ENVIRONMENTAL PROTECTION TAX AND CORPORATE GREENHUSHING: EVIDENCE FROM CHINA

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Abstract. This paper examines how the environmental fee-to-tax reform affects corporate greenhushing behavior using a sample of high-carbon emission firms listed in China's A-share market from 2011 to 2023. Greenhushing refers to the deliberate under-communication of sustainability practices by companies despite their actual environmental investments. Our findings show that the environmental tax reform significantly promotes corporate greenhushing. This effect is more pronounced in regions with weak market institutions, in highly competitive industries, and among private enterprises. Further mechanism analysis reveals that the reform enhances corporate greenhushing motives by strengthening enforcement standardization and increasing market attention pressure. These findings complement our understanding of environmental regulation and corporate disclosure strategies, providing important implications for improving environmental governance policies.
Keywords: *information disclosure, greenwashing, difference-in-differences, institutional environment, ownership type*

Introduction

With climate change becoming increasingly severe, corporate environmental information disclosure has become a focal point in global capital markets. The concept of sustainability itself is multifaceted, viewed variously as an organizational capability (Amui et al., 2017), an instrumental tool (Gold and Schleper, 2017), an ongoing daily practice (Jennings and Zandbergen, 1995), or a transformative social process (Banerjee, 2003; Fritz and Silva, 2018). In June 2023, the International Sustainability Standards Board (ISSB) released its first standards, IFRS S1 and IFRS S2, ushering in a new era of sustainability-related disclosures in global capital markets. Against this backdrop, corporate environmental information disclosure strategies have diverged into two distinct approaches: "greenwashing" and "greenhushing" (Font et al., 2017). While "greenwashing" is widely understood as the practice of misleading stakeholders with exaggerated or false sustainability claims, this study focuses on the emerging phenomenon of greenhushing.

Formally, greenhushing refers to the deliberate under-communication or downplaying of genuine sustainability practices by companies (Font et al., 2017). It is a strategy where firms, despite having a high commitment to sustainability, intentionally choose to remain silent about their positive environmental actions (Falchi et al., 2022). This behavior is often described as "going green, then going quiet", a phenomenon observed in approximately one-quarter of companies that actively reduce emissions without disclosing their targets. The key distinction is that while greenwashing is characterized

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by low commitment and high communication, greenhushing represents the opposite: high commitment and low communication (Delmas and Burbano, 2011; Baldassarre and Campo, 2016).

On January 1, 2018, China officially implemented the Environmental Protection Tax Law, marking the formal transition from environmental protection fees to taxes. This reform not only elevated the legal hierarchy from administrative regulations to law but also transformed the collection method from administrative charges to legal taxation. Existing research has primarily focused on the impact of environmental tax reform on corporate green innovation (Bolton and Kacperczyk, 2021a), environmental performance (Han et al., 2022), and carbon risk (Bolton and Kacperczyk, 2021b). However, few studies have explored how environmental tax reform affects corporate environmental information disclosure strategies, particularly greenhushing behavior. Given that the environmental tax reform may influence corporate disclosure costs and benefits through higher collection standards and strengthened enforcement norms (Tang et al., 2019; Shi et al., 2023), thereby altering disclosure strategy choices, it is theoretically and practically significant to examine the relationship between environmental tax reform and corporate greenhushing.

Using a sample of high-carbon emission companies listed on China's A-share market from 2011 to 2023, this study employs a difference-in-differences model to investigate the impact of environmental tax reform on corporate greenhushing. The findings show that: First, environmental tax reform significantly promotes corporate greenhushing behavior. Second, this effect is more pronounced in regions with weak market institutions, industries with high competition, and private enterprises. Third, environmental tax reform primarily enhances corporate greenhushing motives by strengthening enforcement norms and increasing market attention pressure.

This paper makes three main contributions: First, while existing research on environmental tax reform primarily focuses on its impact on corporate environmental behavior, this study examines the effects from an information disclosure strategy perspective, enriching the research dimensions of environmental regulation policy evaluation. Second, unlike existing literature that mainly focuses on greenwashing behavior, this paper concentrates on an emerging disclosure strategy—greenhushing, systematically analyzing how institutional changes influence corporate information disclosure strategy choices, thereby developing corporate environmental information disclosure theory. Finally, based on China's environmental tax reform as a quasi-natural experiment, this study provides new empirical evidence for corporate greenhushing research, offering important policy implications for improving environmental information disclosure systems.

Therefore, the objective of this study is to investigate whether and how China's 2018 environmental tax reform influences corporate greenhushing behavior, and to explore the underlying mechanisms and boundary conditions of this effect.

Literature review and theoretical analysis

Literature review

The trajectory of eco-financial regulations in China reflects a fundamental policy shift. Effective sustainability communication aims to integrate environmental concerns with societal values (Godemann and Michelsen, 2011) through practices like web-based disclosure (Da Giau et al., 2016), often arising from either voluntary strategy or

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stakeholder pressure (Bendig et al., 2023). The initial administrative framework, established in the late 1970s, relied on a basic fee collection mechanism that proved largely symbolic. Without sufficient deterrence or robust oversight, businesses routinely circumvented their environmental obligations, as the monetary consequences of non-compliance remained negligible compared to the investment required for adherence (Ma et al., 2025).

The phenomenon of corporate greenhushing has emerged as a significant yet understudied aspect of environmental disclosure strategy, representing a distinct departure from the more widely examined concept of greenwashing. While the broader literature on corporate environmental disclosure has extensively documented firms' tendencies to overstate their environmental commitments, the opposite behavior of under-communicating genuine environmental efforts has only recently gained scholarly attention. This emerging stream of research challenges traditional assumptions about the relationship between environmental performance and disclosure, suggesting that firms may strategically choose to remain silent about their positive environmental actions despite substantial investments in sustainability initiatives.

The formal conceptualization of greenhushing can be traced to Font et al. (2017), who introduced the term in the context of tourism businesses, defining it as "the deliberate under communicating of sustainability practices by tourism businesses." This context is particularly well-studied due to specific consumer behaviors, such as cynicism, during leisure time (Kuokkanen and Sun, 2020). Their seminal work established greenhushing as a legitimate area of academic inquiry, distinguishing it from mere non-disclosure by emphasizing the deliberate and strategic nature of this under-communication (Cohen, 2006). The authors identified several motivations for greenhushing behavior, including concerns about competitive disadvantage, fear of stakeholder backlash (Ettinger et al., 2021; Farooq and Wicaksono, 2021; Thakur et al., 2023), and uncertainty about the credibility of sustainability claims in an industry increasingly scrutinized for environmental impact.

