almost 0 to 8.86, and the logarithm of carbon emissions ranges from 5.69 to 17.67. On average, about 77% of a firm's total outstanding shares are controlled by institutional investors, and about 94% of the firms in our sample have at least one blockholder.

Table 2 shows the sample distribution of firms across the two-digit SIC industries. Here, we see that a considerable proportion of our sample comes from industries with higher environmental/pollution concerns, such as the chemical and allied products industry, and traditional power generation and transportation industries such as the electric, gas and sanitary industry. Our sample also includes other types of manufacturing industries, such as industrial machinery and equipment industry. Overall, our sample contains sufficient variation across industries.[5]

Commonly owned peers and carbon emissions

Ordinary least-squares analysis

To assess the extent to which the number of cross-owned peers through common ownership is related to subsequent corporate carbon emissions, we first estimate the following model using the traditional ordinary least squares (OLS) method, with further controls on fixed effects:

$$Y_{i,t+1} = a + \beta_1 * CrossPeers_{it} + \gamma * X_{it} + \delta_i + \theta_t + \varepsilon_{it} \quad (1)$$

where i is a firm and t is the time. The dependent variable $Y_{i,t+1}$ stands for firm i's carbon emissions (raw or

[4]Table A.I provide information on variable definitions in more detail.

[5]We have further discussions on the sample structure and distribution, and the details can be found in the online appendix at: https://1drv.ms/b/c/9cb286b33b3e9528/EU7Kjd-jwotNh9uuCylU4VsBYhudwuL9QdyWXAKo-ru81g?e=0tmVTC.

Table 2. Industry distribution (top 20)

Industry name	SIC 2-digit code	No. of obs	Percent (%)
Business services	73	1,413	10.84
Chemical and allied products	28	1,363	10.45
Electronic and other electric equipment	36	833	6.39
Electric, gas and sanitary services	49	776	5.95
Industrial machinery and equipment	35	764	5.86
Instruments and related products	38	678	5.2
Oil and gas extraction	13	539	4.13
Insurance carriers	63	429	3.29
Transportation equipment	37	399	3.06
Security and commodity brokers	62	376	2.88
Food and kindred products	20	372	2.85
Communications	48	307	2.35
Wholesale trade – Durable goods	50	260	1.99
Health services	80	208	1.59
Fabricated metal products	34	196	1.5
Engineering and management services	87	188	1.44
Apparel and accessory stores	56	181	1.39
Eating and drinking places	58	170	1.3
Paper and allied products	26	166	1.27
Primary metal industries	33	165	1.27

Notes: This table presents the number of observations and the corresponding percentages over the total sample for the top 20 industries based on two-digit SIC codes. The sample period is 2006–2019.

scaled) in year $t + 1$. Variable $CrossPeers_{it}$ is one of the two common ownership proxies for firm i over fiscal year t. We control for a battery of corporate characteristics in X_{it}. Moreover, we include both firm (δ_i) and time (θ_t) fixed effects. and the standard errors are clustered at the firm level.

Table 3 presents the OLS regression results. The coefficient estimates of both cross-owned measures are negative and significant for the carbon emissions measures, suggesting that a larger number of commonly held peers is associated with subsequently lower carbon emissions. Considering the economic significance, column (1) reflects that a one-standard-deviation increase in the total number of commonly connected peers is associated with a 2.37% (= 1.58 × −0.015) change in corporate scaled carbon emissions, which represents 1.38% (= 0.0237/1.72) of its standard deviation. Similarly, column (2) shows that a one-standard-deviation increase in the number of commonly connected peers through an average institutional investor is associated with a 2.5% (= 1.39 × −0.018) change in the scaled emissions, which represents 1.45% (= 0.025/1.72) of its standard deviation. Therefore, our results are both statistically and economically significant and suggest a negative association between the number of commonly owned peers and subsequent corporate carbon emissions. The magnitude of our estimate is also similar to that of earlier research (i.e. when compared with earlier studies, the effect size is of similar magnitude), an example being the study of Azar *et al.* (2021a), which, based on global evidence, concludes that even the largest investors can only have a 1.15% influence on carbon emissions.

As for the control variables, we find that firm size is positively associated with the logarithm of carbon emissions but negatively associated with the scaled carbon emissions. Large firms generally engage in more economic activity and produce more products. Because carbon emissions are generated during production and economic activities, the positive relationship between the logarithm of carbon emissions and firm size is intuitive. However, the negative association between firm size and the scaled carbon emissions implies that larger firms have higher productivity and can use energy more efficiently; therefore, their emissions per unit would be lower. We also find that cash reserves are negatively correlated with carbon emissions, whereas R&D expenditures are positively correlated with emissions. These results can be linked with a firm's growth opportunities.

In addition, it has been argued that emissions may be explained in a linear fashion by sales, owing to the scaling effect and also because sales may impute emissions (Zhang, 2023). Accordingly, as a further robustness check, we considered the impact of sales as a control variable; this confirmed our baseline results. We further explored industry* year fixed effects as a control to take account of changes in specific industry characteristics over time; we found that the significance is similar. Full details on how we construct additional variables and the results can be found in the online appendix; these results confirm the robustness of our main arguments.

Table 3. OLS results

	scaled_co2		log_co2	
	(1)	(2)	(3)	(4)
lNCN (no. of com-owned peers)	−0.015*		−0.019**	
	(0.008)		(0.009)	
lAN (avg no. of com-owned peers per inst.)		−0.018**		−0.026***
		(0.009)		(0.010)
size	−0.157***	−0.157***	0.552***	0.552***
	(0.029)	(0.029)	(0.034)	(0.034)
che	−0.120***	−0.120***	−0.198***	−0.198***
	(0.036)	(0.036)	(0.041)	(0.042)
lev	−0.043	−0.043	−0.120	−0.121
	(0.085)	(0.085)	(0.101)	(0.101)
roa	0.091	0.090	0.259***	0.259***
	(0.062)	(0.062)	(0.072)	(0.072)
xrd	0.372**	0.373**	0.656***	0.657***
	(0.175)	(0.175)	(0.196)	(0.196)
capx	−0.081	−0.078	0.177	0.181
	(0.244)	(0.244)	(0.246)	(0.246)
aqc	−0.052	−0.051	−0.158***	−0.158***
	(0.046)	(0.046)	(0.048)	(0.048)
dppegt	−0.021	−0.021	−0.025	−0.026
	(0.014)	(0.014)	(0.016)	(0.016)
blkown	0.071	0.045	−0.121	−0.157
	(0.097)	(0.099)	(0.104)	(0.104)
insown	0.080	0.081	0.162**	0.166**
	(0.062)	(0.062)	(0.070)	(0.070)
blkdum	−0.001	0.006	0.045	0.059
	(0.036)	(0.038)	(0.039)	(0.041)
_cons	4.649***	4.649***	6.927***	6.925***
	(0.223)	(0.223)	(0.259)	(0.259)
Firm fixed effect	Y	Y	Y	Y
Year fixed effect	Y	Y	Y	Y
R^2	0.956	0.956	0.975	0.975
Observations	12893	12893	13041	13041

Notes: This table shows the results of regressing the measures of connected peers over corporate carbon emissions. lNCN is the logarithm of the number of same-industry peers that have common blockholders with the firm; lAN is the logarithm of the number of same-industry peers block-held by the average common blockholder. log_co2 is the logarithm of corporate annual total carbon emissions (Scope 1 and Scope 2); scaled_co2 is the corporate annual total carbon emissions (Scope 1 and Scope 2) scaled by current total assets. Columns (1) and (2) report the results for the scaled carbon emissions; columns (3) and (4) report the results for the logarithm of total carbon emissions. Both firm and year fixed effects are included for regressions with control variables. The firm-level clustered robust standard errors are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Other variable definitions are shown in Table A.I. The sample period is 2006–2019.

