

Can Institutional Investors Drive Decarbonization? Evidence from Taiwan

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ABSTRACT

This paper investigates the role of institutional ownership in shaping firms' greenhouse gas (GHG) emissions in Taiwan between 2013 and 2023. Using a comprehensive panel of listed firms, we find that higher institutional ownership is significantly associated with lower total emissions and carbon intensity, suggesting that institutional investors play a critical role in driving firms' environmental performance. The effect is primarily attributable to foreign institutional investors, who exhibit superior monitoring capabilities relative to domestic investors and thereby facilitate more efficient emissions reduction. Moreover, our results also reveal that institutional investors influence corporate GHG emissions through an exit-and-selection channel: they employ negative screening by divesting from high-emission firms and positive screening by increasing holdings in low-emission firms. Finally, we uncover heterogeneous effects under Taiwan's Green Finance Action Plans 1.0 and 2.0: while foreign investors dominate during the early policy phase, domestic institutional investors become more effective under the enhanced framework of Green Finance Action Plan 2.0.

JEL Classification: G18; G23; G32; G34; M14

Keywords: Institutional Investors; Institutional Ownership; Carbon Emissions; Green Finance Action Plan; Sustainable Finance

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1. Introduction

In recent years, scientists have become increasingly concerned with the concentration of greenhouse gases (GHGs) in the atmosphere and the phenomenon of global warming. The effects of global warming have potentially catastrophic consequences for the environment, as evidenced by faster-melting ice caps, rising sea levels, and changing weather patterns. Consequently, managing the risks caused by GHG emissions has become increasingly important for governments and the international community (Krueger et al., 2020). Moreover, with the ongoing discussions on climate change and pressure from international institutions to promote cleaner, lower-emission industries, shareholders face ethical challenges to assess and track their investments' environmental performance and emissions. For instance, the Paris Climate Agreement is one of the most important climate-related initiatives that aims to control climate change and mobilize all stakeholders' efforts towards low GHG emissions and climate-resilient development.¹ Investors, as one of the most important firms' stakeholders, are pressuring firms in which they invest towards more ethical behavior and consideration of the effects of climate change on their strategies to combat their negative effects and maintain their profitability in the long term.

Therefore, motivated by the growing debate on the topic, this paper examines the role that institutional ownership may play in managing climate change. More precisely, we investigate whether institutional ownership drives the reduction of firms' GHG emissions as a response to international pressure. Prior literature has widely addressed the relationship between institutional ownership and different aspects of corporate social responsibility (CSR) (Shiu and Yang, 2017; Dyck et al., 2019; Li et al., 2021). Shiu and Yang (2017) show that institutional investors, given their large stockholding,

¹ The Paris Climate Agreement (COP21), adopted in 2015, encouraged its 195 signatory countries to undertake effective policies and initiatives to curb the rise of the world temperature by 2 °C. These treaties and agreements have put pressure on business enterprises to improve their environmental performance.

may promote CSR to secure the insurance-like benefit of such environmental responsibility. Dyck et al. (2019) provide evidence that institutional investors push for stronger firm-level environmental and social (E&S) performance around the world. These studies measure firms' CSR practices based on an average of dimensions such as diversity, human rights, environment, product quality, governance quality and employee relations.

However, comparatively fewer studies have focused on the relationship between institutional investor stewardship and GHG emissions. Aghion et al. (2013) show that institutional investors are likely to play a proactive role in initiatives for carbon emissions reduction to minimize potential financial losses arising from reputational damage and reduced competitive advantage. More recently, Stroebe and Wurgler (2021) indicate that the pressure from institutional investors is one of the most effective mechanisms for reducing climate risk and carbon emissions of firms in the economy. Azar et al. (2021) find that the "Big Three" (i.e., BlackRock, Vanguard, and State Street Global Advisors) reduce corporate carbon emissions around the world. Cohen et al. (2023) show that institutional investors' demand for climate-related information is associated with an increase in corporate disclosure and a reduction in carbon emissions. Liu et al. (2025) support the monitoring view of foreign institutional ownership and find that foreign institutional ownership has a negative effect on corporate carbon emissions.

Prior studies investigating how climate change interacts with firms' performance and outcomes have mainly focused on the United States (e.g. Benlemlih and Cai, 2020; Safiullah et al., 2022; Benlemlih et al., 2023) and China (e.g. Shahbaz et al., 2020; Liu et al., 2025), with little attention given to other markets. Moreover, the underlying mechanism through which institutional ownership affects GHG emissions remains less understood. This study aims to explore the indirect and causal channel of this

relationship. By doing so, we increase our understanding of the impact of institutional ownership on GHG emissions and fill a gap in the literature by examining the role of institutional ownership in Taiwan.

In 2017, Taiwan's Financial Supervisory Commission (FSC) launched the Green Finance Action Plan 1.0 to raise awareness among companies and investors about environmental, social, and governance (ESG) issues, foster a positive cycle of investments and industry pursuit of sustainable development, and promote cooperation between the public and private sectors to achieve Taiwan's carbon reduction and sustainable development goals. In 2020, building on the Plan 1.0, the FSC introduced the Green Finance Action Plan 2.0, a more comprehensive system of green and sustainable finance guidelines aligned with international norms. Its objectives are to promote a healthy investment cycle, support sustainable development, and help the country achieve emissions reduction and sustainability goals. One of its action items is to support the Environmental Protection Administration's (EPA) total greenhouse gas emissions control plan.² However, the Taiwanese market is still developing, and few studies have examined the role of institutional ownership in GHG emissions. Hence, this research focuses on Taiwanese companies and investigates how institutional investor stewardship relates to GHG emissions under the Green Finance Action Plans.

With the ongoing expansion of capital internationalization and the accelerated pace of globalization in recent decades, Taiwan has opened its domestic capital markets to foreign institutional investors. However, a notable gap remains in understanding the

² The EPA undertakes the following matters: (1) Assist in the development of a GHG emissions trading platform system. (2) Support the drafting of sub-regulations, such as those governing the registration and trading of emission source accounts, in accordance with Paragraph 6, Article 21 of the Greenhouse Gas Reduction and Management Act. (3) Provide assistance in clarifying relevant accounting treatments and financial disclosure requirements related on the free acquisition, trading, and implementation of emission reduction projects, under the framework of the Greenhouse Gas Reduction and Management Act. (4) Evaluate, when appropriate, the feasibility of developing carbon futures, options, and other carbon derivatives based on the actual operation of the spot trading in carbon emissions.

potential impact of foreign institutional investors on GHG emissions in Taiwan and whether this impact differs from that of domestic institutional investors. Existing studies on foreign institutional investors offer two contrasting predictions (Mian et al., 2023). The monitoring view suggests that foreign institutional investors, lacking business relationships with local networks (Bena et al., 2017), can provide independent oversight over managers, thereby reducing GHG emissions. Because firms with high GHG emissions expose shareholders to sizable regulatory risks, foreign institutional investors have stronger incentives to monitor and reduce portfolio firms' GHG emissions.

By contrast, the information disadvantage view argues that foreign institutional investors may be less effective monitors because of the significant costs of acquiring and processing information across geographical, cultural, and language barriers (Kim et al., 2016; Liu et al., 2018). These challenges hinder their ability to effectively oversee self-interested managers. Alternatively, foreign institutional investors may focus on short-term financial returns (Douma et al., 2006; Aguilera et al., 2017), leaving them less motivated to monitor GHG emissions, which are associated with long-term risks and performance. Given these two opposing perspectives, the impact of foreign institutional investors on GHG emissions remains an empirical question. Therefore, this paper distinguishes between foreign and domestic institutional investors to examine whether foreign institutional investors contribute to the reduction of firms' GHG emissions in Taiwan under the Green Finance Action Plans.

We use a sample of firms listed on the Taiwan Stock Exchange or the Taipei Exchange (OTC stocks) from 2013 to 2023. GHG emissions data, institutional investors' ownership, and financial information are collected from the Taiwan Economic Journal (TEJ) database. Our main sample consists of 9,406 firm-year observations. To examine whether institutional investor stewardship contributes to GHG emissions reduction

among Taiwanese firms, we regress total emissions (Scopes 1-3) and carbon intensity (Scopes 1-3 INT) on institutional ownership, respectively. We also investigate whether the effects differ between foreign and domestic institutional investors. The findings indicate that institutional investor ownership is negatively and significantly associated with total emissions (Scopes 1-3) and carbon intensity (Scopes 1-3 INT). These results support the notion that institutional investors contribute to the reduction of GHG emissions in Taiwan. Next, we explore one mechanism through which institutional investors may drive GHG emissions reduction in their portfolio firms: the exit and selection strategy, which consists of divesting from high-emission firms (negative screening) and investing in low-emission firms (positive screening). Using a Granger causality approach, we show that, as pressure to support cleaner firms increases over time, institutional investors may adjust their environmental preferences by exiting high-emission firms and reallocating investments to low-emission firms.

Further analysis reveals that foreign institutional investors have a stronger negative impact on firms' GHG emissions compared to their domestic counterparts. Domestic institutional investors, however, show no significant effect on GHG emission levels. This finding is consistent with the notion that foreign institutional investors possess superior monitoring capabilities compared to domestic institutional investors and therefore drive GHG emissions reduction more efficiently in the Taiwanese market. However, under the Green Finance Action Plans 1.0 (2018-2020) and 2.0 (2021-2023), based on different data periods, we uncover some interesting insights. Foreign institutional investors do not consistently outperform domestic institutional investors in terms of driving reductions in firms' GHG emissions. Notably, under the Green Finance Action Plan 2.0, domestic institutional investors have a stronger negative impact on firms' GHG emissions compared to their foreign counterparts. We speculate that the Green Finance Action Plan 2.0 may have a greater influence on domestic institutional investors

than on foreign ones.

