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Does CEO Green Experience Influence Corporate Response to the Environmental Protection Tax? Evidence on Disclosure and Boundary Conditions

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Abstract

This paper examines whether CEO green experience shapes firms' responses to China's environmental protection tax (EPT) under the 2018 "fee-to-tax" reform. Using a panel of Chinese A-share listed firms from 2013 to 2023, we construct a firm–year measure of the effective environmental payment burden by harmonizing pollution discharge fees (pre-2018) with EPT payments (post-2018) and scaling by operating revenue. This measure is intended to capture firm-level response patterns under the EPT regime, rather than represent firms' underlying environmental outcomes directly. CEO green experience is measured through keyword-based text analysis and manual verification of publicly available CEO résumés and coded as an indicator variable. Employing a two-way fixed effects framework with firm and year fixed effects and firm-clustered standard errors, we find that firms led by green-experienced CEOs exhibit a significantly lower effective EPT burden. Mechanism tests suggest that environmental information disclosure—proxied by the issuance of a standalone environmental report—serves as an important channel in this relationship: green-experienced CEOs are more likely to promote environmental reporting, which is associated with a lower effective tax burden. A battery of robustness checks, including alternative measures of CEO green experience and restricting the sample to the post-2018 period, supports the stability of the main results. Heterogeneity analyses further suggest that the association is stronger among highly educated CEOs, large firms, and firms in heavily polluting industries. The findings highlight the role of executive characteristics and disclosure institutions in shaping firm-level responses to market-based environmental regulation.

Keywords: CEO green experience; environmental protection tax; environmental information disclosure; corporate environmental governance

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1. Introduction

China's rapid industrialization has generated substantial economic growth, but it has also imposed significant environmental costs and increased the urgency of ecological governance. In response, the Chinese government has continuously strengthened environmental regulations, among which the Environmental Protection Tax Law, formally implemented in 2018, represents an important institutional reform. By replacing the former pollution discharge fee system with a statutory environmental tax, the "fee-to-tax" reform enhanced

the legal authority, collection rigidity, and enforcement consistency of environmental regulation, thereby providing a distinctive setting for examining how firms respond to tax-based environmental pressure [1,2].

Within this institutional context, the environmental protection tax burden offers a useful firm-level indicator because it reflects the extent to which firms are fiscally exposed to, and respond under, the environmental tax regime. At the same time, this paper does not assume that a lower environmental tax burden necessarily reflects superior underlying environmental outcomes. Such an interpretation would be overly restrictive because variation in tax burden may arise through multiple channels, including substantive pollution abatement, stronger environmental management, improved compliance processes, or more efficient tax-response strategies. Accordingly, the focus of this study is not to equate lower tax burden with superior environmental outcomes but to examine whether CEO green experience is systematically associated with different firm-level response patterns under the environmental tax regime.

Existing studies on environmental taxation have mainly examined the consequences of regulation from the perspectives of policy design, compliance costs, green innovation, and firm characteristics [3]. This literature has generated important insights, but it has paid relatively limited attention to the role of top executives in shaping firm-level responses to environmental tax pressure. This omission is important because environmental regulation is not implemented only through formal rules; it is also interpreted, prioritized, and translated into organizational actions by decision-makers within firms. Even under the same institutional environment, firms may adopt different response strategies depending on how top managers perceive environmental risks, evaluate regulatory costs, and incorporate ecological concerns into strategic decision-making.

This perspective is consistent with upper echelons theory, which suggests that organizational outcomes are partly shaped by executives' cognitive frames, values, and accumulated experiences [4,5]. In this context, CEO green experience—such as green-related educational background, environmental work experience, or prior exposure to environmental issues—may influence how firms understand and respond to environmental tax pressure. A growing body of literature suggests that CEOs with green experience are more likely to support environmental responsibility, promote green investment, and improve underlying environmental outcomes. However, most prior studies focus on broad environmental outcomes rather than firm behavior under a specific tax-based regulatory instrument. As a result, an important question remains underexplored: when firms are subject to environmental tax pressure, does CEO green experience systematically shape heterogeneous firm-level tax-response patterns?

To address this question, this study focuses on environmental disclosure as an informational and governance channel. From the perspective of upper echelons theory, CEOs with green experience may attach greater importance to environmental transparency, regulatory legitimacy, and the strategic value of credible disclosure. They may therefore be more likely to promote standalone environmental reporting and strengthen the visibility of environmental disclosure [6]. In turn, stronger disclosure may affect how firms respond to environmental taxation by enhancing transparency, strengthening governance, improving external monitoring, and formalizing environmental compliance processes. In this sense, environmental disclosure is examined here not as definitive evidence of actual emissions reduction but as a possible channel through which CEO green experience may be associated with firm-level tax-response patterns under the environmental tax regime.