Overall, our baseline results suggest that common ownership could help firms reduce carbon emissions and that the magnitude of the effect is substantial and cannot be ignored.[6]

[6]We also conduct several other robustness checks, including changing the industry classification method, removing data before 2008, excluding the brown industry sample, and considering both the regulatory environment and financial crisis period. The main results remain the same. Please see the online appendix for more details.

Identification: Financial institution mergers

However, our OLS estimates could be biased owing to endogeneity. More specifically, it is possible that institutional investors do not randomly choose firms, and thus cross-ownership might endogenously emerge when many firms within an industry adopt similar emissions policies. For example, institutional investors may have environmental concerns and tend to hold firms with lower carbon risk, especially regulatory risk. Thus, if the carbon emissions of firms within an industry are correlated, we identify higher cross-ownership in that industry. Similarly, institutional investors may have better skills at picking stocks with more promising long-term performance. These stocks are likely to have lower carbon emissions and, thus, fewer associated risks.

To address such endogeneity concerns, we follow He and Huang (2017) and obtain the exogenous variation in a firm's commonly owned peers using financial institution mergers as a quasi-natural experiment. This experiment is built on the fact that financial institutions, such as securities brokers, asset management firms and bank-holding companies, often merge for reasons unrelated to the fundamentals of their portfolio holdings. Normally, in such a merger, the target's existing portfolios are taken over and held by the acquirer for a certain period because of concerns about transaction costs and liquidity issues (He and Huang, 2017; Park *et al.*, 2019). Therefore, if one firm is block-held by the acquirer, and the other firm is block-held by the target, then these two firms become commonly owned peers after the merger is finalized. This experiment is considered valid because financial institution mergers are unlikely to result from concerns regarding individual firms' carbon emissions. Such mergers are often driven by financial sector deregulation (He and Huang, 2017; Houston, James and Ryngaert, 2001).

Following He and Huang (2017), we build a list of the financial institution mergers that were completed during our sample period.[7] Then we identify treatment firms following two criteria in the preceding quarter of each merger announcement: (1) the firm is block-held by one of the merging financial institutions in the quarter immediately before the merger announcement date; (2) the other merging institution is not a blockholder of the same firm but is a blockholder of at least one of its same-industry peers. An advantage of this procedure is that we do not use ex-post information to form our treatment group. Therefore, we have less concern that the selection of the treatment firms will be influenced by the acquirer's trading decisions after the merger.

[7]We thank Lewellen and Lowry (2021) for creating this list and making it publicly available.

Table 4. Quasi-natural experiment results

	scaled_co2		log_co2	
	(−1,1)	(−3,3)	(−1,1)	(−3,3)
	(1)	(2)	(3)	(4)
Treat*Post	−0.170*	−0.237***	−0.253***	−0.240***
	(0.093)	(0.088)	(0.097)	(0.091)
Post	−0.020	−0.003	0.049	0.087
	(0.044)	(0.068)	(0.047)	(0.076)
size	−0.166	−0.300**	0.506***	0.374***
	(0.160)	(0.121)	(0.158)	(0.126)
che	−0.793**	−0.603***	−0.977**	−0.611**
	(0.361)	(0.210)	(0.403)	(0.241)
lev	0.089	0.624*	0.120	0.508*
	(0.354)	(0.318)	(0.366)	(0.290)
roa	1.256***	0.621**	1.243***	0.820***
	(0.413)	(0.308)	(0.457)	(0.314)
xrd	1.027	2.849*	3.768*	2.760
	(1.927)	(1.574)	(1.979)	(1.832)
capx	−0.942	−1.261	−1.052	−1.249
	(0.985)	(1.064)	(1.069)	(0.979)
aqc	−0.370	−0.260	−0.441	−0.295
	(0.400)	(0.217)	(0.452)	(0.239)
dppegt	0.021	0.140	0.016	0.033
	(0.142)	(0.103)	(0.155)	(0.106)
blkown	0.248	−0.147	0.003	−0.260
	(0.295)	(0.239)	(0.307)	(0.249)
insown	0.103	−0.119	0.310	−0.079
	(0.367)	(0.153)	(0.399)	(0.147)
blkdum	0.243	0.092	0.118	0.141
	(0.226)	(0.111)	(0.251)	(0.095)
_cons	5.103***	6.512***	7.795***	9.154***
	(1.377)	(1.066)	(1.371)	(1.102)
Firm*Merger fixed effect	Y	Y	Y	Y
Year fixed effect	N	Y	N	Y
R^2	0.981	0.965	0.987	0.978
Observations	653	1511	654	1517

Notes: This table shows the difference-in-differences results of the effects of common cross-owned peers on corporate carbon emissions. log_co2 is the logarithm of corporate annual total carbon emissions (Scope 1 and Scope 2); scaled_co2 is the corporate annual total carbon emissions (Scope 1 and Scope 2) scaled by current total assets. We choose two event windows: (−1, 1) and (−3, 3); for instance, (−1, 1) means that the sample includes firm-year observations from year $t-1$ to year $t+1$. Columns (1) to (2) report the results for the scaled carbon emissions; columns (3) to (4) report the results for the logarithm of total carbon emissions. Both firm*merger and year fixed effects are included. The firm-level clustered robust standard errors are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Other variable definitions are shown in Table A.I.

To address the concern that differences in managerial skills, selection styles and investment strategies between the target and acquirer might be related to corporate performance, a control firm must meet the following two criteria in the quarter before the merger announcement: (1) the firm must be block-held by the same financial institution that block-holds a treatment firm; (2) the other merging financial institution is not a blockholder of any peer firms within the industry. Therefore, financial institution mergers do not change the cross-ownership of the control firms but do increase the cross-ownership of the treatment firms. An important advantage of this approach is that it covers multiple mergers during our sample period.