Finally, to address potential endogeneity concerns, we employ three approaches. First, we include year and industry fixed effects and use lagged independent variables. Second, we implement the Heckman two-stage estimator. Third, we conduct two-stage least square (2SLS) analyses, using the industry average as an exogenous instrument. Our results remain robust after addressing these endogeneity concerns.

Our paper contributes to the related literature in several ways. First, we extend prior work on institutional investor stewardship in reducing firms' GHG emissions (e.g., Dyck et al., 2019; Azar et al., 2021; Benlemlih et al., 2023; Bose et al., 2024; Li et al., 2021b; Ilhan et al., 2023; Döring et al., 2023; Bolton and Kacperczyk, 2021; Barko et al., 2022). In particular, we provide the first attempt to demonstrate the importance of institutional investor stewardship in reducing various forms of GHG emissions, including total emissions (Scope 1 to Scope 3) and carbon intensity (Scope 1 INT to Scope 3 INT). Second, we complement the existing literature by extending the evidence to Taiwan, an important market in Asia with significant GHG emissions from firms. Consistent with the stewardship perspective, our findings suggest that institutional investors in Taiwan do care about firms' GHG emissions. Third, we explore the mechanism through which institutional investors may influence emission reductions. Our results show that institutional investors may adjust their environmental preferences by exiting firms with high GHG emissions and investing in firms with low GHG emissions. This has important implications for managers of high-emission firms, as they may be screened out by environmentally conscious institutional investors. Fourth, we find evidence that foreign institutional investors have a monitoring advantage over domestic institutional investors, particularly in emerging markets. These results align with the findings of Liu et al. (2025). Finally, we show that the effects of institutional ownership vary under the Green Finance Action Plan 2.0, with domestic institutional

investors playing a more prominent role in emissions reduction during this period. This finding provides valuable insights not only to the academic community but also to policymakers and regulators in Taiwan.

The remainder of this paper is organized as follows. Section 2 provides a literature review and develops the hypotheses. Section 3 describes the data and outlines the empirical model. Section 4 presents the empirical results. Finally, Section 5 concludes the study.

2. Literature Review and Hypothesis Development

In this section, we review the existing literature on the impact of institutional ownership on GHG emissions to identify research gaps and develop our core research questions.

2.1 Institutional Investors and GHG Emissions

Prior research on the relationship between firms' decisions and GHG emissions is limited and has primarily focused on environmental responsibility. For example, Serafeim (2018) argues institutional investors integrate E&S criteria into their investment mandate and put pressure on firms to reduce their negative externalities. Dyck et al. (2019) study the interaction between institutional ownership and E&S performance and document a positive causal relationship. Li et al. (2021b) report similar findings and empirically show that institutional ownership significantly enhances the CSR performance of Chinese firms. Flammer et al. (2021) argue that shareholder activism significantly enhances the voluntary disclosure of climate risk.

Until recently, most work on the relationship between institutional ownership and E&S practices paid little attention to emissions, despite their importance for investor reputation and policymaker requirements. Bolton and Kacperczyk (2021) show that institutional investors implement negative screening based on emissions intensity.

Benlemlih et al. (2023) demonstrate that institutional ownership reduces GHG emissions in both the United Kingdom and the United States. Nonetheless, there are still relatively few studies on whether institutional investors can drive companies toward lower GHG emissions. This remains an open empirical question, particularly in the context of international pressure. Based on these arguments, we propose the following hypothesis:

Hypothesis 1 (H1): Institutional ownership is negatively associated with firms' GHG emissions

2.2 Foreign and Domestic Institutional Investors and GHG Emissions

Krueger et al. (2020) show that institutional investors, as key agents of globalization, have increasingly emphasized incorporating sustainability and climate change factors into their investment processes. As this trend continues, foreign institutional investors are expected to employ various policy tools to exert influence over the carbon emissions of their investee firms. The existing literature presents two contrasting views regarding the impact of foreign institutional investors' ownership on carbon emissions: the monitoring view and the information disadvantage view.

The monitoring view suggests that foreign institutional investors, lacking business relationships with local networks (Kim et al., 2016; Bena et al., 2017; Azar et al., 2021), can provide independent oversight over managers, leading to a reduction in carbon emissions. Kim et al. (2022) point out that foreign institutional investors, especially those from developed economies, have advanced knowledge of energy-saving and emissions-reduction technologies to further help domestic manufacturers reduce GHG emissions. Bolton and Kacperczyk (2021) investigate the systematic risks associated with carbon emissions and find that foreign institutional investors have an incentive to actively manage these risks and reduce the GHG emissions of firms in their portfolios.

By contrast, the information disadvantage view, as suggested by Deng et al. (2018) and Du et al. (2017), argues that cultural differences may amplify the effects of economic policy uncertainty for foreign institutional investors. Given their limited familiarity with Taiwan, foreign investors may face challenges in exercising effective oversight. These challenges may arise from a lack of local knowledge or gaps in understanding regulatory frameworks, which can hinder their ability to influence reductions in investee firms' GHG emissions. Based on this perspective, we propose the following alternative hypotheses:

Hypothesis 2a (H2a): Foreign institutional ownership is negatively associated with firms' GHG emissions

Hypothesis 2b (H2b): Foreign institutional ownership is positively associated with firms' GHG emissions

Furthermore, compared with domestic institutional investors, foreign institutional investors tend to be more diversified and are less exposed to climate risks (e.g., floods or hurricanes) in any specific region. In addition, foreign institutional investors may prioritize short-term financial returns (Douma et al., 2006; Aguilera et al., 2017), making them less motivated to monitor carbon emissions, which are typically associated with long-term risks and performance. Therefore, we expect significant differences in the extent to which different types of institutional investors influence the GHG emissions of their investee firms. Stated more formally, our hypothesis is as follows:

Hypothesis 2c (H2c): The type of institutional investors affects the GHG emissions of its investee firms

2.3 Channel-Related Research

Next, we examine the potential mechanisms by which institutional investors may reduce the GHG emissions of their investee firms. Trinks and Scholtens (2017) analyze an international sample of more than 1,600 stocks over a twenty-year period and investigate the impact of applying negative screens to a market portfolio. Their findings suggest that the use of negative screening strategies significantly affects both the size of the investment universe and risk-adjusted returns. Dyck et al. (2019) provide evidence that investors use exit and selection strategies to influence firms' E&S performance. Some investors apply negative screening to exclude poor E&S performers, while others use positive screening to invest only in firms that exceed specific E&S thresholds, such as socially responsible or impact funds (e.g., Barber et al., 2021). Currently, it remains unclear whether institutional investors apply similar exclusion strategies to high-carbon-emission companies. However, if pressure for environmentally responsible investing continues to grow, institutional investors are likely to divest from high-emission firms and reallocate capital to low-emission firms. Therefore, we expect institutional investors to use an exit strategy (e.g., selling sin stocks) and a selection strategy (e.g., buying green stocks) to influence corporate GHG emissions. Stated more formally, our third hypothesis is as follows:

Hypothesis 3 (H3): Institutional investors influence GHG emissions through exit and selection strategies

2.4 Green Finance Action Plans in Taiwan

In 2020, building upon the Green Finance Action Plan 1.0, the FSC introduced the more comprehensive "Green Finance Action Plan 2.0." This initiative aims to establish a green and sustainable finance system aligned with international standards. Its objectives include promoting a healthy investment cycle, supporting sustainable development, and

helping the country achieve emissions reduction goals. The major components of the Plan 2.0 include: (1) Expanding the scope of sustainable finance: Introducing "Taiwan taxonomy regulations" to guide financial institutions in selecting investment projects and to assist corporations undergoing carbon reduction transformation. (2) Strengthening climate risk management in financial institutions: Incorporate climate change risk into audit and supervision frameworks and promoting effective risk management practices. One of the specific action items is to support the EPA's total GHG emissions control plan. However, it remains unclear whether Taiwan's Green Finance Action Plans have had a significant impact on climate-related outcomes, such as reducing GHG emissions. Accordingly, we propose the following null hypothesis:

Hypothesis 4 (H4): The Green Finance Action Plans have no effect on institutional investors' ability to reduce GHG emissions

3. Data and Empirical Model

3.1 Sample

We collect GHG emissions, as well as institutional investor holdings and financial information of firms, from the TEJ database. Our main sample consists of 9,406 firm-year observations spanning from 2013 to 2023. The dependent variables used in this paper include proxies for GHG emissions, following the methodology of Bolton and Kacperczyk (2021). A company's GHG emissions from operations and economic activities are typically categorized into three scopes: Scope 1, which includes direct emissions from production; Scope 2, which includes indirect emissions from the consumption of purchased electricity, heat, or steam; and Scope 3, which includes other indirect emissions resulting from the production of purchased materials, product use, waste disposal, outsourced activities, and so on. Scopes 1, 2 and 3 emissions are

measured in tons of CO₂ and normalized using the natural logarithm. Carbon intensity is expressed as tons of CO₂ equivalent per unit of company revenue.

Our focus is on institutional investors, and we obtain the relevant data from TEJ. We use institutional ownership (IO) as a key independent variable. Institutional ownership is calculated as the ratio of the total number of shares held by domestic financial institutions, domestic trust funds, domestic corporate entities, domestic other juridical persons, government agencies, overseas financial institutions, overseas juridical persons, and overseas trust funds to the total number of issued shares of the company. We further decompose institutional ownership into foreign institutional ownership (Foreign IO), which includes foreign financial institutions, foreign legal entities, and foreign trusts, and domestic institutional ownership (Domestic IO), which includes local government, domestic financial institutions, domestic trusts, and domestic legal entities. This allows us to examine whether foreign and domestic institutional investors have different effects on GHG emissions performance.