Using panel data on Chinese A-share listed companies from 2013 to 2023, this paper empirically examines the association between CEO green experience and firms' environmental tax burden intensity. The dependent variable is measured as environmental

protection tax expenditures after 2018 and pollution discharge fees before 2018, each scaled by operating revenue to ensure comparability across periods. The key explanatory variable is CEO green experience, constructed from publicly available CEO résumé information on green-related educational and work experience, supplemented by context-screened text identification from the CSMAR and Wind databases. Building on this framework, the empirical analysis proceeds in three steps. First, it tests whether CEO green experience is significantly associated with environmental tax burden intensity. Second, it examines whether the results are consistent with a disclosure-related channel. Third, it explores whether the relationship varies across different firm contexts, including firm size, pollution intensity, and governance-related conditions.

The empirical results show that firms led by CEOs with green experience exhibit significantly lower environmental tax burden intensity, and this relationship remains robust to a series of additional tests. The results further provide preliminary evidence consistent with a disclosure-related channel linking CEO green experience to firms' environmental tax burden. In addition, the association is more pronounced in certain firm contexts, suggesting that the relationship is heterogeneous rather than uniform. Taken together, these findings indicate that managerial characteristics help explain heterogeneous firm responses to environmental taxation, even though the tax burden itself cannot fully distinguish substantive pollution abatement from other strategic responses.

This study contributes to the literature in three ways. First, it extends research on CEO green experience from broad environmental outcomes to the more specific context of firm responses under the environmental protection tax regime, thereby enriching the micro-level literature on environmental regulation. Second, by explicitly distinguishing environmental tax burden from direct underlying environmental outcomes, it offers a more precise framing of how managerial characteristics matter under tax-based regulation. Third, by examining environmental disclosure as an informational and governance channel, this study provides preliminary evidence on one possible pathway through which executive characteristics may shape heterogeneous firm responses to environmental taxation. More broadly, the findings suggest that managerial traits are relevant for understanding differences in how firms respond to environmental regulation, although they should not be interpreted as sufficient grounds for direct regulatory classification or preferential tax treatment on their own. In addition, this study contributes to the sustainability literature by highlighting how executive backgrounds shape firms' disclosure practices and governance responses under tax-based regulation, thereby linking managerial traits to broader sustainability-oriented governance.

This study also remains cautious regarding potential endogeneity in CEO appointments. Firms facing stronger environmental pressure may be more likely to appoint CEOs with green experience, which could bias the estimated relationship. To alleviate this concern, the empirical analysis incorporates firm and year fixed effects and implements a series of robustness checks. Nevertheless, this paper interprets the results with appropriate caution and avoids stronger causal or policy claims than the evidence can support.

The remainder of this paper is organized as follows. Section 2 reviews the institutional background and related literature. Section 3 presents the research design, variable definitions, and data sources. Section 4 reports the empirical results, including the baseline analysis, channel analysis, heterogeneity analysis, and robustness checks. Section 5 concludes.

2. Institutional Background, Literature Review, and Hypothesis Development

2.1. CEO Green Experience and Environmental Protection Tax: An Upper Echelons Perspective

Upper echelons theory argues that organizational outcomes are partly shaped by executives' cognitive frames, values, and accumulated experiences. Because top managers

interpret external pressures through bounded rationality, acquired traits such as educational background and professional experience may become embedded in managerial judgment and strategic decision-making, thereby influencing corporate strategy and performance [5]. Subsequent research further suggests that the influence of executive characteristics is contingent on the broader institutional environment and the degree of managerial discretion available to CEOs [4]. In the environmental domain, this perspective has encouraged growing interest in the micro-foundations of corporate environmental behavior, especially the role of CEO characteristics in shaping firms' responses to sustainability-related pressures.

Within this line of research, CEO green experience generally refers to green-related educational training, prior work experience in environmental regulation or environmental management, or other forms of career exposure to environmental issues. Existing studies broadly suggest that such experience is associated with stronger environmental orientation and more proactive environmental behavior. For example, CEOs with green experience have been linked to higher environmental responsibility, stronger environmental investment, and better ESG-related environmental outcomes [7,8]. Related studies also indicate that environmentally oriented executive traits may stimulate green innovation, particularly when firms possess adequate resources and stronger governance capacity [9,10]. More generally, research on executive characteristics and green corporate behavior suggests that managerial traits can play an important role in shaping firms' environmental strategies [11].