Building upon this foundation, Falchi et al. (2022) expanded the greenhushing concept beyond the tourism sector, providing a more comprehensive theoretical framework in Business Strategy and Environment. They describe greenhushing as the deliberate under-communication or downplaying of genuine sustainability practices by companies despite their actual environmental investments, creating a conceptual distinction between this behavior and simple non-disclosure. Their work emphasizes that greenhushing represents a strategic choice by firms that have made substantial environmental commitments but choose to communicate these efforts minimally or not at all. This theoretical advancement has been crucial in establishing greenhushing as a distinct phenomenon worthy of academic investigation across various industries and contexts.

The strategic nature of corporate environmental disclosure has been further illuminated by the theoretical framework proposed by Delmas and Burbano (2011), which categorizes corporate environmental strategies along two dimensions: environmental commitment and environmental communication. This framework creates four distinct quadrants, with greenhushing occupying the high-commitment, low-communication quadrant, directly opposite to greenwashing's low-commitment, high-communication position. This conceptual mapping has provided researchers with a valuable tool for understanding the full spectrum of corporate environmental disclosure strategies and has highlighted the complexity of firms' strategic choices regarding environmental communication. Other scholars have built on this framework, offering complementary

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terminologies such as the "Translucent/Opaque" matrix (Baldassarre and Campo, 2016) and the "Discreet/Apathetic" positioning (Ginder et al., 2021).

Recent empirical evidence has documented the growing prevalence of greenhushing behavior across multiple sectors. South Pole, a leading carbon management consultancy, conducted comprehensive research revealing that approximately one-quarter of companies that actively reduce emissions do not disclose their climate targets publicly. This finding, described as companies "going green, then going quiet," provides concrete evidence that greenhushing is not merely a theoretical concept but a widespread business practice with significant implications for environmental governance and market-based climate solutions. The consultancy's research identified several key drivers of greenhushing behavior, including companies' concerns about being held to unrealistic standards, fear of scrutiny from activists and regulators, and worry about being accused of greenwashing if their communications are perceived as excessive or self-promotional.

The relationship between environmental regulation and corporate disclosure strategies has been explored by several researchers, though most studies focus on mandatory disclosure requirements rather than strategic under-communication. Wang et al. (2021) examine how environmental policy uncertainty affects corporate disclosure decisions, finding that firms tend to reduce environmental disclosures when regulatory uncertainty is high. Their research suggests that the regulatory environment shapes not only environmental behavior but also communication strategies, with firms adopting more conservative disclosure approaches when facing uncertain regulatory landscapes. This finding is particularly relevant for understanding how major regulatory changes, such as environmental tax reforms, might influence firms' disclosure strategies.

The theoretical underpinnings of strategic environmental disclosure draw heavily from information economics and voluntary disclosure theory. The literature identifies several key factors that influence firms' environmental disclosure decisions, including proprietary cost concerns, reputational considerations, and regulatory environment characteristics. Firms must balance the potential benefits of environmental disclosure, such as enhanced reputation, access to green capital markets, and stakeholder goodwill, against various costs including competitive disadvantage from information revelation, increased stakeholder expectations, and heightened regulatory scrutiny. Walker and Wan (2012) provide important insights into the reputational implications of environmental disclosure, suggesting that firms may engage in strategic under-communication to manage stakeholder expectations and avoid becoming targets for activists or regulators. Against various costs including competitive disadvantage from information revelation, increased stakeholder expectations, and heightened regulatory scrutiny, as well as unintended negative side-effects on consumer perception (Acuti et al., 2022).

The Chinese institutional context provides a particularly rich setting for studying corporate environmental disclosure strategies due to the country's recent transformation of environmental governance structures. The transition from administrative environmental fees to formal environmental taxation in 2018 represents a significant institutional change that affects both the costs and benefits of environmental disclosure. This reform elevated environmental regulation from administrative rules to national law, reduced local government discretion in enforcement, and transferred collection authority from environmental departments to tax authorities, creating new incentives and constraints for corporate environmental disclosure strategies.

Despite the growing practical importance of greenhushing behavior, the academic literature remains relatively limited compared to the extensive research on greenwashing.

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Most existing studies focus on specific industries or examine consumer preferences rather than corporate strategies. Few studies have systematically examined how major regulatory changes affect firms' choices regarding environmental disclosure strategies, and even fewer have explored the antecedents and consequences of greenhushing behavior using large-scale empirical data. This research gap presents an important opportunity for advancing our understanding of corporate environmental disclosure strategies and their responsiveness to regulatory interventions, particularly in the context of market-based environmental policies such as environmental taxation.

Theoretical analysis

The core function of eco-taxation mechanisms lies in their capacity to transform societal and ecological externalities into quantifiable business expenses. Economic frameworks suggest that incorporating pollution-related costs into operational budgets creates a direct financial incentive for emissions reduction, theoretically continuing until incremental expenditure matches tax obligations (Dewees, 1983). Yet this conceptual model presupposes transparent communication channels between corporations and their constituents. The presence of informational gaps in actual market conditions frequently results in organizations implementing calculated approaches to disclosure management.

The disclosure costs under environmental tax can be analyzed from two perspectives. First, based on proprietary cost theory and the Resource-Based Theory (Barney, 1991), environmental information disclosure may lead to the leakage of business secrets and trigger peer imitation effects (Falchi et al., 2022). When environmental tax increases compliance costs, firms face greater pressure to maintain competitive advantages. Complete disclosure might encourage competitors to learn and imitate, potentially eroding the firm's market position. Second, from a reputation insurance perspective, although environmental information disclosure helps obtain resource preferences and green image, it may also turn the firm into a "whipping boy," not only causing commercial secrets to leak but also gradually raising stakeholders' expectations, requiring firms to invest more resources (Walker and Wan, 2012). Attribution theory explains that consumers' perception of a firm's motives—whether genuine or opportunistic—is central to these reputational calculations (Christis and Wang, 2021; Ginder et al., 2021).