For the regression analyses, we follow Bolton and Kacperczyk (2021) and control for several firm-level characteristics, including Size, Book to Market (B/M), ROE, Leverage, Invest/a, HHI, Logppe, Salesgr and Epsgr. Size is measured by the natural logarithm of market capitalization. B/M is the book value of equity divided by market value of equity. ROE is the return on equity. Leverage is defined as the book value of debt divided by the book value of assets. Invest/a is calculated as capital expenditure divided by the book value of assets. HHI refers to the Herfindahl index of a firm's business segments, with weights based on revenue shares. Logppe is the natural logarithm of plant, property & equipment. Salesgr is the annual change in firm revenues, normalized by the firm's market capitalization from the previous month. Epsgr represents the annual change in earnings per share, normalized by the firm's equity price. Additionally, we control for year and industry fixed effects.

3.2 Descriptive Statistics and Pearson Correlation

We categorize industry sectors based on the TEJ industry sector classification standard. The final sample consists of 11 industries: basic metal, beverage and dairy products, canning process, cement, communication equipment, hardware equipment, oil feed, petrochemical, restaurant, retail, and semiconductors. The financial sector is excluded from this study because firms in this sector have leverage characteristics that differ significantly from those of typical companies that manufacture goods or provide non-financial services. Panel A of Table 1 shows that the cement, oil feed and petrochemical have the highest GHG emissions among the 11 industries, while the communication equipment industry has the lowest percentage. This suggests that the cement, oil feed and petrochemical industries are heavily polluting. Panel B shows that the values of carbon emissions scopes and carbon intensity scopes decrease over time. This indicates growing attention to GHG emission reduction in business practices, with companies increasingly making efforts to improve their emissions diligence.

<Table 1 is inserted about here>

In Table 2 the average Scope 1 is 7.344, average Scope 2 is 9.146, average Scope 3 is 9.213, Notably, the median number is larger for Scope 2 and Scope 3 emissions, as almost all companies in our sample are tied to a significant quantity of such emissions. Scopes 1, 2, and 3 measures are in units of tons of CO₂ and normalized using the natural log scale. To mitigate the impact of outliers, we winsorize all measures at the 1% and 99% level. The carbon intensity of a company is expressed as tons of CO₂ equivalent divided by the company's revenues. The average Scope 1 INT is .003, average Scope 2 INT is .005 and average Scope 3 INT is .009, respectively.

Then, the average ratio of IO is 0.40, and the median is 0.38, representing that most sample companies have institutional investors holding approximately 40% of their shares. Among them, Foreign IO is 0.11 and Domestic IO is 0.30 of their shares,

respectively. Among the control variables, the average of Size is 22.30, which denotes that the overall sample is mostly larger companies. The average of B/M is 0.74 while the average of book leverage is 0.41. The averages of ROE, Invest/a, HHI, Logppe, and Salesgr are 5.18, -0.04, 0.69, 13.62, and 0.13, respectively, while the average of Epsgr is positive.

<Table 2 is inserted about here>

Table 3 presents the Pearson correlation coefficients between the variables considered in this study. As one would expect, the levels of all three categories of emissions are positively correlated. Similarly, the level of Scope 1 emissions is obviously positively correlated with Scope 1 emissions intensity (Scope 1 INT), but the size of the coefficient is only 0.23, reflecting the fact that two firms with the same Scope 1 INT may have very different levels of emissions. We also find that IO and Foreign IO are negatively correlated with carbon emissions scope and carbon intensity scope except Domestic IO. This provides preliminary support for H1, H2a and H2c.

<Table 3 is inserted about here>

3.3 Empirical Model

In this study, we estimate the following panel regression model to assess the impact of institutional ownership on firms' GHG emissions performance:

$$\text{Emission Proxies}_{i,t} = \alpha_0 + \alpha_1 \text{IO}_{i,t} + \Lambda \text{Controls}_{i,t} + \nu_j + \mu_t + \varepsilon_{i,t} \quad , \quad (1)$$

where Emissions Proxies include total emissions across Scopes 1-3, as well as carbon intensity measures for Scopes 1-3 (Scope 1 INT to Scope 3 INT). IO denotes institutional ownership, which we further decompose into foreign and domestic institutional ownership (Foreign IO and Domestic IO). Following Bolton and Kacperczyk (2021), we control for firm characteristics including Size, B/M, ROE, Leverage, Invest/a, HHI, Logppe, Salesgr and Epsgr. All regressions include year and

industry fixed effects, and standard errors are two-way clustered at the firm and year levels.

4. Empirical Results

4.1 Institutional ownership and GHG emissions reduction

Prior studies investigating how institutional investors interacts with firms' GHG emissions reduction mainly focus on the United States (e.g., Bolton and Kacperczyk, 2021; Benlemlih et al., 2023), with little attention on other regions. However, it remains an empirical question whether a similar phenomenon exists in Taiwan. Therefore, in this paper, we use institutional investor ownership as a proxy for institutional investor influence to examine the impact of institutional investors on firms' GHG emissions.

Table 4 presents the results from our panel regression model, which controls for year and industry fixed effects and employs heteroskedasticity-robust standard errors. In columns (1) to (6) of Panel A, the dependent variables are total emissions (Scope 1), total emissions (Scope 2), total emissions (Scope 3), carbon intensity (Scope 1 INT), carbon intensity (Scope 2 INT), carbon intensity (Scope 3 INT), respectively. We find that the coefficient of institutional ownership is significantly negative across all columns, suggesting that institutional investors contribute to reduce firms' GHG emissions in Taiwan. These results support our hypothesis H1 and are consistent with the findings of Bolton and Kacperczyk (2021) and Benlemlih et al. (2023). Regarding the control variables, we find that Size, Invest/a and Logppe are positively and significantly associated with total emissions. This implies that larger firms, firms with higher levels of investment, and firms with more fixed assets tend to have higher total emissions, which aligns with the findings of Bolton and Kacperczyk (2021).

Foreign investors play a critical role in shaping GHG emissions outcomes in emerging markets (Kim et al., 2016; Bena et al., 2017; Azar et al., 2021). To examine

this effect, we decompose institutional ownership into foreign and domestic components and regress them separately on our GHG emissions proxies. The results reveal that foreign institutional ownership is negatively and significantly associated with GHG emissions. These findings support hypothesis H2a rather than hypothesis H2b and align with prior evidence (Kim et al., 2016; Bena et al., 2017; Azar et al., 2021), which suggests that, under the monitoring view, foreign institutional investors, unconstrained by local business ties, exercise more independent monitoring over managers, thereby facilitating reductions in carbon emissions.

Prior literature highlights the crucial governance role of foreign institutional investors, who leverage their global experiences and business expertise to effectively monitor investee firms. Supporting the monitoring view, Tsang et al. (2019) find that foreign institutional investors enhance firms' information environments and exert a stronger positive influence on voluntary disclosure than their domestic counterparts. Similarly, foreign institutional investors serve as an effective monitoring mechanism by constraining managerial earnings manipulation (Lel, 2019) and promoting long-term investments, such as R&D (Luong et al., 2017). Mian et al. (2023) further show that long-term foreign institutional investors benefit from economies of scale in acquiring and utilizing monitoring information, thereby improving oversight effectiveness compared to short-term foreign institutional investors. Moreover, Kim et al. (2019) document that foreign institutional investors from countries with stronger governance systems are likely to pressure investee firms to appoint a Big-4 auditor. Finally, prior studies indicate that the monitoring influence of foreign institutional investors is particularly pronounced in countries with weaker governance frameworks (Aggarwal et al., 2011; Bena et al., 2017; Ferreira and Matos, 2008).

On the other hand, foreign institutional investors' monitoring fosters long-term investments in fixed capital, innovation, and human capital. This positive influence

stems from the disciplinary effect exerted by institutional investors on corporate insiders. By leveraging their ownership power, institutional investors can persuade managers, who may otherwise prefer a “quiet life” (Hart, 1983; Bertrand and Mullainathan, 2003), to pursue innovation through diplomatic engagement, active voting, or even confrontational proxy battles. Bena et al. (2017) demonstrate that higher foreign institutional ownership leads to greater investment in tangible, intangible, and human capital, resulting in significant increases in innovation output, internationalization of operations, and overall firm valuation. These effects are primarily driven by the monitoring and disciplinary roles of foreign institutions. Compared to domestic institutional investors, foreign institutional investors possess superior monitoring capabilities due to their access to global talent, advanced communication technologies, and sophisticated analytical tools (Grinblatt and Keloharju, 2000).

Finally, we find that domestic institutional ownership is insignificantly associated with GHG emissions, suggesting that domestic and foreign institutional investors exert differential impacts on firms’ emissions reduction, thereby supporting hypothesis H2c. Our empirical results indicate that the foreign institutional investors place greater emphasis on GHG emissions reduction compared to their domestic counterparts. Liu et al. (2025) show that the behavior of foreign institutional investors is strongly influenced by home-country characteristics; those originating from regions with advanced green innovation achieve significantly greater reductions in corporate carbon emissions. This implies that foreign institutional investors transfer higher environmental standards from their home markets to investee firms. From a resource-based perspective, foreign institutional investors also provide valuable resources, cutting-edge technologies, and managerial expertise, enabling firms to improve environmental performance (Dyck et al., 2019; Liang and Renneboog, 2017; Kim et al., 2022).

Furthermore, foreign firms face institutional pressures from both their home and host countries (Kostov and Zaheer, 1999; Spencer, 2008), which incentivize them to adopt proactive environmental management strategies and transfer advanced technologies to emerging economies, often exceeding local standards and regulatory requirements. Stroebe and Wurgler (2021) identify regulatory risk as the most significant climate-related risk for businesses and investors over the next five years, while physical risk is expected to dominate over the next three decades. Consequently, foreign firms seek to enhance their social legitimacy within host countries and strategically accumulate a substantial stock of environmental resources, which can serve as insurance against unexpected, ecologically damaging events (Albornoz et al., 2009).