Table 4 reports the difference-in-differences (DiD) results. *Treat* is an indicator variable that equals one for firms in the treatment group and zero for control firms; *Post* is an indicator variable that equals one for post-merger years and zero for pre-merger years. The merger year for each event is excluded, and we choose two event windows, (−1, 1) and (−3, 3), to discuss both the short- and long-run effects. Columns (1) and (2) report the results for the scaled carbon emissions; and columns (3) and (4), those for the carbon emissions logarithm. The focal coefficient estimate for our analysis, β_1, is negative and significant in all regressions, suggesting that an exogenous increase in the number of commonly connected peers leads the treatment firms to reduce carbon emissions more than the control firms do. In terms of the economic significance, we find that, on average, the treatment firms reduce more carbon emissions (by 17% to 23.7% in the scaled term, or by 24%–25.9% in the

Table 5. Path analysis

	scaled_co2		log_co2	
	lNCN (1)	lAN (2)	lNCN (3)	lAN (4)
Direct path				
p(IND, DEP)	−0.059***	−0.058***	−0.059***	−0.058***
	(0.011)	(0.005)	(0.012)	(0.014)
Indirect path for cooperation				
p(IND, coop)	0.051***	0.060***	0.051***	0.060***
	(0.004)	(0.005)	(0.004)	(0.005)
p(coop, DEP)	−0.465***	−0.466***	−0.465***	−0.466***
	(0.025)	(0.025)	(0.027)	(0.027)
p(IND, coop)*p(coop, DEP)	−0.024***	−0.028***	−0.024***	−0.028***
	(0.002)	(0.003)	(0.002)	(0.003)
Total effect				
p(IND, co2)+p(IND, coop)*p(coop, DEP)	−0.082***	−0.086***	−0.083***	−0.086***
	(0.011)	(0.012)	(0.012)	(0.014)
Control variables	Y	Y	Y	Y
Observations	11533	11533	11665	11665

Notes: This table shows the results of the path analysis examining the effect of common ownership on carbon emissions through cooperation channels. IND stands for one of the two common ownership measures (lNCN or lAN); and DEP stands for one of the two carbon emissions measures (log_co2 or scaled_co2). The variable coop represents our measure of the cooperation. Each p(X1,X2) means the path coefficient from path X1 to X2. Control variables are the same as those used in our main tests. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Other variable definitions are shown in Table A.I. The sample period is 2006–2019.

logarithm) than the control firms when they have more peers connected through common ownership. Overall, the results support the view that common ownership has a negative causal effect on corporate carbon emissions.[8]

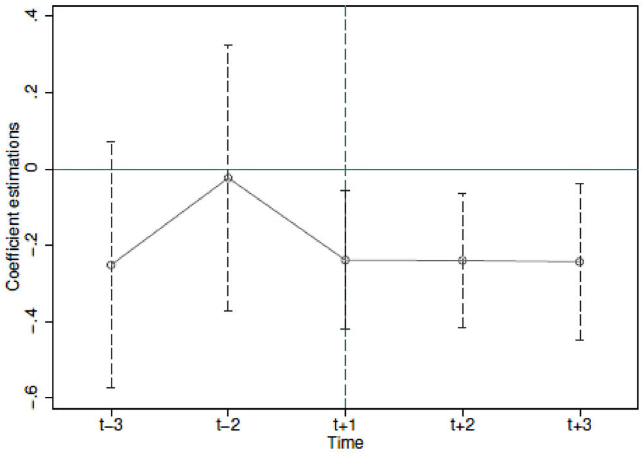
Moreover, the validity of our DiD approach relies on an important assumption, namely the parallel-trends assumption, which states that the DiD estimate should be zero in the absence of treatment. Figure 2 presents the parallel-trends results for the window (−3, 3). More specifically, we find no significant differences between the treatment and control groups before the event year but significant and persistent differences after the event year, suggesting that the parallel-trends assumption in our setting is satisfied.

Channel discussion

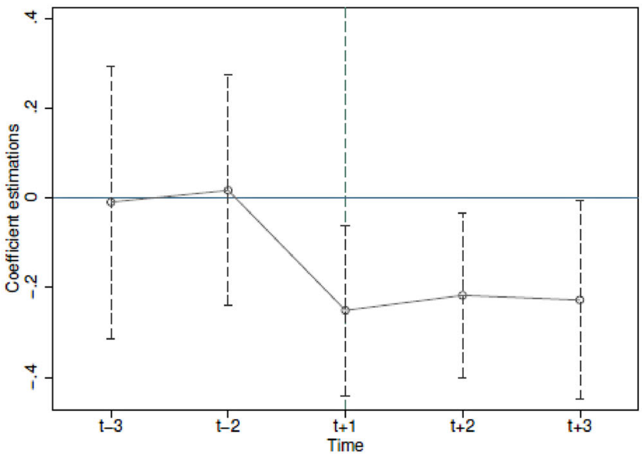
Common ownership promotes corporate cooperation through reducing the proprietary cost concerns related to disclosure and it incentivizes firms to internalize the external benefits of their disclosure for commonly owned peers (Jung, 2013; Park *et al.*, 2019). This could reduce information asymmetry, facilitate industry-wide cooperation, and thus reduce the comparative cost for individual firms of adopting low-carbon strategies. To confirm our hypothesis, we employ path analysis and a structural equation model (SEM) to identify and better perceive the channel through which common ownership plays a role in affecting carbon emissions (Baron and Kenny, 1986; DeFond, Lim and Zang, 2016). We employ the corporate teamwork score proposed by Li *et al.* (2021) to measure the level of cooperation. Figure 3 shows the SEM and the corresponding paths.

Table 5 reports the results of the path analysis. For illustrative purposes, we concentrate on column (1) and interpret the results in greater detail. The results for the other columns are very similar. More specifically, the indirect path coefficient between the number of total cross-owned peers and the level of cooperation [$p(lNCN, coop)$] is positive and significant at the 1% level, which is consistent with our argument that common ownership promotes corporate cooperation. The path coefficient between the level of cooperation and the scaled carbon emissions [$p(coop, scaled\_co2)$] is negative and significant at the 1% level, which is consistent with our view that firms are more likely to reduce carbon emissions if more industry peers are collaborating. Consistent with our hypothesis H2, the total indirect path for cooperation [$p(lNCN, coop) * p(coop, scaled\_co2)$] is negative and significant at the 1% level, suggesting that common ownership results in a reduction in corporate carbon emissions through promoting corporate cooperation.

[8]We also conduct additional robustness tests to ensure the reliability of our identification strategy, including considering industry differences, proving the increase in connected peers, and testing the parallel-trends assumption. The results are similar. However, we do acknowledge that our approach has several caveats. Please see the online appendix for more details.



(a) Parallel trend for scaled_co2



(b) Parallel trend for log_co2

Figure 2. Parallel-trends tests. These graphs present the results of the parallel-trends test. The vertical axes represent the coefficient estimations from the parallel-trends test; the horizontal axes represent the time relative to the event that happened in year t*. We exclude event year* t *from the regressions, and set year* t − *1 as the base year for our analysis. Panel (a) shows the results for scaled carbon emissions, and (b) shows the results for the logarithm of carbon emissions. The dashed line represents the 95% confidence interval for each coefficient estimation*

Synergy effect on other corporate ESG performance

One of the most straightforward factors in corporate efforts at combating climate change is the public view of the corporate environmental image. The general public cares about corporate environmental performance and makes its voice heard through many channels, especially social media (Buntaine *et al.*, 2024). Therefore, we conjecture that common ownership could help a firm build a better public image as it becomes active in reducing emissions and improving its environmental performance. Next, a push from institutional investors and collaboration among connected peers can also raise a firm's climate change awareness. And thus, we conjecture that common ownership enhances managers' awareness of climate change. Finally, as firms might adopt greener and newer technologies, we are also curious about whether the corporate transition to a low-carbon strategy would make the firm pay more attention to innovation and products. Therefore, it could be argued that through the promotion of decarbonization, common ownership may help engender a culture that encourages firms to show more concern for innovation and the products that ensue from it.