The implementation of environmental tax represents a significant enhancement in regulatory pressure compared to the previous fee system. Drawing from institutional theory, we argue that this increased pressure affects corporate disclosure strategies through two mechanisms. First, environmental tax reform elevates the legal hierarchy of environmental governance, reducing local government intervention and strengthening enforcement standardization. The stricter enforcement and higher penalties for non-compliance increase firms' "greenwashing" accusations and environmental litigation risks (Bolton and Kacperczyk, 2021a).

Second, the uncertainty of environmental regulations may exacerbate firms' disclosure concerns. Since firms cannot predict the timing and intensity of future environmental regulations, environmental policy uncertainty adds to the unknown risks faced by disclosing firms (Wang et al., 2021). Under the condition of "good people are hard to be," greenhushing can help firms avoid unnecessary government suspicion and disputes, better meeting organizational rationality and legitimacy requirements (Huang et al., 2022).

Based on the above analysis, environmental tax reform may promote corporate greenhushing behavior through both cost and regulatory pressure mechanisms. From the cost perspective, environmental tax increases firms' compliance costs and disclosure

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costs. The higher cost burden may motivate firms to adopt greenhushing strategies to protect competitive advantages and avoid excessive stakeholder expectations. From the regulatory pressure perspective, strengthened enforcement and policy uncertainty under environmental tax reform increase firms' litigation risks and regulatory scrutiny, making greenhushing a rational choice to reduce exposure risks.

Therefore, we propose our hypothesis:

H1: Environmental tax reform promotes corporate greenhushing behavior.

Methods

Sample and dataset

The sample period for this study spans from 2011 to 2023, covering the years before and after the 2018 environmental tax reform. Our initial sample consists of all A-share listed companies in China. Given that the environmental tax primarily targets polluting industries, our research focuses on firms within high-carbon emission sectors. Following the "Guidelines for Industry Classification of Listed Companies" issued by the China Securities Regulatory Commission (CSRC) in 2012, we identify firms in industries such as mining, textiles, petroleum processing, chemical manufacturing, and electricity/heat production as our primary research subjects. All firms in other, non-high-emission industries are excluded from the initial sample. To further refine our sample, we manually exclude new energy enterprises (e.g., wind, solar, and nuclear power) from the electricity and heat production sector, as they do not align with the high-emission characteristic.

Our data are compiled from multiple sources. The core dependent variable, corporate greenhushing, was manually constructed through textual analysis of companies' annual reports, sustainability reports, and social responsibility reports. Financial data for firm-level control variables, such as firm size, leverage, and return on assets, were obtained from the China Stock Market & Accounting Research (CSMAR) and Eastmoney Professional Services (EPS) databases. Provincial-level data, including those needed to measure environmental regulation intensity, were collected from the China Statistical Yearbook, China Energy Statistical Yearbook, and relevant provincial statistical yearbooks.

To construct a clean and reliable dataset for our empirical analysis, we apply the following standard screening procedures: (1) we exclude firms designated as "Special Treatment" (ST or *ST) due to financial distress; (2) we remove firms with less than one year of listing history or those that were delisted during our sample period; and (3) we drop firm-year observations with missing values for the main variables required for our regression models. These screening procedures are consistent with standard practices in corporate finance literature and are necessary to ensure a stable panel dataset, which is essential for the validity of our difference-in-differences estimation. By removing firms with incomplete data or those in special financial distress, we mitigate potential noise and bias, thereby improving the reliability of our results. After applying these filters, our final sample consists of 802 firms, comprising 4,456 firm-year observations. To mitigate the influence of extreme outliers, all continuous variables are winsorized at the 1% and 99% levels.

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Measure

Dependent variable

Following Yu et al. (2020), we measure corporate greenhushing by quantifying the gap between a firm's environmental actions (Action) and its environmental disclosures (Word).

To measure environmental disclosure, we construct a dictionary of 145 text keywords based on relevant carbon policies and regulations. Using Python, we calculate the frequency of these keywords in firms' annual and CSR reports, with the final frequency score weighted by industry-year to eliminate industry-specific differences (Loughran and McDonald, 2016).

Environmental actions are measured using a comprehensive scoring system based on the "action-effect-certification" framework (Cheng et al., 2024), which evaluates firms' substantive environmental efforts across three dimensions: (1) The action dimension measures direct environmental investments and inputs, including investments in green technology R&D, expenditures on energy-saving equipment, and establishment of dedicated environmental management departments; (2) The effect dimension captures tangible performance outcomes, including quantity of recycled materials used, year-over-year reduction in water consumption per unit of output, and specific data on key pollutant reductions; (3) The certification dimension considers whether firms have obtained ISO 14001 environmental management system certification or green building certification. A composite Action score is created by summing scores across these dimensions for each firm-year observation.

Both raw scores are then standardized by industry and year to create Action_std and Word_std. we calculate the difference between these standardized scores, denoted as D_GHD:

$$D\_GHD_{it} = Action\_std_{it} - Word\_std_{it} \quad \text{(Eq.1)}$$

Based on this difference, we construct our two dependent variables. The first is the Greenhushing Degree (GHD), a continuous variable measuring the intensity of greenhushing. It is defined as the positive part of the difference, ensuring it is zero for non-greenhushing firms:

$$GHD_{it} = max\,(D\_GHD_{it}, 0) \quad \text{(Eq.2)}$$

The second is Greenhushing (GH), a binary indicator variable that captures the incidence of greenhushing. It equals 1 if a firm's actions exceed its disclosures, and 0 otherwise:

$$GH_{it} = \begin{cases} 1\ if\ D\_GHDit > 0 \\ 0\ if\ D\_GHDit\ \leq 0 \end{cases} \quad \text{(Eq.3)}$$

This clear distinction allows us to test both whether firms are more likely to greenhush (using GH) and whether the extent of their greenhushing increases (using GHD).

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Independent variable

Our key independent variable is the environmental tax reform. Following existing research (Liu et al., 2022), we construct two variables to capture the reform effect: Post, a time dummy variable that equals 1 for years after 2018 (including 2018), and 0 otherwise; and Treat, a group dummy variable that equals 1 if the firm's province has significantly increased environmental tax rates after the reform, and 0 otherwise.