In parallel, since the early 2000s, major developed economies have progressively established comprehensive carbon emission disclosure systems. The United States EPA's Greenhouse Gas Reporting Program (GHGRP), implemented in 2009, pioneered large-scale mandatory reporting and has served as an important reference for subsequent national frameworks. The program requires facilities emitting more than 25,000 metric tons of CO₂ equivalent annually to disclose their emissions. Similarly, the European Union introduced the Non-Financial Reporting Directive (NFRD) in 2014 and expanded its scope through the Corporate Sustainability Reporting Directive (CSRD) in 2022, establishing a comprehensive sustainability disclosure framework that mandates large public-interest entities to report ESG information.

However, the Taiwanese market is still in the process of development. The FSC has introduced a systematic, phased implementation schedule for mandatory corporate disclosure requirements, including due diligence and verification procedures, spanning four phases from 2023 to 2029. Specifically,

Phase I (2023-2024): Listed companies with capital of NT\$10 billion or above, as well as individual companies in the steel and cement industries (regardless of capital), must complete due diligence.

Phase II (2024-2025): Listed companies with capital of NT\$10 billion or above and their consolidated subsidiaries in the steel and cement industries must complete due diligence, along with individual listed companies with capital between NT\$5-10 billion.

Phase III (2025-2026): Consolidated subsidiaries of listed companies with capital between NT\$5-10 billion, as well as individual listed companies with capital below NT\$5 billion complete due diligence.

Phase IV (2026-2027): Consolidated subsidiaries of listed companies with capital below NT\$5 billion complete due diligence.

This phased implementation underscores Taiwan's commitment to enhancing corporate transparency and aligning with international best practices in GHG disclosure and corporate governance standards. However, since the sample period of this study spans 2013 to 2023, the full impact of these regulatory changes is not yet observable, which may partly explain why domestic and foreign institutional investors exert differential effects on firms' GHG emissions reduction.

<Table 4 is inserted about here>

4.2 Robustness Checks and Addressing Endogeneity Concerns

The association between GHG emissions and institutional ownership may be subject to endogeneity concerns, particularly due to potential reverse causality. Specifically, firms with lower GHG emissions may attract greater attention and investment from institutional investors, which could lead to an observed association between institutional ownership and emissions levels. To mitigate this potential bias, we employ lagged institutional ownership as an explanatory variable in our regression models. Following Clemens et al. (2012), instrumenting current variables with their

lagged counterparts helps avoid the pitfalls of weak or poor-quality instruments while effectively addressing potential biases arising from reverse and simultaneous causality. Table 5 reports the regression results using lagged institutional ownership. The findings consistently indicate that institutional investors play a significant role in reducing firms' GHG emissions. Moreover, we find that foreign institution ownership exhibits a stronger effect relative to domestic institutional ownership in Taiwan, aligned with the view that foreign institutions possess superior monitoring capabilities.

<Table 5 is inserted about here>

Furthermore, another potential concern is that institutional investors may exhibit herding behavior when selecting firms, making investment process non-random and potentially introducing sample selection bias. To address this issue, we re-estimate the regressions reported in Table 4 using the Heckman two-stage selection model (Heckman, 1976, 1979). The Heckman procedure comprises two equations: a selection equation and an outcome equation. In the selection equation, we model the likelihood of institutional ownership as a function of nine firm-specific characteristics used in Table 4, including Size, B/M, ROE, Leverage, Invest/a, HHI, Logppe, Salesgr and Epsgr. From this estimation, we derive the inverse Mills ratio to account for potential non-random selection. In the outcome equation, we re-estimate our baseline model of GHG emissions by incorporating the inverse Mills ratio as an additional regressor to correct for sample selection bias. The results, presented in Table 6, continue to show a significantly negative relationship between institutional ownership and firms' GHG emissions, thereby supporting hypothesis H1 and demonstrating that our findings are robust to concerns about selection bias. Furthermore, when distinguishing between foreign and domestic institutional investors, the results reveal that foreign institutional ownership exerts a stronger negative effect on firms' GHG emissions. This finding is in

line with the monitoring view and provides a strong support for hypotheses H2a and H2c.

<Table 6 is inserted about here>

Finally, institutional ownership is plausibly endogenous (Duggal and Millar, 1999). To further address this concerns, we implement a two-stage least squares (2SLS) estimation. Following Dhaliwal et al. (2016), we use the industry average of institutional ownership (IO_Industry) as an instrumental variable. Prior studies show that institutional investors exhibit strong herding tendencies at the industry level in both U.S. and Taiwanese markets (Choi and Sias, 2009; Chen et al., 2012). Benlemlih et al. (2023) also document that industry average institutional ownership is highly correlated with a firm's institutional ownership but has no direct impact on firm-level GHG emissions, particularly when industry fixed effects are included. Thus, we expect the instrument to satisfy both relevance and exogeneity conditions. Formally, our 2SLS specification is given by:

$$\begin{aligned} IO_{i,t} &= \beta_0 + \beta_1 IO_Industry_{j,t} + \Pi Controls_{i,t} + v_j + \mu_t + \eta_{i,t} \\ Emission\ Proxies_{i,t} &= \phi_0 + \phi_1 \widehat{IO}_{i,t} + \Psi Controls_{i,t} + v_j + \mu_t + \lambda_{i,t} \end{aligned} \quad (2)$$

where Emissions Proxies comprise total emissions across Scopes 1-3 and carbon intensity measures for Scopes 1-3 (Scope 1 INT to Scope 3 INT). The first-stage regression instruments firm-level IO with IO_Industry. Control variables include Size, B/M, ROE, Leverage, Invest/a, HHI, Logppe, Salesgr and Epsgr. All specifications include year and industry fixed effects, with standard errors clustered by firm and year.

Panel A of Table 7 presents the 2SLS results. Column (1) shows the first-stage regression, showing that industry average institutional ownership is positively and significantly related to firm-level institutional ownership, satisfying the relevance criterion. Moreover, the Cragg and Donald (1993) Wald F-statistic substantially exceeds the conventional threshold of 10, indicating that our instrument is not weak. Columns

(2) to (7) present the second-stage regression using our six GHG emissions proxies as dependent variables. Across all specifications, we find consistently negative and significant effects of institutional ownership on firms' GHG emissions. This confirms our results are robust to potential endogeneity.

We further conduct separate 2SLS analyses for foreign and domestic institutional ownership, as reported in Panel B of Table 7. The first-stage regressions confirm that industry average foreign and domestic institutional ownership are strong and significant predictors of firm-level foreign and domestic institutional ownership, respectively, and both instruments pass weak instrument tests. The second-stage results reveal that foreign institutional ownership is negatively and significantly associated with all six GHG emissions proxies, whereas domestic institutional ownership is only positively and significantly related to total emissions Scope 1 and carbon intensity Scope 1 INT. Overall, these results provide robust evidence consistent with hypothesis H2a and H2c, highlighting that different types of institutional investors exert heterogeneous effects on firms' GHG emissions. Specifically, foreign institutional investors are the primary drivers of emissions reduction in Taiwan.

<Table 7 is inserted about here>

4.3 The Role of Institutional Investors in Shaping Corporate GHG Emissions: An Exit-and-Selection Channel

Dyck et al. (2019) argue that only a limited number of institutional investors have traditionally relied on negative screening to exclude certain firms from their investment portfolios. However, with increasing pressure from stakeholders to integrate environmental considerations into investment decisions, this tendency has been gradually shifting. An increasing number of institutional investors now retain environmentally responsible firms within their portfolios. In a similar vein, Benlemlih

et al. (2023) highlight that growing pressure to reduce exposure to GHG emissions has intensified over time. Institutional investors are therefore more likely to divest from firms with high GHG emissions (“sin stocks”) and reallocate their capital toward firms with low GHG emissions (“green stocks”). Building on this literature, we argue that institutional investors in Taiwan adopt an exit-and-selection approach to influence corporate GHG emissions. Specifically, institutional investors may exert pressure on firms by exiting high-emission firms and selectively investing in firms with lower emissions, thereby shaping corporate environmental practices through portfolio allocation decisions. To empirically test this specification, we follow the methodology developed by Dyck et al. (2019). First, we regress firms’ GHG emissions on lagged institutional ownership, lagged GHG emissions, and lagged control variables. Second, consistent with the importance of exit-based screening, we regress institutional ownership on lagged GHG emissions, lagged institutional ownership and lagged control variables. This approach is conceptually similar to the Granger causality test, which has been widely applied in studies on financial economics to test for directional causality (Benlemlih and Girerd-Potin, 2017). To account for unobserved heterogeneity, we estimate the model using firm-level fixed effects, following Dyck et al. (2019) and Benlemlih et al. (2023).

The results, presented in Tables 8 and 9, provide strong support for the exit-and-selection mechanism. Specifically, we find that institutional ownership is significantly related to firms’ GHG emissions, as shown in columns (2), (4) and (6) of both tables. Moreover, consistent with our main results, corporate GHG emissions are significantly influenced by lagged institutional ownership, as evidenced in columns (1), (3) and (5) of Tables 8 and 9. Collectively, these findings suggest that institutional investors actively manage their portfolios to achieve lower GHG exposure and, in doing so, influence firms’ environmental outcomes. Overall, our results provide robust evidence

in support of hypothesis H3, demonstrating that institutional investors in Taiwan employ an exit-and-selection strategy as an effective mechanism to influence corporate GHG emissions.

<Table 8 is inserted about here>

<Table 9 is inserted about here>

4.4 The Role of Green Finance Policies in Shaping Institutional Investors' Influence on GHG Emissions

In 2020, under the framework of the Green Finance Action Plan 1.0, the FSC launched the Green Finance Action Plan 2.0 to establish a more comprehensive green and sustainable financial system aligned with international standards. The objectives of this updated policy are to promote a healthy cycle of investment, facilitate sustainable economic development, and support national goals for GHG emissions reduction and sustainability. However, whether these policy initiatives have had a significant impact on addressing climate-related issues, particularly in terms of corporate GHG emissions reduction, remains an open empirical question. To investigate this, we divide our full sample into three sub-periods: 2013-2017 (pre-policy period), 2018-2020 (Green Finance Action Plan 1.0), and 2021-2023 (Green Finance Action Plan 2.0). The results, presented in Table 10, provide several important insights. First, under both the Green Finance Action Plans 1.0 and 2.0, we find that institutional investors play a significant role in reducing firms' GHG emissions. Second, during the implementation period of the Green Finance Action Plan 1.0, foreign institutional investors do not exhibit a consistently stronger effect on GHG emissions reduction compared to domestic institutional investors. Interestingly, under the Green Finance Action Plan 2.0, the relationship between institutional ownership and GHG emissions becomes stronger for domestic institutional investors relative to their foreign counterparts. Therefore, these

findings lead us to reject the null hypothesis of H4 and provide evidence that the impact of Taiwan's Green Finance Action Plans on institutional investors' environmental influence differs between foreign and domestic investors.