More specifically, we use the ESG controversies score (esg_con) as a proxy for public views on corporate environmental reputation; the climate change exposure score to measure managers' awareness of climate change at the firm level; and the corporate innovation culture (inn_cul) and quality culture (qua_cul) scores as proxies for corporate attention to innovation and products, respectively (Li *et al.*, 2021; Sautner *et al.*, 2023).

Table 6 presents the results. Columns (1) and (2) report the results of the public views on the corporate environmental statute. Consistent with our conjecture, we find that common ownership improves subsequent public views on corporate ESG reputations. Columns (3) and (4) report the results for managerial awareness of climate change. The results show that, as more peers are connected, managers' climate change awareness increases significantly. Columns (5) and (6) report the results of the corporate innovation culture scores, and columns (7) and (8) report the results of the corporate product quality culture scores. The effects of common ownership on these two culture scores are all positive and significant, suggesting that, with the adaptation to low-carbon business, the firm also cares more about its innovation and product quality. Overall, we find that other ESG metrics also improve following an increase in the number of peers that are cross-owned by institutional investors.

Additional analyses

So far, our results are consistent with the hypothesis that common ownership fosters industry-wide collaboration to combat climate change due to carbon emissions. To further understand this effect, we carry out an extensive array of additional tests to look at the channel and the driving factors of such an effect. Table 7 provides a summary of the tests and results we obtain. We have a comprehensive illustration for these tests in the online appendix.

Variation in the industry and geographic climate risks

We further investigate whether common institutions are more likely to exert their influence if they hold more firms in an industry or are located in a position with high

Table 6. OLS tests for other ESG-related performance

	esg_con		Cexp		inn_cul		qua_cul	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lNCN	0.763**		0.017*		0.016**		0.009*	
	(0.327)		(0.009)		(0.007)		(0.005)	
lAN		0.799**		0.028***		0.018**		0.011*
		(0.353)		(0.011)		(0.008)		(0.005)
size	−1.898**	−1.890**	−0.033*	−0.034*	−0.001	−0.001	−0.039***	−0.039***
	(0.824)	(0.824)	(0.020)	(0.020)	(0.019)	(0.019)	(0.013)	(0.013)
che	2.263*	2.268*	0.031	0.031	0.000	0.000	0.035*	0.035*
	(1.265)	(1.265)	(0.025)	(0.025)	(0.025)	(0.025)	(0.018)	(0.018)
lev	−1.943	−1.935	−0.160**	−0.16**	0.043	0.042	−0.065	−0.065
	(2.650)	(2.649)	(0.077)	(0.077)	(0.064)	(0.064)	(0.044)	(0.044)
roa	9.021***	9.068***	0.052	0.050	−0.086*	−0.087*	−0.021	−0.021
	(2.933)	(2.932)	(0.055)	(0.055)	(0.052)	(0.052)	(0.038)	(0.038)
xrd	13.132*	13.112*	0.025	0.025	0.071	0.070	0.023	0.023
	(6.775)	(6.765)	(0.119)	(0.119)	(0.135)	(0.135)	(0.091)	(0.091)
capx	5.222	5.115	0.234	0.232	−0.241*	−0.242**	−0.011	−0.012
	(6.388)	(6.387)	(0.161)	(0.161)	(0.123)	(0.123)	(0.077)	(0.077)
aqc	1.080	1.064	0.049	0.048	−0.069	−0.069	−0.042	−0.043
	(1.934)	(1.933)	(0.044)	(0.044)	(0.046)	(0.046)	(0.034)	(0.034)
dppegt	0.419	0.421	0.015	0.015	−0.008	−0.008	0.013	0.013
	(0.681)	(0.682)	(0.019)	(0.019)	(0.017)	(0.017)	(0.012)	(0.012)
blkown	4.131	5.421*	0.010	0.040	−0.115	−0.088	−0.053	−0.038
	(2.974)	(2.996)	(0.101)	(0.100)	(0.076)	(0.075)	(0.055)	(0.054)
insown	3.242	3.353	−0.045	−0.052	−0.077	−0.075	−0.021	−0.021
	(2.466)	(2.461)	(0.063)	(0.062)	(0.052)	(0.052)	(0.036)	(0.036)
blkdum	−3.485**	−3.585**	0.021	0.001	−0.037	−0.042	−0.006	−0.010
	(1.521)	(1.551)	(0.039)	(0.040)	(0.028)	(0.029)	(0.021)	(0.021)
_cons	99.236***	99.115***	1.044***	1.051***	2.020***	2.020***	1.713***	1.714***
	(6.695)	(6.701)	(0.127)	(0.127)	(0.119)	(0.119)	(0.087)	(0.087)
Firm fixed effect	Y	Y	Y	Y	Y	Y	Y	Y
Year fixed effect	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.437	0.437	0.8186	0.8186	0.672	0.672	0.666	0.666
Observations	15150	15150	37926	37926	34634	34634	34634	34634

Notes: This table shows the results of regressing the measures of connected peers over the corporate ESG performance measures. The variable esg_con is the ESG controversies score; Cexp is the climate change exposure score; inn_cul is the corporate innovation culture score; and qua_cul is the corporate quality culture score. Columns (1) and (2) report the results for the ESG controversies score; columns (3) and (4) report the results for climate change exposure; columns (5) to (8) report the results for the corporate culture scores. Both firm and year fixed effects are included for all regressions. The firm-level clustered robust standard errors are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. Other variable definitions are shown in Table A.I.

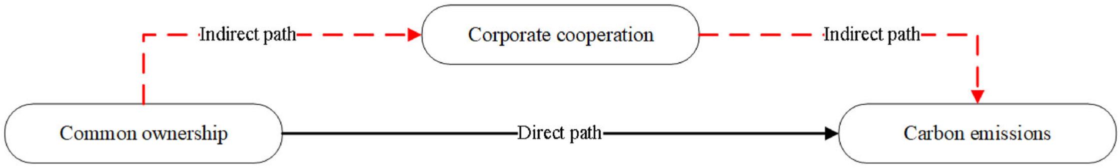


Figure 3. Path analysis between common ownership and carbon emissions. This graph presents a detailed path for the path analysis. The variable coop represents the level of corporate cooperation. The path analysis is based on the following system of equations: $coop = \gamma_0 + \gamma_1 CrossPeers + \gamma_2 Controls + \varepsilon$; $Carbon\ emissions = \delta_0 + \delta_1 CrossPeers + \delta_2 coop + \delta_3 Controls + \varepsilon$

Table 7. Summary of additional tests

	Test	Methods	Findings
(1)	Variations in the industry and geographic climate risks	OLS	The effect of common ownership on carbon emissions is stronger when the institutions hold more firms from industries or locations with high climate risk.
(2)	How many connected peers are required to generate the collaborating effect?	Threshold test and semiparametric analysis	A substantial number of cross-owned peers is required for the collaborating effect to be effective.
(3)	Source of carbon reduction: Scope 1 versus Scope 2	OLS	The decrease in corporate carbon emissions comes mainly from the reduction in Scope 2 emissions.
(4)	Investors' ESG preference and how investors affect corporate behaviour	OLS	The effect will be stronger for those institutions that are more ESG- and long-term-focused; the common institutions exert influence on portfolio firms through voting behaviour.
(5)	Do firms sacrifice market share?	OLS	Firms with carbon emissions information and included in our sample tend to sacrifice market share under common ownership, whereas other firms do not.