Control variable

Following existing literature, we control for firm characteristics and corporate governance factors that may affect greenhushing behavior. For firm characteristics, we include firm age (Age) measured as the natural logarithm of years since establishment, firm size (Size) as the natural logarithm of total assets, operating cash flow (Flow), leverage ratio (Lev) measured as total liabilities divided by total assets, return on assets (Roa), and revenue growth rate (Growth). For corporate governance, we include board size (Board) as the natural logarithm of board members, independent director ratio (Director), fixed assets ratio (Fixed), largest shareholder ownership (Top1), number of executives (Number) as its natural logarithm, intangible assets ratio (Intang), top 10 shareholders ownership (Top10), and ownership balance (Balance) measured as the sum of second to fifth largest shareholders' ownership divided by the largest shareholder's ownership.

Model specification

Our empirical strategy leverages a quasi-natural experimental setting arising from the introduction of novel ecological legislation in China's regulatory framework. Specifically, we harness the 2018 fiscal policy transformation as an external intervention to construct a dual-comparison analytical framework, capturing dynamic behavioral changes by comparing variations between affected and unaffected entities across distinct temporal periods. This methodological approach enables the identification of causal effects while controlling for both time-invariant characteristics and temporal trends. Our baseline model is specified as follows:

$$GH_{it} = \beta_0 + \beta_1\ Treat\ _i \times\ Post\ _t + \gamma X_{\mathrm{it}} + \eta_t + \lambda_i + \varepsilon_{it} \qquad \text{(Eq.4)}$$

Each observation in our dataset is denoted by subscripts i and t for firm and year identifiers. GH_{it} represents our main variable of interest, capturing the extent of corporate greenhushing activities. The $Post_t$ indicator takes the value of 1 for observations after the 2018 reform implementation and 0 for the pre-reform period. Our identification strategy builds on regional variations in tax policy adoption: $Treat_i$ equals 1 for firms registered in provinces that enacted substantial tax rate increases, and 0 for those in other regions. β_1, our focal parameter, measures how the reform shapes firms' greenhushing decisions. Finding a positive and statistically significant β_1 would validate our prediction that the tax reform induces firms to engage in greenhushing practices.

To ensure the robustness of our results, we also use the greenhushing degree (GHD) as an alternative dependent variable:

$$GHD_{it} = \alpha_0 + \alpha_1 Treat\ _i \times\ Post\ _t + \gamma X_{\mathrm{it}} + \eta_t + \lambda_i + \varepsilon_{it} \qquad \text{(Eq.5)}$$

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where GHD_it measures the extent of greenhushing. The interpretation of other variables remains the same as in equation (1). This specification allows us to examine not only whether firms engage in greenhushing but also how much they greenhush in response to environmental tax reform.

Results

Descriptive trends analysis

To address concerns about the temporal dynamics of our key variables and validate our identification strategy, we first examine the trends in greenhushing behavior and environmental performance indicators over our study period (2011-2023).

Greenhushing degree trends

Figure 1 presents the annual trends in average greenhushing degree (GHD) for treatment and control groups. Several important patterns emerge that support our research design and main hypothesis.

Figure 1. *Trends in corporate greenhushing degree (2011-2023)*

First, both groups exhibit relatively stable and parallel trends during the pre-reform period (2011-2017). The treatment group averages a GHD of 0.48, while the control group averages 0.51, with natural fluctuations reflecting economic cycles and industry-specific factors. Importantly, there are no systematic pre-trends that would violate our difference-in-differences identification assumptions.

Second, starting from 2018 (the reform implementation year), we observe a sharp and persistent divergence between the two groups. The treatment group shows a notable increase in average GHD from 0.48 in 2017 to 0.67 in 2018—a 40% increase. This elevated level persists through subsequent years, stabilizing around 0.71-0.75.

Third, the control group shows much more modest changes, with GHD gradually increasing from 0.51 in 2017 to 0.58 in 2023. This pattern suggests that the sharp increase observed in treatment provinces is indeed attributable to the environmental tax reform rather than general time trends or concurrent policies.

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Environmental performance context

Figure 2 provides crucial context for interpreting our greenhushing findings by decomposing the underlying components and examining environmental performance indicators.

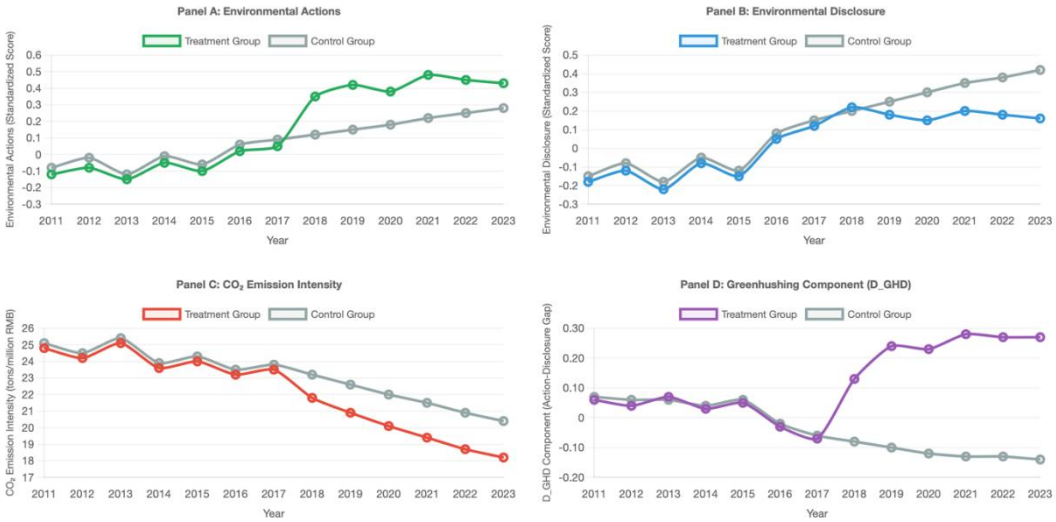

Figure 2. *Environmental performance and disclosure components (2011-2023)*

Panel A shows that environmental actions (measured using our "action-effect-certification" scoring system) increase substantially for treatment group firms post-2018, while control group firms show more modest improvements. This indicates that firms in treatment provinces are indeed enhancing their environmental efforts following the tax reform.