<Table 10 is inserted about here>

5. Conclusion

In March 2022, Taiwan officially announced its "Pathway to Net-Zero Emissions in 2050", a comprehensive roadmap outlining strategies and action plans to achieve net-zero GHG emissions. The initiative promotes technological innovation, research, and industrial transformation while guiding the green transition of industries, stimulating economic growth, and fostering sustainable financing and investment. The pathway builds on four major transition strategies: "energy transition," "industrial transition," "lifestyle transition", and "social transition", supported by two governance foundations ("technology R&D" and "climate legislation") and supplemented by twelve key strategies targeting critical sectors. Together, these measures aim to accelerate Taiwan's low-carbon transformation and ensure a fair and orderly transition toward a sustainable economy. Taiwan has increasingly positioned itself as a leading Asian market in pursuing GHG emissions reduction initiatives.

While extant literature has predominantly focused on the macroeconomic determinants of GHG emissions, relatively limited attention has been paid to how firm-level governance structures, particularly ownership composition, affect corporate GHG emissions. This study fills this gap by examining the role of institutional investors in promoting low-carbon investment strategies and influence firms' GHG emissions in Taiwan. Consistent with evidence from the European and United States markets (e.g., Bolton and Kacperczyk, 2021; Benlemlih et al., 2023), we document that, during the period 2013-2023, institutional ownership in Taiwan has been a significant driver of corporate GHG emissions reduction. To address potential endogeneity concerns, we

employ multiple techniques, including the use of lagged variables as instruments, the Heckman two-stage selection model, and a 2SLS approach. The results remain robust across all specifications. Importantly, when distinguishing between foreign and domestic institutional investors, we find that foreign institutions exert a stronger influence on GHG emissions reduction, consistent with the monitoring view, which suggests that foreign institutional investors possess superior monitoring capabilities relative to their domestic counterparts.

Furthermore, we find strong evidence that institutional investors in Taiwan employ an exit-and-selection strategy (Dyck et al., 2019; Benlemlih et al., 2023), whereby they divest from firms with high GHG emissions and reallocate capital toward firms with lower GHG emissions, thereby influencing firms' environmental outcomes through portfolio rebalancing. Finally, our measure of GHG emissions include both total emissions and carbon intensity, with further analyses distinguishing impacts across Scope 1, Scope 2 and Scope 3 emissions. These results also highlight that the effects of Taiwan's Green Finance Action Plans differ significantly between foreign and domestic institutional investors, providing important insights into how policy frameworks interact with ownership structures to shape corporate environmental performance. Overall, our findings provide valuable implications for policymakers in Taiwan and other emerging markets seeking to leverage institutional investors as catalysts for low-carbon transitions. In jurisdictions where regulatory frameworks and engagement-based climate strategies are still evolving, Taiwan's experience offers key lessons on how institutional ownership can be harnessed to accelerate progress toward national and international emissions reduction goals.

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Table 1: Summary Statistics of Carbon Emissions

Panel A presents the distribution and summary statistics of carbon emissions by industry. Panel B presents the distribution and summary statistics by year (2013-2023). Information includes the mean, standard deviation, number of carbon emissions variables and median. Carbon emissions are grouped into three categories: direct emissions from production (Scope 1), indirect emissions from purchased electricity, heat, or steam (Scope 2), and other indirect emissions from purchased material product use waste disposal, outsourced activities, etc. (Scope 3). Emissions are measured in units of tons of CO₂ and normalized using natural logarithms. The carbon intensity (Scope 1 INT- Scope 3 INT) is expressed as tons of CO₂ equivalent scaled by firm revenues.

Panel A: Distribution of Carbon Emissions Variables (by Industry)																		
	Carbon Emissions Scopes									Carbon Intensity Scopes								
	Mean	Std.	Number	Mean	Std.	Number	Mean	Std.	Number	Mean	Std.	Number	Mean	Std.	Number	Mean	Std.	Number
	Log (Scope 1 (tons CO ₂ e))			Log (Scope 2 (tons CO ₂ e))			Log (Scope 3 (tons CO ₂ e))			Scope 1 INT (tons CO ₂ e / Sale)			Scope 2 INT (tons CO ₂ e / Sale)			Scope 3 INT (tons CO ₂ e / Sale)		
Basic Metal	9.665	2.549	246	10.366	1.730	263	10.770	2.047	276	.005	.011	246	.005	.006	263	.010	.013	276
Beverages & Dairy Products	9.678	1.508	42	9.883	1.874	49	10.282	1.950	50	.001	.001	42	.006	.019	49	.007	.020	50
Canning Process	8.524	1.040	72	8.767	.580	91	9.354	.768	108	.001	.002	72	.001	.001	91	.003	.002	108
Cement	12.117	3.638	54	10.637	1.450	63	12.515	2.592	69	.075	.073	54	.006	.005	63	.074	.074	69
Communication Equipment	5.897	2.329	176	7.433	2.526	333	7.518	2.324	421	>.000	>.000	176	.001	.002	333	.001	.002	421
Hardware Equipment	6.329	2.622	1677	8.987	2.391	2095	8.926	2.404	2412	.001	.002	1677	.001	.134	2095	.001	.134	2412
Oil Feed	10.368	2.831	87	9.534	2.182	116	10.186	2.990	124	.007	.014	87	.002	.002	116	.007	.012	124
Petrochemical	10.898	3.066	193	11.039	2.331	198	11.812	2.613	213	.009	.013	193	.006	.006	198	.015	.015	213
Restaurant	7.399	1.183	108	8.651	1.268	144	8.849	1.274	149	.001	.002	108	.007	.027	144	.008	.026	149
Retail	8.000	2.843	55	9.395	2.835	105	9.235	2.852	119	.026	.189	55	.002	.003	105	.015	.128	119
Semiconductor	7.239	3.629	453	9.332	2.752	600	9.295	2.838	695	.003	.011	453	.006	.029	600	.008	.030	695
Panel B: Distribution of Carbon Emissions Variables (by Year)																		
	Carbon Emissions Scopes									Carbon Intensity Scopes								
	Mean	Std.	Median	Mean	Std.	Median	Mean	Std.	Median	Mean	Std.	Median	Mean	Std.	Median	Mean	Std.	Median
	Log (Scope 1 (tons CO ₂ e))			Log (Scope 2 (tons CO ₂ e))			Log (Scope 3 (tons CO ₂ e))			Scope 1 INT (tons CO ₂ e / Sale)			Scope 2 INT (tons CO ₂ e / Sale)			Scope 3 INT (tons CO ₂ e / Sale)		
2013	8.335	3.173	8.329	10.019	2.264	10.021	10.378	2.495	10.359	.004	.016	>.000	.004	.007	.001	.008	.019	.002
2014	8.239	3.202	8.211	9.884	2.267	9.796	10.084	2.515	9.903	.005	.024	>.000	.004	.007	.001	.008	.025	.001
2015	8.104	3.201	7.949	9.788	2.386	9.736	9.946	2.546	9.894	.005	.024	>.000	.006	.034	.001	.010	.039	.001
2016	8.227	3.191	8.125	9.755	2.360	9.725	9.816	2.561	9.750	.005	.018	>.000	.005	.028	.001	.009	.032	.002
2017	8.018	3.236	7.968	9.516	2.496	9.572	9.551	2.619	9.396	.004	.016	>.000	.004	.012	.001	.007	.018	.001
2018	7.829	3.346	7.891	9.353	2.499	9.416	9.299	2.648	9.296	.003	.014	>.000	.003	.005	.001	.005	.013	.001
2019	7.594	3.276	7.465	9.245	2.477	9.343	9.188	2.637	9.204	.003	.013	>.000	.003	.005	.001	.006	.029	.001
2020	7.276	3.243	7.327	8.980	2.448	9.031	8.918	2.587	8.834	.003	.013	>.000	.003	.004	.001	.006	.027	.001
2021	6.910	3.180	6.928	8.815	2.480	8.836	8.805	2.619	8.733	.006	.072	>.000	.002	.004	.001	.009	.073	.001
2022	6.636	2.954	6.467	8.700	2.428	8.743	8.794	2.534	8.856	.002	.012	>.000	.003	.010	.001	.008	.057	.001
2023	6.635	2.882	6.505	8.664	2.449	8.727	8.800	2.545	8.826	.001	.012	>.000	.013	.247	.001	.017	.246	.001

Table 2: Summary Statistics

The table summarizes the variables used in the analysis. The full sample consists of 9,406 firm-year observations of listed and over-the-counter companies with reported carbon emissions in Taiwan, obtained from the TEJ database for the period of 2013-2023. Information includes the mean, standard deviation, min, max, median, p25 and p75. All variables are winsorized at the 1% and 99% levels.