Notes: This table briefly summarizes the additional tests we conducted, the corresponding methods used, and the findings we obtained. Comprehensive information about each test is reported in the online appendix.

climate risks. We find significant results that the effect of common ownership on carbon emissions is stronger when the institutions hold more firms from industries or locations with high climate risk. Overall, the results suggest that institutional investors consider climate risk as a threat to their portfolio firms and exert their influence to reduce carbon emissions. In addition, we also conduct tests to investigate the effect of common ownership across different industry concentrations. Consistent with the anticompetitive effect identified in previous studies (see e.g. He and Huang, 2017), we find some evidence to show that the effect is likely to be stronger in industries with higher levels of competition.

How many connected peers are required?

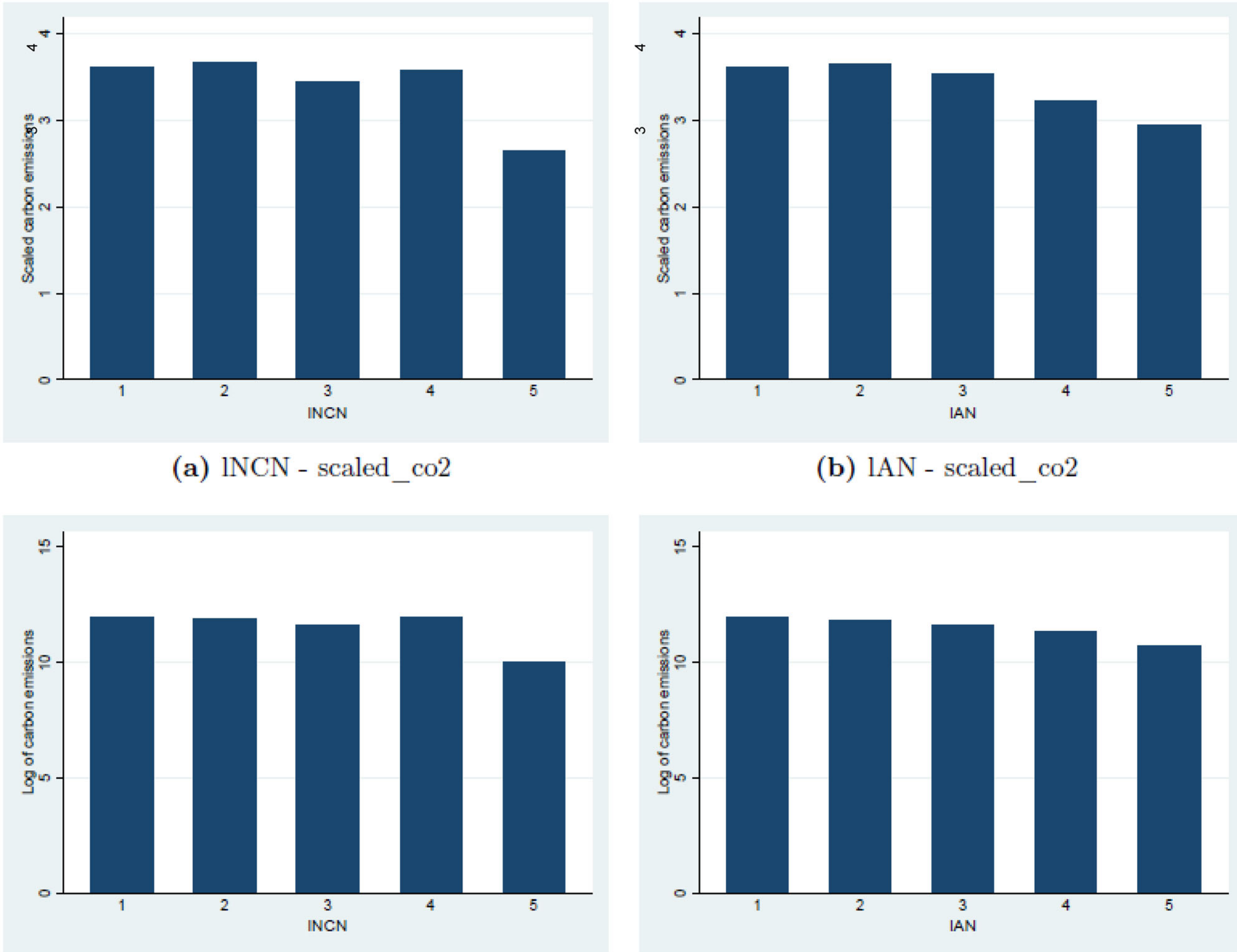
Decarbonization induces significant and immediate increases in cost for companies that adopt it and ultimately places companies at an economic disadvantage in the industry. Concerning the free-rider issue, such as that just mentioned, collaboration is an efficient way to mitigate it (Serafeim, 2018). Thus, we conjecture that a substantial number of cross-owned peers is the foundation of the observed effect, implying a nonlinear relationship between common ownership and emissions. Figure 4 presents a histogram of emissions against firms with the lowest to highest number of cross-owned peers and suggests that the main effect is indeed driven by the firms with a substantial number of cross-owned peers. We also confirm the nonlinear results by using both a threshold test and a semiparametric analysis.

Source of carbon reduction: Scope 1 versus Scope 2

To understand how firms achieve carbon reduction, we investigate the changes in the components of total emissions, namely Scope 1 and Scope 2 emissions. We find that the decrease in carbon emissions comes mainly from the reduction in Scope 2 emissions, that is, energy purchased by the firm. Moreover, we do not find significant evidence that firms alter their emissions structure (i.e. the relative ratio of Scope 1 to Scope 2). Overall, the results suggest that firms might improve their energy efficiency and adopt greener kinds of energy to power its operations.

Investors' ESG preference and how investors affect corporate behaviour

Institutions that are more ESG-focused are more willing to forgo financial performance to improve environmental performance; therefore, we conjecture that the common ownership effect on carbon emissions will be stronger for these types of investors. Consistent with our conjecture, we find that the effect will be stronger for those institutions that sign the PRI, and are thus



(a) lNCN - scaled_co2 **(b)** lAN - scaled_co2

(c) lNCN - log_co2 **(d)** lAN - log_co2

Figure 4. Histogram results. There graphs present the histogram between carbon emissions and common ownership. The sample is divided into quintile groups based on the number of commonly owned peers. The horizontal axes represent the quintile groups, whereas group 1 represents the bottom 20% of the sample, and group 5 represents the top 20%. The vertical axes represent carbon emissions. Panels (a) and (b) show the relationship between scaled carbon emissions and lNCN and lAN quintile groups, respectively; panels (c) and (d) show the relationship between the logarithm of carbon emissions and lNCN and lAN quintile groups, respectively

more ESG- and long-term-focused. Furthermore, we provide evidence that the common institutions exert influence on portfolio firms through voting behaviour, and the higher level of the common ownership measures is associated with a higher number of total institutional proposals and socially responsible investment (SRI) proposals submitted. We also find that the effect on emissions reduction is more significant after the achievement of the Paris Agreement, which elevated investors' awareness of climate change.