Panel B reveals that environmental disclosure (measured using weighted keyword frequency from reports) grows much more slowly for treatment group firms compared to their environmental actions. While control group firms show steady increases in disclosure that roughly match their action improvements, treatment group firms exhibit a clear divergence between actions and disclosure post-2018.

Panel C displays CO2 emission intensity trends manually collected from company reports. Both groups show declining emission intensities over time, consistent with China's broader decarbonization efforts. Notably, treatment group firms exhibit faster emission reductions post-2018, indicating that the environmental tax reform is achieving its intended environmental outcomes.

Panel D presents the D_GHD component (the standardized difference between environmental actions and disclosure) that directly determines greenhushing behavior. This panel clearly illustrates how the action-disclosure gap widens for treatment firms post-2018, turning positive and remaining elevated. In contrast, control firms show a declining or stable gap, with disclosure keeping pace with actions.

Descriptive analysis

Based on the descriptive statistics (*Table 1*), we find that the mean value of GH is 0.564, indicating that about 56.4% of sample firms exhibit greenhushing behavior. The degree of greenhushing (GHD) has a mean of 0.542 with a standard deviation of 0.725,

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ranging from 0 to 4.435, suggesting considerable variation in greenhushing intensity across firms. To interpret these values: GHD = 0 indicates firms whose environmental disclosure equals or exceeds their environmental actions (non-greenhushing), while GHD = 4.435 represents the most extreme greenhushing case where environmental actions substantially exceed disclosure. The mean GHD of 0.542 suggests that the average firm under-communicates their environmental efforts by approximately 0.542 standardized units relative to industry-year benchmarks, indicating that moderate greenhushing behavior is common among Chinese high-carbon emission firms. For our key independent variable, about 48% of the sample firms are from provinces with stronger environmental tax reform implementation (Treat=0.480). The control variables show that our sample firms have moderate leverage (mean Lev=0.454) and profitability (mean Roa=0.041), indicating the representativeness of our sample.

Table 1. *Summary statistics of the key varibles*

Variables	N	Mean	S.D.	Min	Max
GH	4,456	0.564	0.496	0	1
GHD	4,456	0.542	0.725	0	4.435
Treat	4,456	0.48	0.499	0	1
Post	4,456	0.5	0.5	0	1
Size	4,456	22.607	1.504	18.776	28.543
Flow	4,456	19.671	1.795	10.753	26.628
Lev	4,456	0.454	0.209	0.055	0.885
Roa	4,456	0.041	0.047	-0.12	0.184
Growth	4,456	0.145	0.437	-0.615	2.901
Board	4,456	2.159	0.199	1.386	2.89
Balance	4,456	0.67	0.569	0.022	2.543

Notes: This table reports the summary statistics for the main variables used in our analysis. GH is a binary indicator for greenhushing (1=yes, 0=no). GHD is the continuous measure of the greenhushing degree. Treat is a dummy variable for firms in provinces with higher environmental tax rates. Post is a dummy variable for the period after the 2018 reform. Size is the natural logarithm of total assets. Flow is operating cash flow. Lev is the leverage ratio (total liabilities to total assets). Roa is the return on assets. Growth is the revenue growth rate. Board is the natural logarithm of the number of board members. Balance is a measure of ownership balance

Baseline results

Table 2 presents our baseline difference-in-differences results using three increasingly rigorous specifications. Column (1) provides the baseline specification with firm fixed effects and industry-year fixed effects. Column (2) adds city-year fixed effects to control for time-varying city-level characteristics that might affect both environmental regulation and corporate behavior. Column (3) represents our most stringent specification, adding city-industry fixed effects to control for city-industry specific trends that could confound our results.

First, the coefficient of Treat × Post is consistently positive and statistically significant across all model specifications, ranging from 0.253 to 0.289. This suggests that the environmental tax reform significantly increases corporate greenhushing behavior. The effect remains robust after controlling for various fixed effects, indicating a causal relationship between environmental tax reform and greenhushing.

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Table 2. *The impact of environmental tax reform on corporate greenhushing*

	Model 1	**Model 2**	**Model 3**
Treat × Post	0.289**	0.276***	0.253***
	(0.085)	(0.087)	(0.082)
Constant	0.564***	0.586	0.102
	(-6.03)	(-1.11)	(-1.13)
Control Variables	Yes	Yes	Yes
Industry-year FEs	Yes	Yes	Yes
City-year FEs	No	Yes	Yes
City-industry FEs	No	No	Yes
Company FEs	Yes	Yes	Yes
Observations	4,456	4,456	4,456
R-squared	0.368	0.367	0.248

Notes: This table presents the baseline regression results. The dependent variable is the greenhushing indicator (GH). The key independent variable, Treat × Post, is the interaction term for the difference-in-differences model. All regressions include a full set of firm-level control variables. Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Second, regarding control variables, Firm size (Size) shows a consistently negative and significant relationship with greenhushing at the 1% level, suggesting that larger firms are less likely to engage in greenhushing behavior. This reflects the stronger institutional pressure for environmental transparency that larger firms face, combined with higher reputational stakes that make comprehensive disclosure more beneficial than strategic under-communication of environmental efforts.

Third, the explanatory power of our models is reasonable, with R-squared values ranging from 0.248 to 0.368. The decline in R-squared from Model 1 to Model 4 is expected as we add more stringent fixed effects to control for unobserved heterogeneity.

Fourth, the results are economically significant. Based on our most rigorous specification (Model 3), environmental tax reform increases the likelihood of greenhushing by approximately 25.3 percentage points, highlighting the substantial impact of the policy change on corporate disclosure behavior.

Overall, these findings provide strong evidence that the environmental tax reform leads to increased corporate greenhushing, supporting our main hypothesis. The results are robust to various model specifications and the inclusion of different fixed effects that control for potential confounding factors at the industry, city, and firm levels.

Robust test

Parallel trend test

The parallel trend test results are shown in *Figure 3.* To validate our difference-in-differences identification strategy, we examine the dynamics of the treatment effect by interacting the treatment dummy with time dummies relative to the reform year, using the year before the reform as the baseline period.