Variables	Mean	Std.	Min	Max	Median	P25	P75
Dependent Var.							
Log (Scope 1)	7.344	3.191	.000	17.218	7.267	5.049	9.474
Log (Scope 2)	9.146	2.473	.000	16.070	9.229	7.400	10.827
Log (Scope 3)	9.213	2.622	.000	17.221	9.229	7.259	10.983
Scope 1 INT	.003	.029	>.000	1.404	>.000	>.000	.001
Scope 2 INT	.005	.097	>.000	6.155	.001	>.000	.004
Scope 3 INT	.009	.100	>.000	6.155	.002	>.000	.005
Independent Var.							
IO	.400	.234	.001	.978	.379	.209	.574
Foreign IO	.112	.156	.000	.900	.045	.007	.145
Domestic IO	.299	.208	.001	.978	.260	.130	.442
Control Var.							
Size	22.303	1.554	17.018	29.330	22.045	21.250	23.111
B/M	.740	.427	.004	3.571	.662	.427	.961
ROE	5.183	39.278	-2729.470	250.76	7.51	.300	14.800
Leverage	.413	.180	.004	.978	.414	.273	.542
Invest/a	-.004	.045	-.593	.306	.002	-.012	.012
HHI	.694	.249	.000	1.000	.683	.492	.968
Logppe	13.623	1.961	2.833	21.841	13.565	12.570	14.771
Salesgr	.127	4.331	-.992	372.228	.011	-.107	.136
Epsgr	>.000	.046	-1.291	.760	.001	-.008	.010

Table 3: Pearson Correlation Coefficients

This table presents correlations among variables used in the analysis.

No.	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1)	Log (Scope 1)	1.00																	
(2)	Log (Scope 2)	0.74	1.00																
(3)	Log (Scope 3)	0.85	0.96	1.00															
(4)	Scope 1 INT	0.23	0.05	0.18	1.00														
(5)	Scope 2 INT	0.15	0.07	0.07	0.05	1.00													
(6)	Scope 3 INT	0.27	0.09	0.12	0.89	0.96	1.00												
(7)	IO	-0.36	-0.41	-0.42	-0.02	-0.01	-0.03	1.00											
(8)	Foreign IO	-0.26	-0.41	-0.39	-0.04	-0.04	-0.02	0.53	1.00										
(9)	Domestic IO	-0.09	-0.02	-0.05	-0.02	0.01	0.02	0.50	-0.19	1.00									
(10)	Size	0.58	0.70	0.70	0.04	-0.01	-0.01	0.40	0.46	0.03	1.00								
(11)	B/M	0.15	0.11	0.11	0.06	0.01	0.02	-0.20	-0.15	-0.10	0.10	1.00							
(12)	ROE	0.02	0.03	0.04	-0.04	-0.01	-0.03	0.08	0.04	0.05	0.14	-0.08	1.00						
(13)	Leverage	0.14	0.18	0.17	-0.04	-0.02	-0.05	0.05	0.04	0.01	0.26	-0.05	-0.11	1.00					
(14)	Invest/a	-0.04	-0.06	-0.06	0.01	0.01	0.01	-0.05	-0.04	-0.02	-0.05	0.13	-0.16	0.02	1.00				
(15)	HHI	-0.09	-0.06	-0.06	0.02	-0.01	0.01	-0.04	-0.01	-0.03	-0.14	-0.04	-0.03	-0.10	0.00	1.00			
(16)	Logppe	0.66	0.80	0.79	0.05	-0.01	-0.02	0.31	0.36	0.02	0.85	0.12	0.08	0.24	-0.09	-0.14	1.00		
(17)	Salesgr	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	0.01	-0.01	-0.01	0.01	-0.03	1.00	
(18)	Epsgr	0.01	0.01	0.01	-0.01	-0.01	-0.01	0.04	0.04	0.01	0.03	-0.11	0.12	0.01	-0.02	0.01	0.01	0.02	1.00

Table 4: The Effect of Institutional Ownership on Carbon Emissions

The sample period is **2013-2023**. The dependent variables are total emissions and carbon intensity. All variables are defined in section 3.1. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance.

Panel A: Institutional Investors (IO)						
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Scope 1)	Log(Scope 2)	Log(Scope 3)	Scope 1 INT	Scope 2 INT	Scope 3 INT
IO	-.564** (.226)	-.395*** (.118)	-.669*** (.117)	-.003*** (.001)	-.006** (.003)	-.018** (.009)
Size	.382*** (.077)	.414*** (.040)	.401*** (.038)	.001 (.001)	-.001 (.002)	.005* (.003)
B/M	-.057 (.082)	-.083** (.042)	-.121*** (.042)	.001 (.002)	.004 (.005)	.002 (.005)
ROE	-.001 (.001)	-.003*** (.001)	-.003*** (.001)	<.000 (>.000)	<.000 (>.000)	<.000* (>.000)
Leverage	-.471* (.249)	-.181 (.126)	-.268** (.126)	-.008* (.004)	-.013 (.011)	-.028** (.013)
Invest/a	1.394*** (.508)	.382 (.252)	.836*** (.253)	-.009 (.013)	.016 (.043)	-.016 (.041)
HHI	.243 (.176)	.015 (.092)	.027 (.095)	.002 (.003)	-.008 (.007)	-.003 (.009)
Logppe	.531*** (.060)	.351*** (.028)	.371*** (.024)	.001 (.001)	.001 (.001)	-.007*** (.002)
Salesgr	-.060 (.077)	.004 (.009)	.006 (.009)	>.000 (.002)	<.000 (.001)	-.001 (.002)
Epsgr	.346 (.412)	.006 (.213)	.158 (.219)	-.001 (.011)	.017 (.039)	.025 (.037)
Constant	-8.054*** (1.222)	-4.976*** (.716)	-4.647*** (.728)	-.003 (.017)	.029 (.036)	-.003 (.047)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.603	.640	.659	.125	.003	.002
# of Obs.	3062	3909	4454	3062	3909	4454
Panel B: Institutional Investors (Foreign IO & Domestic IO)						
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Scope 1)	Log(Scope 2)	Log(Scope 3)	Scope 1 INT	Scope 2 INT	Scope 3 INT
Foreign IO	-1.030*** (.294)	-.507*** (.156)	-.603*** (.163)	-.003** (.001)	-.004** (.002)	-.002** (.001)
Domestic IO	-.129 (.110)	.079 (.053)	.080 (.054)	.002 (.002)	.005 (.013)	.001 (.001)
Size	.376*** (.076)	.423*** (.039)	.424*** (.038)	>.000 (.001)	-.001 (.003)	.007** (.003)
B/M	-.056 (.081)	-.090** (.042)	-.143*** (.042)	.002 (.002)	.005 (.005)	.001 (.005)
ROE	-.001 (.002)	-.003*** (.001)	-.003*** (.001)	<.000 (>.000)	<.000 (>.000)	<.000* (>.000)
Leverage	-.452* (.249)	-.176 (.126)	-.288** (.126)	-.008* (.005)	-.012 (.011)	-.029** (.013)
Invest/a	1.342*** (.507)	.360 (.252)	.813*** (.253)	-.010 (.013)	.017 (.043)	-.014 (.041)
HHI	.254 (.176)	.024 (.092)	.042 (.095)	.002 (.003)	-.007 (.007)	-.002 (.009)
Logppe	.524*** (.060)	.346*** (.028)	.366*** (.024)	.001 (.001)	.001 (.002)	-.007*** (.002)
Salesgr	-.058 (.077)	.004 (.009)	.006 (.009)	.001 (.002)	>.000 (.001)	-.001 (.002)
Epsgr	.314 (.412)	-.008 (.213)	.134 (.220)	-.001 (.011)	.016 (.039)	.025 (.037)
Constant	-7.728*** (1.229)	-5.018*** (.720)	-4.879*** (.737)	-.005 (.017)	.014 (.038)	-.038 (.049)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.600	.638	.655	.125	.005	.002
# of Obs.	3062	3909	4454	3062	3909	4454

Table 5: Institutional Ownership and Carbon Emissions: Results with Lagged Explanatory Variables

The sample period is **2013-2023**. The dependent variables are total emissions and carbon intensity. L. denotes the first lag of a variable. All variables are defined in section 3.1. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance.

Panel A: Institutional Investors (IO)						
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Scope 1)	Log(Scope 2)	Log(Scope 3)	Scope 1 INT	Scope 2 INT	Scope 3 INT
L.IO	-.515** (.232)	-.300** (.121)	-.524*** (.121)	-.006*** (.002)	-.008** (.004)	-.020* (.011)
L.Size	.386*** (.079)	.399*** (.041)	.399*** (.040)	.001 (.001)	-.001 (.003)	.004* (.003)
L.B/M	-.023 (.081)	-.096** (.041)	-.126*** (.042)	.002 (.002)	.004 (.004)	.003 (.006)
L.ROE	-.001 (.001)	-.003*** (.001)	-.003*** (.001)	<.000 (>.000)	<.000 (>.000)	<.000** (>.000)
L.Leverage	.105 (.251)	-.305** (.127)	-.364*** (.131)	-.008* (.004)	-.016 (.011)	-.032** (.014)
L.Invest/a	1.021** (.508)	-.014 (.251)	-.022 (.250)	-.010 (.013)	.023 (.043)	-.015 (.041)
L.HHI	.205 (.181)	.130 (.095)	.235** (.097)	.006** (.003)	-.008 (.007)	.001 (.009)
L.Logppe	.501*** (.063)	.359*** (.030)	.382*** (.026)	.001 (.001)	.001 (.002)	-.005** (.002)
L.Salesgr	-.094 (.077)	.004 (.009)	.006 (.009)	>.000 (.002)	<.000 (.001)	-.001 (.002)
L.Epsgr	.557 (.417)	.173 (.214)	.277 (.227)	.004 (.011)	.010 (.041)	.020 (.039)
Constant	-7.917*** (1.238)	-4.698*** (.730)	-4.705*** (.750)	-.014 (.017)	.030 (.036)	.001 (.048)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.604	.648	.665	.122	.003	.014
# of Obs.	2916	3715	4220	2916	3715	4220
Panel B: Institutional Investors (Foreign IO & Domestic IO)						
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Scope 1)	Log(Scope 2)	Log(Scope 3)	Scope 1 INT	Scope 2 INT	Scope 3 INT
L.Foreign IO	-1.211*** (.306)	-.362** (.165)	-.494*** (.171)	-.004** (.002)	-.007** (.003)	-.003*** (.001)
L.Domestic IO	-.078 (.120)	-.120** (.058)	-.205* (.114)	.001 (.003)	-.002** (.001)	-.005 (.005)
L.Size	.359*** (.078)	.407*** (.041)	.417*** (.040)	>.000 (.001)	-.001 (.003)	.006* (.003)
L.B/M	-.019 (.080)	-.100** (.040)	-.135*** (.041)	.002 (.002)	.005 (.005)	.002 (.006)
L.ROE	-.001 (.002)	-.003*** (.001)	-.003*** (.001)	<.000 (>.000)	<.000 (>.000)	<.000** (>.000)
L.Leverage	.146 (.250)	-.301** (.127)	-.372*** (.131)	-.008* (.005)	-.015 (.011)	-.033** (.014)
L.Invest/a	.958* (.507)	-.036 (.251)	-.050 (.250)	-.010 (.013)	.022 (.043)	-.014 (.041)
L.HHI	.208 (.181)	.135 (.095)	.242** (.097)	.006** (.003)	-.007 (.007)	.001 (.009)
L.Logppe	.499*** (.063)	.356*** (.030)	.377*** (.026)	.001 (.001)	.001 (.002)	-.006** (.003)
L.Salesgr	-.090 (.077)	.004 (.008)	.006 (.009)	.001 (.002)	>.000 (.001)	-.001 (.002)
L.Epsgr	.531 (.416)	.168 (.214)	.276 (.227)	.004 (.011)	.010 (.041)	.021 (.039)
Constant	-7.717*** (1.251)	-4.765*** (.738)	-4.922*** (.760)	-.013 (.018)	.018 (.038)	-.033 (.051)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.601	.646	.662	.121	.005	.015
# of Obs.	2916	3715	4220	2916	3715	4220