Do firms sacrifice market share?

He and Huang (2017) document that common ownership predicts market growth. We provide evidence consistent with our baseline argument that when firms cooperate on reducing carbon emissions through common ownership, they are willing to sacrifice their market shares, whereas other firms gain additional shares, consistent with He and Huang's (2017) argument. This result is also consistent with the rather small economic magnitudes they encountered (He and Huang 2017).

Conclusion

This paper examines whether common ownership could foster collaboration among firms within an industry in terms of tackling climate change by reducing carbon emissions. We find that firms with more commonly held peers reduce carbon emissions more. By exploring exogenous variation in common ownership, we show that this relation is likely to be causal. Moreover, consistent with industry experts' call for cooperation, we show that this effect exists only when many firms are connected, suggesting that common ownership plays an important role in forming collective efforts to combat climate change.

Our findings have several implications for policy. This paper suggests that beyond regulatory and fiscal policies, common ownership arrangements can serve as a lever for collective environmental action. While government initiatives are crucial in guiding investor and corporate behaviour towards sustainability, our findings reveal the potential of market-based mechanisms to support these objectives, especially in the face of policy uncertainty and potential regulatory reversals. This underscores the importance of institutional investors in fostering a proactive approach to climate change that can persist across varying political landscapes.

In contributing to the debate on common ownership and competition, this paper provides evidence of a positive externality generated from common ownership: the promotion of collaborative efforts in carbon emission reduction. Therefore, our study calls for a more sophisticated consideration of any regulatory actions on common ownership, recognizing the need to reconcile the protection of competitive markets with the facilitation of collective environmental actions enabled by such ownership structures.

At a theoretical level, this study explores the circumstances under which firms adopt a path that differs from prevailing dominant modes of practice. Earlier work highlights inter-organizational factors (Mamoudian et al., 2021; Crace and Gehman, 2023) or (extra-organizational) regional or sectoral institutional dynamics (Kellard *et al.*, 2023); this study complements this by highlighting the potentially beneficial effects of ownership concentration. As with societal-level institutions, ownership concentration may facilitate the building of ties and information exchange between organizations (Jackson and Deeg, 2019), rather than simply serving as a device for exercising oligopolistic market power. Although ownership concentration may indeed also contribute to market dominance, this study reveals that collaboration at the operational level may have separate and quite distinct effects in facilitating incremental progress towards greener forms of production.

Overall, this paper highlights the role played by institutional investors in tackling climate issues, with important implications for climate- and antitrust-related regulations. The latter has a vital role to play in protecting customers, especially when barriers faced by potential competitors to entry are high. However, ownership concentration seems to have more positive effects in advancing the move towards renewables. Following on from our study, two prospective extensions have emerged for future research: first, to examine the effects of common ownership across different industries or countries on corporate carbon emissions; and, second, to understand whether other shareholders, such as minority or individual investors, within a firm would benefit or lose from a common blockholder push to reduce corporate carbon emissions. A limitation of our research is that the emission data are reported voluntarily over our sample period. Future research could consider the deployment of machine-learning prediction techniques to address the potential self-selection bias.

References

Addoum, J. M., D. T. Ng and A. Ortiz-Bobea (2020). 'Temperature shocks and establishment sales', *Review of Financial Studies*, **33**, pp. 1331–1366.

Aggarwal, R., I. Erel, M. Ferreira and P. Matos (2011). 'Does governance travel around the world? Evidence from institutional investors', *Journal of Financial Economics*, **100**, pp. 154–181.

Alda, M. (2019). 'Corporate sustainability and institutional shareholders: the pressure of social responsible pension funds on environmental firm practices', *Business Strategy and the Environment*, **28**, pp. 1060–1071.

Allen, M. L., M. M. Allen, D. Cumming and S. Johan (2021). 'Comparative capitalisms and energy transitions: renewable energy in the European Union', *British Journal of Management*, **32**, pp. 611–629.

Antón, M., F. Ederer, M. Giné and M. Schmalz (2023). 'Common ownership, competition, and top management incentives', *Journal of Political Economy*, **131**, pp. 1294–1355.

Appel, I. R., T. A. Gormley and D. B. Keim (2016). 'Passive investors, not passive owners', *Journal of Financial Economics*, **121**, pp. 111–141.

Aretz, K., S. Banerjee and O. Pryshchepa (2019). 'In the path of the storm: Does distress risk cause industrial firms to risk-shift?', *Review of Finance*, **23**, pp. 1115–1154.

Ariely, D., A. Bracha and S. Meier (2009). 'Doing good or doing well? Image motivation and monetary incentives in behaving prosocially', *American Economic Review*, **99**, pp. 544–555.

Azar, J. (2017). 'Portfolio diversification, market power, and the theory of the firm', *SSRN*, p. 2811221.

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

Azar, J., Y. Qiu and A. J. Sojourner (2021b). 'Common ownership reduces wages and employment', *SSRN*, p. 3954399.

Azar, J., M. C. Schmalz and I. Tecu (2018). 'Anticompetitive effects of common ownership', *Journal of Finance*, **73**, pp. 1513–1565.

Azar, J. and X. Vives (2021). 'General equilibrium oligopoly and ownership structure', *Econometrica*, **89**, pp. 999–1048.

Baldauf, M., L. Garlappi and C. Yannelis (2020). 'Does climate change affect real estate prices? Only if you believe in it', *Review of Financial Studies*, **33**, pp. 1256–1295.

Baron, R. M. and D. A. Kenny (1986). 'The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations', *Journal of Personality and Social Psychology*, **51**, pp. 1173–1182.

Baumol, W. J. (2001). 'When is inter-firm coordination beneficial? The case of innovation', *International Journal of Industrial Organization*, **19**, pp. 727–737.

Benlemlih, M., M. Arif and M. Nadeem (2023). 'Institutional ownership and greenhouse gas emissions: a comparative study of the UK and the USA', *British Journal of Management*, **34**, pp. 623–647.

Bennett, P. (2019). 'Must an occupational pension scheme take into account ESG factors even if there is a risk of financial detriment to the pension fund?', *Trust Law International*, **32**, p. 239.

Benton, R. A. and J. A. Cobb (2019). 'Eyes on the horizon? Fragmented elites and the short-term focus of the American corporation', *American Journal of Sociology*, **124**, pp. 1631–1684.

Bernstein, A., M. T. Gustafson and R. Lewis (2019). 'Disaster on the horizon: the price effect of sea level rise', *Journal of Financial Economics*, **134**, pp. 253–272.

Bhojraj, S., P. Hribar, M. Picconi and J. McInnis (2009). 'Making sense of cents: an examination of firms that marginally miss or beat analyst forecasts', *Journal of Finance*, **64**, pp. 2361–2388.

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

Brooks, C., Z. Chen and Y. Zeng (2018). 'Institutional cross-ownership and corporate strategy: the case of mergers and acquisitions', *Journal of Corporate Finance*, **48**, pp. 187–216.

Buntaine, M. T., M. Greenstone, G. He, M. Liu, S. Wang and B. Zhang (2024). 'Does the squeaky wheel get more grease? The direct and indirect effects of citizen participation on environmental governance in China', *American Economic Review*, **114**, pp. 815–850.