However, the existing literature does not uniformly support a simple positive-effect view of CEO green experience. First, the influence of executive environmental traits may be conditional on firm resources, governance arrangements, external monitoring, and industry-specific regulatory salience. Even when CEOs possess strong environmental awareness, their ability to translate such orientation into observable organizational outcomes depends on whether firms have sufficient implementation capacity and incentives [4,12]. Second, some observed effects may be more symbolic than substantive. Executive environmental orientation may be expressed through environmental communication, legitimacy management, or signaling behavior without necessarily producing equivalent improvements in underlying operational outcomes [6,13]. Third, the observed association may partly reflect CEO–firm matching rather than executive values alone since firms already subject to stronger environmental scrutiny or endowed with better governance structures may be more likely to appoint CEOs with environmentally relevant backgrounds. In addition, not all managerial experiences generate similar consequences. For instance, non-green experiences such as poverty may heighten resource scarcity concerns and increase the likelihood of environmental violations, suggesting that the effects of executive background are heterogeneous across types of experience [14]. Taken together, these studies imply that the impact of CEO green experience should be understood as context-dependent and potentially channel-specific, rather than uniformly positive [15].

This context dependence is particularly important under environmental taxation. As a market-based environmental regulatory instrument, the environmental protection tax (EPT) seeks to internalize pollution costs and induce firms to adjust production, compliance, and environmental management strategies through cost pressures and regulatory incentives [1,16]. Existing studies show that the EPT can affect corporate financial performance, environmental investment, and green innovation, but the direction and magnitude of these effects are not uniform across firms or over time [3,17–19]. This heterogeneity suggests that firms' responses to environmental taxation depend not only on policy design and industry conditions but also on how top executives interpret environmental tax pressure.

From this perspective, CEO green experience may matter because it shapes how firms respond under the EPT regime. CEOs with green experience may be more likely to attach importance to environmental compliance, pollution control, and environmental governance

and may therefore guide firms toward more proactive responses to environmental tax pressure. At the same time, this study does not assume that a lower environmental tax burden should be mechanically interpreted as better underlying environmental outcomes. Rather, the environmental tax burden is treated here as a firm-level indicator of response under a tax-based environmental regulatory regime. Against this background, the relevant question is whether CEO green experience is systematically associated with lower effective environmental tax burden intensity under the EPT regime. Based on this reasoning, we propose the following hypothesis:

Hypothesis 1 (Main Effect). *CEO green experience is negatively associated with firms' effective environmental protection tax burden.*

2.2. CEO Green Experience, Environmental Information Disclosure and Environmental Protection Tax: A Disclosure-Related Channel Perspective

Environmental information disclosure occupies an increasingly important position in China's environmental governance system. As disclosure requirements have become more formalized, environmental reporting has evolved from a largely voluntary communication practice into an institutional mechanism through which firms convey environmental compliance and governance-related information to regulators and external stakeholders [6,13,20]. In the context of environmental taxation, disclosure is especially relevant because it may affect how firms' environmental practices are observed and evaluated under the environmental protection tax (EPT) regime.

In this study, environmental information disclosure is conceptualized primarily as an informational and governance channel. On the one hand, more standardized and transparent disclosure can reduce information asymmetry between firms and regulators by improving the visibility of firms' environmental practices, compliance status, and reporting consistency. This may help reduce regulatory uncertainty and improve the predictability of tax administration under the EPT regime [18]. On the other hand, stronger disclosure may reinforce internal governance and external monitoring by making firms' environmental behavior more observable to boards, regulators, investors, the media, and the public. In this sense, environmental disclosure may shape how firms respond to environmental tax pressure, even though it should not be interpreted as definitive evidence of actual emissions reduction [21].

CEO green experience may be systematically related to such disclosure practices. Executives with green-related educational or professional backgrounds are more likely to recognize the strategic importance of environmental transparency, regulatory legitimacy, and credible reporting. Accordingly, they may be more willing to establish formalized disclosure systems, encourage standalone environmental reporting, and improve the visibility of environmental governance activities [7,8]. At the same time, this paper does not treat environmental disclosure as a broad umbrella mechanism covering signaling effects, financing effects, and direct emissions reduction simultaneously. Rather, it is examined more narrowly as a channel through which CEO green experience may influence firms' response patterns under environmental taxation by increasing compliance visibility and reducing information frictions.