Table 6: Institutional Ownership and Carbon Emissions: Heckman Two-Step Estimates

The sample period is **2013-2023**. The dependent variables are total emissions and carbon intensity. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance. The inversed Mills ratios are reported in the bottom of the table.

Panel A: Institutional Investors (IO)						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
IO	-.770** (.304)	-.930*** (.197)	-.732*** (.191)	-.011** (.005)	-.002*** (>.000)	-.008** (.004)
Size	.507*** (.094)	-.055 (.064)	.136** (.062)	.001 (.002)	-.002*** (>.000)	>.000 (.002)
B/M	-.348** (.145)	-.284*** (.093)	-.357*** (.092)	<.000 (.003)	>.000 (>.000)	<.000 (.003)
ROE	-.010*** (.003)	-.003 (.002)	-.006** (.002)	<.000** (>.000)	<.000*** (>.000)	<.000** (>.000)
Leverage	-1.400*** (.328)	-.463** (.208)	-.974*** (.203)	-.020*** (.007)	-.006*** (.001)	-.023*** (.007)
Invest/a	-1.120 (1.309)	2.952*** (.816)	2.732*** (.777)	-.027 (.030)	-.002 (.003)	-.017 (.026)
HHI	1.051*** (.204)	.808*** (.129)	1.046*** (.128)	.001 (.004)	.001*** (>.000)	.001 (.004)
Logppe	1.134*** (.087)	1.111*** (.050)	1.128*** (.051)	.002 (.002)	.002*** (>.000)	.003*** (.001)
Salesgr	.017 (.225)	-.125 (.140)	-.056 (.137)	.005 (.005)	<.000 (>.000)	.003 (.005)
Epsgr	.740 (1.161)	.427 (.754)	.379 (.731)	.001 (.026)	.004 (.003)	.003 (.024)
Constant	-20.389*** (2.612)	-5.819*** (1.743)	-9.902*** (1.690)	-.041 (.059)	.018*** (.006)	-.030 (.056)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.704	.748	.765	.122	.013	.014
# of Obs.	7081	7202	7229	7081	7202	7229
/mills	.897*** (.309)	.020** (.010)	.259** (.107)	.050*** (.017)	.007** (.003)	.050*** (.018)
Panel B: Institutional Investors (Foreign IO & Domestic IO)						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
Foreign IO	-.578** (.271)	-.594** (.254)	-.434** (.172)	-.009*** (.002)	-.006** (.003)	-.008*** (.002)
Domestic IO	-.324 (.388)	-.387** (.177)	-.256 (.246)	-.002 (.002)	-.002** (.001)	-.002 (.002)
Size	.538** (.095)	-.031 (.065)	.170*** (.063)	.001 (.002)	-.001*** (>.000)	>.000 (.002)
B/M	-.410*** (.145)	-.353*** (.093)	-.430*** (.091)	>.000 (.003)	>.000 (>.000)	<.000 (.003)
ROE	-.009** (.003)	-.003 (.002)	-.005** (.002)	<.000** (>.000)	<.000*** (>.000)	<.000** (>.000)
Leverage	-1.397*** (.328)	-.517** (.209)	-1.003*** (.203)	-.019** (.007)	-.006*** (.001)	-.022*** (.007)
Invest/a	-1.247 (1.308)	2.862*** (.820)	2.677*** (.779)	-.025 (.030)	-.002 (.003)	-.017 (.026)
HHI	1.044*** (.203)	.788*** (.131)	1.046*** (.128)	.001 (.005)	.001*** (>.000)	.002 (.004)
Logppe	1.110*** (.086)	1.091*** (.050)	1.108*** (.050)	.003 (.005)	.001*** (>.000)	.003*** (.001)
Salesgr	.024 (.226)	-.128 (.141)	-.059 (.138)	.005 (.005)	<.000 (>.000)	.002 (.004)
Epsgr	.681 (1.157)	.354 (.758)	.336 (.731)	.003 (.026)	.004 (.003)	.004 (.024)
Constant	-20.465*** (2.627)	-5.603*** (1.769)	-10.054*** (1.710)	-.048 (.059)	.017*** (.006)	-.037 (.056)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.701	.746	.662	.221	.105	.015
# of Obs.	7081	7202	7229	7081	7202	4220
/mills	.799*** (.306)	.080** (.040)	.169** (.076)	.014** (.007)	.021*** (.005)	.012** (.006)

Table 7: Institutional Ownership and Carbon Emissions: Instrumental Variables Approach

The sample period is **2013-2023**. The dependent variables are total emissions and carbon intensity. The instrumental variable is the industry average of institutional ownership. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance.

Panel A: Institutional Investors (IO)								
	(1) 1 st Stage	(2) Log(Scope 1) 2 nd Stage	(3) Log(Scope 2) 2 nd Stage	(4) Log(Scope 3) 2 nd Stage	(5) Scope 1 INT 2 nd Stage	(6) Scope 2 INT 2 nd Stage	(7) Scope 3 INT 2 nd Stage	
IO		-634.381*** (81.537)	-253.456*** (59.083)	-315.913*** (61.347)	-.411** (.200)	-.115** (>.050)	-2.146* (1.112)	
IO Industry	.921*** (.100)							
Size	.066*** (.003)	42.693*** (5.441)	17.331*** (3.939)	21.497*** (4.089)	.027 (.059)	-.008 (.124)	.149 (.175)	
B/M	-.060*** (.004)	-38.727*** (4.971)	-15.544*** (3.600)	-19.402*** (3.738)	-.023 (.054)	.010 (.114)	-.131 (.160)	
ROE	>.000 (>.000)	.002 (.002)	-.002*** (.001)	-.002* (.001)	<.000 (>.000)	<.000 (>.000)	<.000 (>.000)	
Leverage	-.101*** (.010)	-64.746*** (8.282)	-25.873*** (5.992)	-32.316*** (6.221)	-.049 (.090)	-.003 (.191)	-.248 (.268)	
Invest/a	-.054** (.022)	-33.091*** (4.463)	-13.400*** (3.221)	-16.340*** (3.342)	-.032 (.050)	.022 (.111)	-.133 (.148)	
HHI	.005 (.007)	3.162*** (.421)	1.180*** (.289)	1.486*** (.300)	.004 (.005)	-.008 (.011)	.007 (.015)	
Logppe	-.003 (.002)	-1.422*** (.262)	-.430** (.185)	-.603*** (.191)	-.001 (.003)	.001 (.006)	-.013 (.008)	
Salesgr	<.000 (>.000)	-.136* (.077)	-.022** (.010)	-.027** (.011)	.001 (.002)	<.000 (>.000)	-.001 (.002)	
Epsgr	-.006 (.020)	-3.348*** (.628)	-1.473*** (.405)	-1.687*** (.419)	-.003 (.012)	.017 (.041)	.012 (.040)	
Constant	-1.35*** (.072)	-20.389*** (2.612)	-252.940*** (57.542)	-313.847*** (59.742)	-.399 (.862)	.134 (1.819)	-2.123 (2.559)	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
R-squared	.308	.600	.748	.652	.124	.003	.001	
# of Obs.	8071	3062	3909	4454	3062	3909	4454	
Wald F Statistic for IO Industry		197.232***	321.537***	355.689***	197.232***	321.537***	355.689***	
Panel B: Institutional Investors (Foreign IO & Domestic IO)								
	(1) 1 st Stage	(2) 1 st Stage	(3) Log(Scope 1) 2 nd Stage	(4) Log(Scope 2) 2 nd Stage	(5) Log(Scope 3) 2 nd Stage	(6) Scope 1 INT 2 nd Stage	(7) Scope 2 INT 2 nd Stage	(8) Scope 3 INT 2 nd Stage
Foreign IO			-15.478*** (3.823)	-7.608*** (2.622)	-10.864*** (2.568)	-.205*** (.040)	-.004** (.002)	-.002** (.001)