Busch, T., M. Johnson, T. Pioch and M. Kopp (2018). '*Consistency of Corporate Carbon Emission Data*', Hamburg: University of Hamburg /WWF Deutschland.

Buvik, A. and K. Grønhaug (2000). 'Inter-firm dependence, environmental uncertainty and vertical co-ordination in industrial buyer–seller relationships', *Omega*, **28**, pp. 445–454.

Cao, J., Y. Li, X. Zhan, W. E. Zhang and L. Zhou (2021). 'Carbon emissions, institutional trading, and the liquidity of corporate bonds', *SSRN*, p. 3881497.

Carleton, W. T., J. M. Nelson and M. S. Weisbach (1998). 'The influence of institutions on corporate governance through private negotiations: evidence from TIAA-CREF', *Journal of Finance*, **53**, pp. 1335–1362.

Caskey, J. and N. B. Ozel (2017). 'Earnings expectations and employee safety', *Journal of Accounting and Economics*, **63**, pp. 121–141.

Ceccarelli, M., S. Ramelli and A. F. Wagner (2024). 'Low carbon mutual funds', *Review of Finance*, **28**, pp. 45–74.

Condon, M. (2020). 'Externalities and the common owner', *Washington Law Review*, **95**, pp. 1–81.

Crace, L. and J. Gehman (2023). 'What really explains ESG performance? Disentangling the asymmetrical drivers of the triple bottom line', *Organization and Environment*, **36**, pp. 150–178.

Das Gupta, R. (2022). 'Financial performance shortfall, ESG controversies, and ESG performance: evidence from firms around the world', *Finance Research Letters*, **46**, p. 102487.

DeFond, M. L., C. Y. Lim and Y. Zang (2016). 'Client conservatism and auditor–client contracting', *The Accounting Review*, **91**, pp. 69–98.

Dellavigna, S., J. A. List and U. Malmendier (2012). 'Testing for altruism and social pressure in charitable giving', *Quarterly Journal of Economics*, **127**, pp. 1–56.

Deng, Y. and J. Li (2022). 'Common institutional ownership, hold-up problems, and supply chain innovation'. *SSRN*, p. 4063896.

Deschênes, O. and M. Greenstone (2007). 'The economic impacts of climate change: evidence from agricultural output and random fluctuations in weather', *American Economic Review*, **97**, pp. 354–385.

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

Ederer, F. and B. Pellegrino (2024). 'A tale of two networks: Common ownership and product market rivalry', SSRN, p. 3964304.

Edmans, A., D. Levit and D. Reilly (2019). 'Governance under common ownership', *The Review of Financial Studies*, **32**, pp. 2673–2719.

Edmans, A. and G. Manso (2011). 'Governance through trading and intervention: a theory of multiple blockholders', *The Review of Financial Studies*, **24**, pp. 2395–2428.

Eldar, O. and J. Grennan (2021). 'Common ownership and entrepreneurship', *AEA Papers and Proceedings*, p. 3762218.

Farrell, H. (2009). *The Political Economy of Trust: Institutions, Interests, and Inter-Firm Cooperation in Italy and Germany*. Cambridge: Cambridge University Press.

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

Gao, L., J. Han, J.-B. Kim and Z. Pan (2022). 'Common ownership along the supply chain and corporate earnings management', *SSRN*, p. 4051286.

Gilo, D., Y. Moshe and Y. Spiegel (2006). 'Partial cross ownership and tacit collusion', *RAND Journal of Economics*, **37**, pp. 81–99.

Graham, J. R., C. R. Harvey and S. Rajgopal (2005). 'The economic implications of corporate financial reporting', *Journal of Accounting and Economics*, **40**, pp. 3–73.

Greenstone, M., J. A. List and C. Syverson (2012). 'The effects of environmental regulation on the competitiveness of U.S. manufacturing', *SSRN*, p. 1759405.

Hall, P. A. and D. Soskice (2001). *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford University Press.

Hansen, R. G. and J. R. Lott (1996). 'Externalities and corporate objectives in a world with diversified shareholder/consumers', *Journal of Financial and Quantitative Analysis*, **31**, pp. 43–68.

Hansen, T. A. (2022). 'Stranded assets and reduced profits: analyzing the economic underpinnings of the fossil fuel industry's resistance to climate stabilization', *Renewable and Sustainable Energy Reviews*, **158**, p. 112144.

Hartzmark, S. M. and A. B. Sussman (2019). 'Do investors value sustainability? A natural experiment examining ranking and fund flows', *Journal of Finance*, **74**, pp. 2789–2837.

Hawn, O. and I. Ioannou (2016). 'Mind the gap: the interplay between external and internal actions in the case of corporate social responsibility', *Strategic Management Journal*, **37**, pp. 2569–2588.

He, J. and J. Huang (2017). 'Product market competition in a world of cross-ownership: evidence from institutional blockholdings', *Review of Financial Studies*, **30**, pp. 2674–2718.

Hiatt, S., J. Grandy and B. H. Lee (2015). 'Organizational responses to public and private politics: an analysis of climate change activists and U.S. oil and gas firms', *Organization Science*, **26**, pp. 1769–1786.

Houston, J. F., C. M. James and M. D. Ryngaert (2001). 'Where do merger gains come from? Bank mergers from the perspective of insiders and outsiders', *Journal of Financial Economics*, **60**, pp. 285–331.

Jackson, G. and R. Deeg (2019). 'Comparing capitalisms and taking institutional context seriously', *Journal of International Business Studies*, **50**, pp. 4–19.

Jahnke, P. (2019). 'Ownership concentration and institutional investors' governance through voice and exit', *Business and Politics*, **21**, pp. 327–350.

Jambou, M., A. Torre, S. Dermine-Brullot and S. Bourdin (2022). 'Inter-firm cooperation and local industrial ecology processes: evidence from three French case studies', *The Annals of Regional Science*, **68**, pp. 331–358.

Jang, I. J., N. Kang and A. Yezegel (2022). 'Common ownership, price informativeness, and corporate investment', *Journal of Banking and Finance*, **135**, p. 106373.

Jung, M. J. (2013). 'Investor overlap and diffusion of disclosure practices', *Review of Accounting Studies*, **18**, pp. 167–206.

Kacperczyk, M. T. and J. L. Peydro (2021). 'Carbon emissions and the bank-lending channel', *SSRN*, p. 3915486.

Kellard, N. M., A. Kontonikas, M. J. Lamla, S. Maiani and G. Wood (2023). 'Institutional settings and financing green innovation', *Journal of International Financial Markets, Institutions and Money*, **89**, p. 101853.

Koch, A., M. Panayides and S. Thomas (2021). 'Common ownership and competition in product markets', *Journal of Financial Economics*, **139**, pp. 109–137.

Kogut, B. and G. Walker (2001). 'The small world of Germany and the durability of national networks', *American Sociological Review*, pp. 317–335.

Krueger, P., Z. Sautner and L. T. Starks (2020). 'The importance of climate risks for institutional investors', *Review of Financial Studies*, **33**, pp. 1067–1111.

Lehoux, N., S. D'Amours and A. Langevin (2014). 'Inter-firm collaborations and supply chain coordination: review of key elements and case study', *Production Planning and Control*, **25**, pp. 858–872.