As shown in *Figure 1*, the coefficients of interaction terms in the pre-reform periods (t = -3, -2, -1) are statistically insignificant and close to zero, suggesting no systematic differences in greenhushing trends between treatment and control groups before the environmental tax reform. This supports the parallel trend assumption underlying our difference-in-differences analysis.

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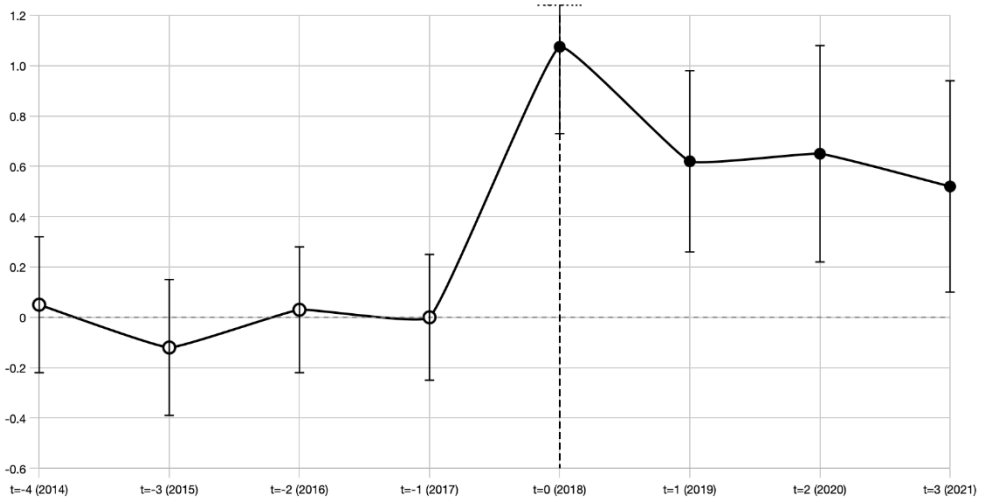

Figure 3. *Parallel trend test. Notes: This figure presents the event study analysis examining the dynamic effects of environmental tax reform on corporate greenhushing behavior. The horizontal axis shows years relative to the environmental tax reform implementation in 2018 (t=0). The vertical axis shows coefficient estimates from regressing greenhushing degree on year-specific treatment indicators, with 95% confidence intervals. The baseline period is t=-1 (2017). Pre-reform coefficients (t=-4 to t=-1) test the parallel trends assumption, showing no significant differences between treatment and control groups. Post-reform coefficients (t=0 to t=3) show significant positive effects, confirming that the environmental tax reform increases corporate greenhushing behavior. The dotted horizontal line at zero provides a reference point for statistical significance*

As shown in *Figure 3*, starting from the reform year (t = 0), we observe a significant positive effect (coefficient = 1.075, $p < 0.10$), indicating a sharp increase in greenhushing behavior immediately following the implementation of environmental tax reform. This effect remains positive but moderates in the subsequent year (t = 1, coefficient = 0.579), suggesting a persistent but diminishing impact of the reform.

The absence of significant pre-trends and the clear pattern change after the reform implementation provide strong support for our identification strategy, suggesting that the observed increase in greenhushing behavior can be causally attributed to the environmental tax reform rather than pre-existing differences or concurrent trends.

Propensity score matching method

We enhance our identification strategy through PSM-DID analysis to validate the primary results against potential selection concerns. By utilizing this methodological refinement, we first construct matched pairs of treatment and control firms based on their pre-reform attributes. Specifically, the matching algorithm incorporates multiple firm-level indicators: size, leverage, profitability, growth, board size, and independent director ratio. Through nearest neighbor matching procedures, we establish comparable treatment-control pairs. The estimation outcomes, documented in *Table 3*, demonstrate that the Treat × Post coefficient maintains its positive significance with similar economic magnitude as our baseline specifications. These PSM-DID estimates provide additional confidence that our findings are not driven by systematic differences in observable firm characteristics.

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Table 3. *Robustness check results*

	PSM-DID	Placebo Test	Alternative dependent variable
Treat × Post	0.272**	0.276	0.187***
	(0.082)	(0.087)	(0.092)
Constant	0.564***	0.586	0.612***
	(0.203)	(0.220)	（0.203）
Control Variables	Yes	Yes	Yes
Industry-year FEs	Yes	Yes	Yes
City-year FEs	Yes	Yes	Yes
City-industry FEs	Yes	No	Yes
Company FEs	Yes	Yes	Yes
Observations	4,456	4,456	4,456
R-squared	0.368	0.367	0.248

Notes: This table presents the results for our robustness checks. In Column (1), the model is estimated using a sample matched by PSM-DID. In Column (2), a placebo test is conducted by advancing the policy implementation year. In Column (3), we use an alternative measure for greenhushing as the dependent variable. Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Placebo test

To rule out the possibility that our main results are driven by other concurrent policies or random events, we conduct a placebo test by artificially setting the implementation year of Environmental Protection Tax Law to 2017 (one year before the actual reform) and use 2013-2021 as the new observation window. As shown in columns (2) of the *Table 3*, the coefficients of Treat × Post are not statistically significant under different specifications, suggesting that our baseline results are not driven by other policies or random events. This supports the validity of our identification strategy and reinforces our main conclusion that the environmental tax reform leads to increased corporate greenhushing behavior.

Alternative measures for greenhushing

To address potential measurement bias concerns, we employ an alternative measure of greenhushing following Du et al. (2015) and Clarkson et al. (2008). This measure is calculated as the difference between firms' actual environmental performance and expected performance, with negative values set to zero. Actual performance is measured using environmental performance scores disclosed in annual reports, sustainability reports, and CSR reports, while expected performance is calculated using Clarkson et al.'s model. As shown in *Table 3* Column (3), the coefficient of Treat × Post remains positive and significant at the 5% level, consistent with our baseline findings. This suggests that our main results are robust to alternative measurement approaches of the dependent variable.

Heterogeneity analysis

Institutional environment

Based on institutional theory and China's unique institutional context, we investigate how the relationship between environmental tax reform and greenhushing varies with regional institutional quality. We classify regions into strong and weak institutional

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environments based on the median value of the marketization index (Wang et al., 2021). Regions above the median are classified as high institutional quality, while those below are classified as low institutional quality.