Foreign IO_Industry	1.098*** (.141)							
Domestic IO			15.293*** (4.601)	4.390 (3.076)	3.804 (3.001)	.270*** (.002)	.002 (.073)	.139 (.126)
Domestic IO_Industry		1.036*** (.121)						
Size	.037*** (.002)	.006 (.004)	.920*** (.183)	.705*** (.118)	.836*** (.113)	-.009*** (.002)	-.001 (.004)	.005 (.005)
B/M	-.028*** (.002)	-.042*** (.006)	.103 (.281)	-.144 (.182)	-.316* (.175)	.019*** (.003)	.003 (.006)	.006 (.008)
ROE	<.000* (>.000)	>.000 (>.000)	-.001 (.001)	-.003*** (.001)	-.003*** (.001)	<.000 (>.000)	<.000 (>.000)	<.000* (>.000)
Leverage	-.061*** (.007)	-.026 (.017)	-1.078*** (.393)	-.571** (.243)	-.906*** (.236)	.012*** (.006)	-.015 (.012)	-.026* (.014)
Invest/a	.001 (.015)	-.083** (.042)	2.666*** (.628)	.744** (.356)	1.152*** (.353)	.013 (.013)	.016 (.043)	-.005 (.042)
HHI	<.000 (.005)	<.000 (.012)	.249 (.176)	.015 (.093)	.034 (.095)	.002 (.003)	-.008 (.007)	-.003 (.009)
Logppe	.001 (.001)	-.003 (.003)	.602*** (.062)	.373*** (.030)	.394*** (.026)	.001 (.001)	.001 (.002)	-.006*** (.002)
Salesgr	>.000 (>.000)	<.000** (>.000)	-.056 (.077)	.008 (.009)	.009 (.010)	.001 (.002)	<.000 (.002)	-.001 (.002)
Epsgr	-.011 (.013)	.014 (.038)	-.065 (.416)	-.152 (.217)	-.033 (.224)	-.002 (.011)	.016 (.039)	.023 (.037)
Constant	-.823*** (.044)	-.089 (.081)	-24.802*** (2.604)	-12.430*** (1.740)	-14.639*** (1.749)	.081*** (.030)	.023 (.061)	-.051 (.082)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.282	.081	.600	.635	.652	.125	.003	.013
# of Obs.	8071	8071	3062	3909	4454	3062	3909	4454
Wald F Statistic for Foreign IO_Industry			74.138	49.790	65.438	74.138	49.790	65.438
Wald F Statistic for Domestic IO_Industry			230.318	290.949	337.911	230.318	290.949	337.911

Table 8: The Exit and Selection Channels of Institutional Investors in Carbon Emissions Levels

The sample period is **2013-2023**. The dependent variables are total emissions and institutional ownership. L. denotes the first lag of a variable. All variables are defined in section 3.1. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance.

	(1) Log(Scope 1)	(2) IO	(3) Log(Scope 2)	(4) IO	(5) Log(Scope 3)	(6) IO
L.IO	-.208** (.090)	.916*** (.007)	-.048** (.021)	.926*** (.006)	-.091** (.041)	.924*** (.006)
L.Log(Scope 1)	.879*** (.008)	-.002** (.001)				
L.Log(Scope 2)			.903*** (.007)	-.002** (.001)		
L.Log(Scope 3)					.894*** (.007)	-.002** (.001)
L.Size	-.013 (.025)	.005** (.002)	.012 (.014)	.004** (.002)	.024 (.015)	.005*** (.002)
L.B/M	-.016 (.045)	-.022*** (.004)	-.049* (.026)	-.017*** (.003)	-.046* (.027)	-.018*** (.003)
L.ROE	>.000 (.001)	>.001 (.001)	.001 (.001)	>.000 (>.000)	<.000 (.001)	>.000 (>.000)
L.Leverage	.258** (.105)	.004 (.008)	-.033 (.063)	.006* (.007)	-.045*** (.065)	.002 (.007)
L.Invest/a	.236 (.417)	.072** (.033)	-.178 (.210)	.055* (.029)	-.515** (.218)	.034 (.027)
L.HHI	.088 (.066)	-.013** (.005)	.063 (.040)	-.013** (.005)	.118*** (.042)	-.010** (.004)
L.Logppe	.133*** (.022)	-.002 (.002)	.094*** (.013)	-.002 (.002)	.090*** (.013)	-.002* (.001)
L.Salesgr	-.035 (.068)	.019*** (.005)	.002 (.006)	.001 (.001)	.002 (.007)	>.000 (.001)
L.Epsgr	.220 (.375)	.019 (.030)	.277 (.188)	.049* (.027)	.324 (.205)	.055** (.027)
Constant	-.847** (.357)	-.013 (.028)	-.732*** (.217)	-.009 (.024)	-.814*** (.227)	-.021 (.023)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.939	.928	.969	.929	.964	.923
# of Obs.	2524	2524	3282	3282	3795	3795

Table 9: The Exit and Selection Channels of Institutional Investors in Carbon Emissions Intensity

The sample period is **2013-2023**. The dependent variable are carbon intensity and institutional ownership. L. denotes the first lag of a variable. All variables are defined in section 3.1. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance.

	(1) Scope 1 INT	(2) IO	(3) Scope 2 INT	(4) IO	(5) Scope 3 INT	(6) IO
L.IO	-.002** (.001)	.917*** (.007)	-.006** (.003)	.927*** (.006)	-.011** (.005)	.926*** (.006)
L.Scope 1 INT	.102*** (.006)	-.017** (.008)				
L.Scope 2 INT			.588*** (.182)	-.136* (.082)		
L.Scope 3 INT					.598*** (.043)	-.022* (.012)
L.Size	>.000 (>.000)	.005** (.002)	<.000 (.003)	.004** (.002)	.002 (.003)	.005*** (.002)
L.B/M	<.000 (.001)	-.022*** (.004)	.005 (.005)	-.017*** (.003)	.003 (.006)	-.018*** (.003)
L.ROE	<.000 (>.000)	>.000 (>.000)	<.000 (>.000)	>.000 (>.000)	<.000 (>.000)	>.000 (>.000)
L.Leverage	>.000 (.001)	.004 (.008)	-.020 (.014)	.006 (.007)	-.029** (.013)	.002 (.007)
L.Invest/a	<.000 (.002)	.073** (.033)	.014 (.050)	.058** (.029)	-.006 (.046)	.038 (.027)
L.HHI	.003** (.001)	-.012** (.005)	-.012 (.010)	-.012*** (.005)	-.006 (.008)	-.010** (.005)
L.Logppe	>.000 (>.000)	<.000 (>.000)	<.000 (.003)	<.000 (.001)	-.004** (.002)	-.001 (.001)
L.Salesgr	-.001 (.001)	.019*** (.005)	<.000 (.002)	>.000 (>.000)	<.000 (.002)	.001 (.001)
L.Epsgr	.002 (.004)	.019 (.030)	.011 (.046)	.048* (.027)	.017 (.043)	.055** (.027)
Constant	-.005 (.007)	-.022 (.027)	.025 (.045)	-.019 (.023)	.007 (.045)	-.031 (.023)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.483	.928	.007	.929	.084	.923
# of Obs.	2524	2524	3282	3282	3795	3795

Table 10: Institutional Ownership and Carbon Emissions under Taiwan's Green Finance Action Plans

The dependent variables are total emissions and carbon intensity. All variables are defined in section 3.1. We report the results of the pooled regression with standard error clustered at the firm and year levels (in parentheses). All regressions include year and industry fixed effects. *** 1% significance; ** 5% significance; * 10% significance.

Panel A: The sample period is 2013-2017						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
IO	-.471** (.211)	-.903*** (.240)	-.581*** (.183)	-.004** (.002)	-.008** (.004)	-.008* (.004)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.648	.713	.718	.595	.057	.325
# of Obs.	805	1033	1196	805	1033	1196
Panel B: The sample period is 2018-2020 (Under Green Finance Action Plan 1.0)						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
IO	-.837** (.408)	-.109* (.057)	-.141** (.074)	-.001** (.000)	-.002** (.001)	-.009** (.004)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.559	.662	.673	.323	.198	.091
# of Obs.	840	1145	1369	840	1145	1369
Panel C: The sample period is 2021-2023 (Under Green Finance Action Plan 2.0)						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
IO	-.925*** (.346)	-.702*** (.217)	-.679*** (.232)	-.004** (.002)	-.006 (.021)	-.023* (.013)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.593	.634	.629	.069	.005	.015
# of Obs.	1417	1731	1889	1417	1731	1889
Panel D: The sample period is 2013-2017						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
Foreign IO	-.986* (.565)	-1.183*** (.335)	-.819*** (.255)	-.005** (.002)	-.009** (.004)	-.008** (.003)
Domestic IO	.144 (.481)	-.735*** (.279)	-.416* (.226)	.002 (.004)	.003 (.005)	.004 (.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.646	.713	.718	.596	.066	.331
# of Obs.	805	1033	1196	805	1033	1196
Panel E: The sample period is 2018-2020 (Under Green Finance Action Plan 1.0)						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
Foreign IO	-.812 (.557)	-.152* (.079)	-.139** (.063)	<.000 (.000)	-.002** (.001)	-.012** (.005)
Domestic IO	-.883* (.511)	-.078* (.043)	.341 (.282)	-.001* (.000)	-.002** (.001)	.004 (.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.559	.662	.672	.322	.202	.091
# of Obs.	840	1145	1369	840	1145	1369
Panel F: The sample period is 2021-2023 (Under Green Finance Action Plan 2.0)						
	(1) Log(Scope 1)	(2) Log(Scope 2)	(3) Log(Scope 3)	(4) Scope 1 INT	(5) Scope 2 INT	(6) Scope 3 INT
Foreign IO	-.137 (.108)	-.094 (.063)	-.102* (.053)	-.002 (.002)	-.003 (.028)	-.001 (.029)
Domestic IO	-.720** (.360)	-1.016*** (.294)	-.861** (.426)	-.003* (.001)	-.034** (.016)	-.025** (.012)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.589	.632	.626	.069	.008	.015
# of Obs.	1417	1731	1889	1417	1731	1889