In the empirical analysis, this channel is proxied by a dummy variable indicating whether a firm issues a standalone environmental report, environmental information disclosure report, or sustainability report with a primary environmental focus in a given year. This measure captures the formalization and visibility of environmental reporting rather than the full multidimensional quality of disclosure. Accordingly, the present study does not interpret this proxy as direct evidence of substantive pollution abatement, but

rather as an indicator of whether environmental reporting has been institutionalized in a more visible and formalized manner.

If CEOs with green experience are more likely to strengthen environmental reporting and disclosure practices, and if such formalized disclosure is associated with lower effective environmental tax burden, then environmental information disclosure can be understood as part of the micro-level transmission process linking managerial characteristics to firms' response patterns under the EPT regime. Based on this reasoning, we propose the following hypothesis:

Hypothesis 2 (Channel Hypothesis). *Environmental information disclosure may serve as an observable channel through which CEO green experience is associated with firms' effective environmental protection tax burden.*

2.3. CEO Green Experience, Firm Characteristics, and Environmental Protection Tax: A Boundary Conditions Perspective

Upper echelons theory further suggests that the effects of executive characteristics are contingent on the context in which executives operate [4]. This implies that CEO green experience should not be expected to influence all firms in the same way. Rather, the translation of managerial traits into observable firm outcomes depends on whether firms possess sufficient resources, whether executives can process complex regulatory signals, and whether environmental issues are sufficiently salient in the external environment.

First, firm size is likely to matter because larger firms generally possess more abundant organizational resources, stronger governance systems, and greater public visibility. These features may enable CEOs with green experience to translate their environmental orientation into more effective environmental management and more structured responses to environmental tax pressure. By contrast, smaller firms may face tighter resource constraints and weaker implementation capacity, which can limit the effect of executive traits [12,17].

Second, CEO education level may also shape the effect of green experience. Higher educational attainment may improve executives' abilities to process complex policy information, understand environmental regulation and taxation, and convert prior green-related knowledge into more coherent strategic responses. In this sense, green experience may be more effective when combined with a stronger cognitive and analytical capacity.

Third, industry pollution attributes may condition the salience of environmental regulation. Firms in heavily polluting industries face stronger regulatory pressure, closer monitoring, and higher environmental exposure, making environmental issues more strategically important. Under such conditions, CEO green experience may become more consequential because the external environment increases both the incentives and the visibility of environmental action [1,18].

Taken together, these considerations suggest that the association between CEO green experience and environmental tax burden is likely to be stronger in contexts where resources are more available, regulatory issues are more salient, and executives are better able to process and act on environmental signals. Based on this reasoning, we propose the following hypothesis:

Hypothesis 3 (Boundary Conditions). *The negative association between CEO green experience and environmental protection tax burden is expected to be more pronounced in larger firms, while differences across CEO educational attainment and industry pollution attributes may exist but are likely to be weaker or limited.*

3. Research Design

3.1. Model

3.1.1. Baseline Model

To examine whether CEO green experience is associated with firms' responses to environmental protection tax policies, this study specifies the following firm–year two-way fixed effects model:

$$EPT_{i,t} = \alpha_0 + \alpha_1 CEOGreen_{i,t} + \alpha_2 Controls_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

where i denotes firm; t denotes year; EPT_{it} represents the environmental protection tax burden for firm i in year t (see Section 3.2 for specific definition); $CEOGreen_{it}$ is the core explanatory variable, indicating whether the CEO possesses green experience; $Controls_{it}$ is the vector of control variables; μ_i is the firm fixed effect, controlling for unobservable and time-invariant firm characteristics; δ_t is the year fixed effect, controlling for common annual shocks, such as macroeconomic conditions and institutional changes; and ε_{it} is the random disturbance term. α_0 is the constant term, α_1 captures the association between CEO green experience and environmental protection tax burden, and α is the coefficient vector for the control variables. To account for heteroskedasticity and serial correlation, standard errors are clustered at the firm level. A statistically significant negative α_1 suggests that firms led by CEOs with green experience tend to have a lower environmental protection tax burden.