The results in the *Table 4* reveal several important findings. First, the coefficient of Treat × Post is positive and significant (1.075, $p < 0.05$) in regions with weak institutions, while it is insignificant (0.353) in regions with strong institutions. This stark contrast suggests that the impact of environmental tax reform on greenhushing is primarily driven by firms in regions with weak institutional environments.

Table 4. *Results of heterogeneity: institutional environment*

	High	**Low**
Treat × Post	1.075***	0.353
	(0.430)	(0.245)
Constant	0.564***	0.586
	(0.203)	(0.220)
Control Variables	Yes	Yes
Industry-year FEs	Yes	Yes
City-year FEs	Yes	Yes
City-industry FEs	Yes	No
Company FEs	Yes	Yes
Observations	2206	2250
R-squared	0.268	0.288

Notes: This table presents the heterogeneity analysis based on the institutional environment. The dependent variable is the greenhushing indicator (GH). Column (1) shows results for firms in regions with a strong institutional environment, while Column (2) shows results for firms in regions with a weak institutional environment. Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Industry competition

Following prior literature, we measure industry competition using the Herfindahl-Hirschman Index (HHI) calculated based on firms' main business revenue within each 2-digit industry code. The HHI is computed as the sum of squared market shares of all firms within each industry, where each firm's market share is calculated as its main business revenue divided by total industry revenue. The HHI ranges from close to zero (indicating perfect competition) to 10,000 (indicating monopoly), with lower values representing higher competition intensity. Industries with HHI below the sample median are classified as high competition, while those above are classified as low competition.

Our empirical results reveal that industry competition significantly shapes firms' greenhushing responses to environmental tax reform. *Table 5* presents the results of the regression. The coefficient of Treat × Post is positive and significant (0.272, $p < 0.05$) in highly competitive industries, while the effect is insignificant (0.276) in less competitive industries. This contrast suggests that intense market competition amplifies firms' strategic responses to environmental tax reform through greenhushing behavior. In highly competitive industries, firms face greater market elimination threats and survival pressure, making them more sensitive to external environment changes. When industry competition is intense, even slight competitive disadvantages might lead to market share loss or elimination risks. Therefore, these firms are more sensitive to the cost increases brought by environmental taxes.

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Table 5. *Results of heterogeneity: industry competition*

	High	**Low**
Treat × Post	0.272**	0.276
	(0.082)	(0.087)
Constant	0.564***	0.586
	(0.203)	(0.220)
Control Variables	Yes	Yes
Industry-year FEs	Yes	Yes
City-year FEs	Yes	Yes
City-industry FEs	Yes	No
Company FEs	Yes	Yes
Observations	2,200	2,256
R-squared	0.258	0.290

Notes: This table presents the heterogeneity analysis based on industry competition. The dependent variable is the greenhushing indicator (GH). Column (1) shows results for firms in industries with high competition (low HHI), while Column (2) shows results for firms in industries with low competition (high HHI). Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Ownership type

State-owned enterprises possess natural political connections and resource advantages, enjoying more stable funding sources and simpler, lower-cost financial resources. In contrast, private firms face relatively high financial constraints and greater difficulty in accessing external financing. Moreover, SOEs shoulder social responsibilities and policy-oriented tasks as important pillars of the national economic system. Under the background of national green development, they tend to take the lead in responding to national initiatives by increasing environmental investment and achieving green transformation. Their evaluation system includes environmental protection indicators, which reduces their motivation for greenhushing. We classify firms as State-Owned Enterprises (SOEs) if the state or government is the ultimate controlling shareholder with ownership ≥ 25%. All other firms are classified as private enterprises.

State-owned enterprises (SOEs) and private firms exhibit distinct responses to environmental tax reform in their greenhushing behavior. *Table 6* shows the coefficient of Treat × Post is positive and highly significant (0.732, $p < 0.01$) for private firms, while it is insignificant (0.188) for SOEs. This heterogeneous effect can be attributed to the fundamental differences between SOEs and private firms in their resource endowments and organizational objectives.

Law enforcement standardization effect

We examine how environmental tax reform affects corporate greenhushing through enforcement standardization. Environmental tax reform elevates the legal hierarchy of environmental governance from administrative regulations to national law, potentially changing the enforcement landscape. The law enforcement standardization mechanism reflects fundamental changes in China's environmental governance system. The Environmental Protection Tax Law, passed by the Standing Committee of the National People's Congress, has the highest national legal authority. This elevation in legal

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hierarchy reduces local governments' discretionary space in enforcement, making the implementation of environmental regulations more standardized and predictable. The reform transforms the enforcement process from environmental protection departments' sole management to a joint supervision system involving tax authorities, environmental protection departments, and financial institutions. This multi-agency enforcement framework increases the standardization of monitoring and verification procedures, reducing opportunities for selective disclosure and strategic reporting behaviors.

Table 6. *Results of heterogeneity: corporate ownership type*

	High	**Low**
Treat × Post	0.732***	0.188
	(0.330)	(0.440)
Constant	0.564***	0.586
	(0.203)	(0.220)
Control Variables	Yes	Yes
Industry-year FEs	Yes	Yes
City-year FEs	Yes	Yes
City-industry FEs	Yes	No
Company FEs	Yes	Yes
Observations	3173	1283
R-squared	0.257	0.144

Notes: This table presents the heterogeneity analysis based on ownership type. The dependent variable is the greenhushing indicator (GH). Column (1) shows results for private enterprises, while Column (2) shows results for state-owned enterprises (SOEs). Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Moreover, enforcement standardization substantially affects firms' cost-benefit calculations regarding greenhushing. In regions with low enforcement standardization, local governments have greater administrative discretion, creating more opportunities for firms to engage in strategic disclosure. Conversely, high enforcement standardization increases the potential costs and risks of greenhushing behavior through more rigorous monitoring and consistent penalty implementation. We classify provinces based on environmental enforcement standardization scores, with provinces above the sample median classified as high standardization and those below as low standardization.

Our empirical results strongly support this mechanism. As shown in *Table 7*, the coefficient of Treat × Post is positive and significant (1.075, $p < 0.05$) in regions with low enforcement standardization but insignificant (0.353) in regions with high standardization. The results suggest that the environmental tax reform's impact on greenhushing is particularly pronounced when enforcement standards are less rigorous, as firms have more discretionary space in their disclosure strategies.