Lewellen, K. and M. B. Lowry (2021). 'Does common ownership really increase firm coordination?', *Journal of Financial Economics*, **141**, pp. 322–344.

Li, K., F. Mai, R. Shen and X. Yan (2021). 'Measuring corporate culture using machine learning', *The Review of Financial Studies*, **34**, pp. 3265–3315.

Lin, C., T. Schmid and M. S. Weisbach (2020). 'Climate change and corporate investments: evidence from planned power plants', *SSRN*, p. 3478625.

Liu, Z., H. Shen, M. Welker, N. Zhang and Y. Zhao (2021). 'Gone with the wind: an externality of earnings pressure', *Journal of Accounting and Economics*, **72**, p. 101403.

Mahmoudian, F., J. Lu, D. Yu, J. A. Nazari and I. M. Herremans (2021). 'Inter-and intra-organizational stakeholder arrangements in carbon management accounting', *The British Accounting Review*, **53**, p. 100933.

Marquis, C., M. W. Toffel and Y. Zhou (2016). 'Scrutiny, norms, and selective disclosure: a global study of greenwashing', *Organization Science*, **27**, pp. 483–504.

Matsumura, E. M., R. Prakash and S. C. Vera-Muñoz (2014). 'Firm-value effects of carbon emissions and carbon disclosures', *The Accounting Review*, **89**, pp. 695–724.

McCahery, J. A., P. C. Pudschedl and M. Steindl (2022). 'Institutional investors, alternative asset managers, and ESG preferences', *European Business Organization Law Review*, **23**, pp. 821–868.

McCahery, J. A., Z. Sautner and L. T. Starks (2016). 'Behind the scenes: the corporate governance preferences of institutional investors', *The Journal of Finance*, **71**, pp. 2905–2932.

Park, J., J. Sani, N. Shroff and H. White (2019). 'Disclosure incentives when competing firms have common ownership', *Journal of Accounting and Economics*, **67**, pp. 387–415.

Pawliczek, A., A. N. Skinner and S. L. Zechman (2022). 'Facilitating tacit collusion through voluntary disclosure: evidence from common ownership', *Journal of Accounting Research*, **60**, pp. 1651–1693.

Persoon, P. G., R. N. Bekkers and F. Alkemade (2020). 'The science base of renewables', *Technological Forecasting and Social Change*, **158**, p. 120121.

Propris, L. D. (2002). 'Types of innovation and inter-firm co-operation', *Entrepreneurship and Regional Development*, **14**, pp. 337–353.

Ramalingegowda, S., S. Utke and Y. Yu (2020). 'Common institutional ownership and earnings management', *Contemporary Accounting Research*, **38**, pp. 208–241.

Riedl, A. and P. Smeets (2017). 'Why do investors hold socially responsible mutual funds?', *The Journal of Finance*, **72**, pp. 2505–2550.

Sautner, Z., L. Van Lent, G. Vilkov and R. Zhang (2023). 'Firm-level climate change exposure', *The Journal of Finance*, **78**, pp. 1449–1498.

Schmalz, M. C. (2021). 'Recent studies on common ownership, firm behavior, and market outcomes', *The Antitrust Bulletin*, **66**, pp. 12–38.

Serafeim, G. (2018). 'Investors as stewards of the commons?', *Journal of Applied Corporate Finance*, **30**, pp. 8–17.

Si, Y., D. Desai, D. Bozhilova, S. Puffer and J. C. Stephens (2023). 'Fossil fuel companies' climate communication strategies: industry messaging on renewables and natural gas', *Energy Research and Social Science*, **98**, p. 103028.

Starks, L. T., P. Venkat and Q. Zhu (2019). 'Corporate ESG profiles and investor horizons', *SSRN*, p. 3049943.

Tarim, E., T. Finke and L. Liu (2021). 'Energy firms' responses to institutional ambiguity and complexity in long energy transitions: the case of the UK and China', *British Journal of Management*, **32**, pp. 648–692.

Wang, J., J. Li and Q. Zhang (2021). 'Does carbon efficiency improve financial performance? Evidence from Chinese firms', *Energy Economics*, **104**, p. 105658.

Widmer, F. (2011). 'Institutional investors, corporate elites and the building of a market for corporate control', *Socio-Economic Review*, **9**, pp. 671–697.

Wood, G., J. J. Finnegan, M. L. Allen, M. M. Allen, D. Cumming, S. Johan, M. Nicklich, T. Endo, S. Lim and S. Tanaka (2020). 'The comparative institutional analysis of energy transitions', *Socio-Economic Review*, **18**, pp. 257–294.

Xu, Q. and T. Kim (2022). 'Financial constraints and corporate environmental policies', *The Review of Financial Studies*, **35**, pp. 576–635.

Zhang, S. (2024). 'Carbon returns across the globe', *The Journal of Finance*, forthcoming.

Appendix A

Table A.I. Variable definitions

Variable	Definition
Dependent variable	
scaled_co2	log(1 + firm's estimated annual greenhouse gas (GHG) emissions/CO_2 and CO_2 equivalent emissions measured as the sum of Scope 1 and Scope 2 emissions in tons scaled by the firm's total assets (in million dollars) in the current year)
log_co2	log(1 + firm's estimated annual GHG emissions)
scaled_co2_scope1	log(1 + firm's annual Scope 1 emissions scaled by the firm's total assets in the current year)
scaled_co2_scope2	log(1 + firm's annual Scope 2 emissions scaled by the firm's total assets in the current year)
scaled_scope1/scope2	Ratio of the firm's scaled Scope 1 emissions over scaled Scope 2 emissions
esg_con	ESG controversies score, which measures a company's exposure to ESG controversies and negative events reflected in global media
Cexp	Climate change exposure score proposed by Sautner *et al.* (2023)
inn_cul	Corporate innovation culture score proposed by Li *et al.* (2020)
qua_cul	Corporate product quality culture score proposed by Li *et al.* (2020)
Key independent variables	
lNCN	log(1 + the number of same-industry peers sharing a common institutional blockholder with the firm)
lAN	log(1 + the number of same-industry peers block-held by the average cross-holding institution)
Other variables	
Coop	Corporate teamwork culture score proposed by Li *et al.* (2020)
Size	Natural logarithm of total assets (AT) in the current year
Che	Cash and short-term investment (CHE) in the current year scaled by total assets in the previous year
Lev	Leverage ratio, calculated as long-term debt (DLTT) over total assets (AT) in the current year
Roa	Return on assets, calculated as operating income before depreciation (OIBDP) scaled by total assets in the previous year
Xrd	Research and development expenditures (XRD) scaled by total assets in the previous year; set at zero if missing
Capx	Capital expenditures (CAPX) by total assets in the previous year
Aqc	Acquisition expenditure (ACQ) scaled by total assets in the previous year
dppegt	Percentage change in property, plant and equipment (PPEGT)
blkown	Total percentage of shares held by institutional blockholders
insown	Total percentage of shares held by institutional investors
blkdum	Dummy variable: equals one if the firm is held by at least one institutional blockholder

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Supporting Information

Additional supporting information can be found online in the Supporting Information section at the end of the article.

Common institutional ownership and corporate carbon emissions

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