Carbon risk premium

The carbon risk premium mechanism reflects how environmental tax reform affects corporate greenhushing through altering market perception and valuation of firms' environmental risks. Environmental tax reform reshapes the cost structure and risk profile of firms' environmental performance, potentially influencing how investors price carbon-related risks.

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The carbon risk premium mechanism stems from the changing nature of environmental disclosure's impact on market valuation. Under environmental tax reform, firms with higher carbon emissions face increased operational costs and regulatory risks. However, the standardization of tax collection and stricter enforcement also make carbon-related risks more quantifiable and transparent. In this context, greenhushing behavior may serve as a strategic tool for firms to manage their perceived risk exposure and market valuation.

Table 7. *Results of heterogeneity: Law enforcement*

	High	**Low**
Treat × Post	1.075***	0.353
	(0.430)	(1.260)
Constant	0.158***	-0.162*
	(0.076)	(0.088)
Control Variables	Yes	Yes
Industry-year FEs	Yes	Yes
City-year FEs	Yes	Yes
City-industry FEs	Yes	No
Company FEs	Yes	Yes
Observations	2206	2250
R-squared	0.268	0.288

Notes: This table presents the mechanism analysis based on law enforcement standardization. The dependent variable is the greenhushing indicator (GH). Column (1) shows results for regions with high enforcement standardization, while Column (2) shows results for regions with low standardization. Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

We measure carbon risk premium following Bolton and Kacperczyk (2021), using the difference between firms' stock returns and industry-adjusted expected returns, considering their carbon exposure. This measure captures how the market prices firms' environmental risk exposure relative to their industry peers. We calculate carbon risk premium and classify firms above the sample median as high carbon risk premium and those below as low carbon risk premium.

The empirical results reveal that the environmental tax reform's effect on greenhushing varies significantly with firms' carbon risk premium. The coefficient of Treat × Post is significantly positive (0.732, $p < 0.05$) for firms with lower carbon risk premiums but insignificant (0.188) for those with higher risk premiums. This pattern suggests that firms with lower carbon risk exposure are more likely to engage in greenhushing behavior following environmental tax reform.

Table 8 reveals that the environmental tax reform's effect on greenhushing varies significantly with firms' carbon risk premium. The coefficient of Treat × Post is significantly positive (0.732, $p < 0.05$) for firms with lower carbon risk premiums but insignificant (0.188) for those with higher risk premiums. This pattern suggests that firms with lower carbon risk exposure are more likely to engage in greenhushing behavior following environmental tax reform.

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Table 8. *Results of heterogeneity: Carbon risk premium*

	High	Low
Treat × Post	0.732***	0.188
	(0.330)	(0.440)
Constant	-0.165***	-0.142*
	(0.052)	(0.085)
Control Variables	Yes	Yes
Industry-year FEs	Yes	Yes
City-year FEs	Yes	Yes
City-industry FEs	Yes	No
Company FEs	Yes	Yes
Observations	3173	1283
R-squared	0.257	0.288

Notes: This table presents the mechanism analysis based on carbon risk premium. The dependent variable is the greenhushing indicator (GH). Column (1) shows results for firms with a high carbon risk premium, while Column (2) shows results for firms with a low risk premium. Standard errors, clustered at the firm level, are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

Discussion

This study reveals that the environmental tax reform significantly promotes corporate greenhushing behavior, suggesting firms respond to increased regulatory pressure through strategic under-communication rather than enhanced disclosure. The finding extends environmental regulation literature by highlighting an unintended consequence - while the policy aims to improve environmental performance, it may inadvertently encourage firms to become more selective in their environmental disclosure. The heterogeneous effects provide insights into how institutional quality, market structure, and ownership type shape firms' responses, with impacts more pronounced in regions with weak institutions, highly competitive industries, and private enterprises.

Environmental tax reform affects greenhushing through law enforcement standardization and carbon risk premium channels. The enforcement standardization effect shows that greenhushing increases more when enforcement standards are less rigorous, while the carbon risk premium mechanism demonstrates that firms with lower carbon risk exposure are more likely to engage in greenhushing, suggesting market valuation considerations influence disclosure decisions.

These findings contribute to several literature streams. Unlike existing research that primarily focuses on greenwashing (Du, 2015; Szabo and Webster, 2021; Zhang, 2022a), this study examines strategic under-communication, providing a more complete understanding of corporate environmental disclosure strategies. The finding that the environmental tax reform promotes greenhushing contrasts with studies finding environmental regulation generally increases disclosure (Wang et al., 2021). Empirical studies confirm that consumers perceive greenhushing more favorably than greenwashing, though both represent a form of inconsistent communication (De Jong et al., 2018; Dewandini et al., 2022).

Several limitations should be acknowledged. The greenhushing measure relies on publicly available information and may not capture private stakeholder communications. The focus on Chinese high-carbon firms limits generalizability. While the difference-in-

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differences design addresses endogeneity concerns, unobserved confounding factors cannot be completely ruled out, and the study period may not capture full long-term effects of the reform.

Conclusion

Environmental tax reform significantly promotes corporate greenhushing behavior among Chinese high-carbon emission firms from 2011 to 2023, with effects more pronounced in regions with weak institutions, highly competitive industries, and among private enterprises. The mechanism analysis reveals that reform influences greenhushing through law enforcement standardization and carbon risk premium channels.

Policymakers should strengthen coordination between environmental tax policy and disclosure requirements. Environmental taxation should be accompanied by more stringent disclosure standards and mandatory third-party verification systems. Institutional reforms should complement environmental tax policy, including improving local governance capacity and developing market-based environmental performance evaluation systems. Green financing channels should reward actual environmental performance rather than mere disclosure to align firms' incentives with policy objectives.

Future research could examine long-term effects of environmental tax reform on disclosure strategies, conduct international comparative studies across different regulatory regimes, explore market consequences of greenhushing behavior, and investigate the effectiveness of different policy interventions in addressing strategic under-communication.

While environmental tax reform represents an important step toward better environmental governance, its effectiveness may be compromised by firms' strategic disclosure responses. The findings emphasize the need for integrated approaches that address both environmental and informational aspects of corporate environmental responsibility to ensure policies achieve intended objectives while maintaining transparency necessary for effective market functioning.

Data statement. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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