3.1.2. Disclosure-Related Channel Analysis (EID)

To further examine one possible pathway through which CEO green experience may be associated with a firm's environmental protection tax burden, this study analyzes the role of environmental information disclosure (EID) as a disclosure-related channel. Because the EID variable used in this study is a binary indicator of whether a firm issues a standalone environmental report, and because the empirical specification is contemporaneous rather than fully sequential in time, the following analysis is not intended to establish a strict causal mediation effect. Instead, it is used to assess whether the empirical results are consistent with a disclosure-related channel.

$$EPT_{i,t} = \alpha_0 + \alpha_1 CEOGreen_{i,t} + \alpha_2 Controls_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (2)$$

$$EID_{i,t} = \theta_0 + \theta_1 CEOGreen_{it} + \theta_2 Controls_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (3)$$

$$EPT_{i,t} = \gamma_0 + \gamma_1 CEOGreen_{i,t} + \gamma_2 EID_{i,t} + \gamma_3 Controls_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (4)$$

where $EPT_{i,t}$ denotes the environmental protection tax burden for firm i in year t; $CEOGreen_{i,t}$ represents the CEO green experience indicator; EID denotes the environmental information disclosure variable; $Controls_{it}$ is the vector of control variables; μ_i and δ_t denote the firm fixed effect and year fixed effect, respectively; and $\varepsilon_{i,t}$ is the random error term.

Equation (2) restates the baseline model in Equation (1) as the first step of the disclosure-related channel analysis for completeness and comparability.

Equation (3) examines whether CEO green experience is associated with environmental information disclosure.

Equation (4) then includes both $CEOGreen_{it}$ and EID_{it} to assess whether environmental information disclosure is associated with environmental protection tax burden after controlling for CEO green experience.

If $CEOGreen_{it}$ is significantly associated with $EPT_{i,t}$ in Equation (2), if $CEOGreen_{it}$ is positively associated with EID_{it} in Equation (3), and if EID_{it} is significantly associated with $EPT_{i,t}$ in Equation (4) while the coefficient on $CEOGreen_{it}$ becomes smaller in magni-

tude, then the results are interpreted as being broadly consistent with a disclosure-related channel. However, given the binary nature of the EID proxy and the contemporaneous specification, this analysis is interpreted cautiously as preliminary channel evidence rather than conclusive proof of a formally identified mediation effect.

3.1.3. Boundary Conditions: Subsample Heterogeneity Tests

To examine whether the negative association between CEO green experience and environmental protection tax burden varies across different managerial and organizational contexts, this study conducts boundary condition tests based on CEO educational attainment, firm size, and industry pollution attributes. Rather than estimating interaction-term models, this study adopts a split-sample strategy and compares the estimated coefficient on CEOGreen across different subsamples.

Specifically, the full sample is divided into relevant subgroups, and the baseline regression is re-estimated separately for each subsample. This approach allows us to assess whether the association between CEOGreen and EPT differs systematically across firms with different contextual characteristics. To strengthen the statistical basis of the comparison, this study further employs bdiff tests to examine whether the estimated coefficient on CEOGreen differs significantly across groups.

If the coefficient on CEOGreen is more negative in one subgroup than in another and the bdiff test confirms that the between-group difference is statistically significant, the result is interpreted as evidence consistent with the boundary-condition argument in Hypothesis 3. If subgroup differences are only descriptive but not statistically significant, the results are interpreted more cautiously.

This empirical strategy moves beyond simple narrative subgroup comparison and provides a more rigorous assessment of whether the association between CEO green experience and environmental protection tax burden varies across CEO- and firm-level characteristics.

3.2. Variable Selection

3.2.1. CEO Green Experience

Following Lu et al. (2022) and Huang and Wei (2023), this study defines CEO green experience as whether a CEO has received green-related education or has previously engaged in green-related work [7,22]. Specifically, each CEO's educational background is manually examined to determine whether the reported major belongs to environment-related fields, such as pulp and paper, environmental engineering, environmental studies, or environmental science. Each CEO's work history and job responsibilities are also manually reviewed to identify whether the CEO has held positions or responsibilities related to environmental governance, such as serving in environmental protection agencies, environmental protection committees, pollution prevention and control functions, or other closely related green-development roles. If a CEO has at least one such green-related educational or work experience, CEOGreen is coded as 1; otherwise, it is coded as 0. This definition is consistent with the prior literature that measures CEO green experience on the basis of green-related education and work experience reflected in CEO résumés.

To improve measurement transparency and reduce false positives, the baseline coding is supplemented by résumé-based text identification. In line with Huang and Wei an expanded dictionary includes terms such as environment, environmental protection, new energy, clean energy, ecological, low carbon, sustainable, energy saving, and green. However, these broad terms are not interpreted in isolation [7]. They are coded only when they appear in résumé contexts related to educational background, work experience, professional responsibilities, governance roles, or environment-related projects. This contextual screening helps mitigate construct contamination arising from overly generic expressions.

Because experience-based CEO variables are commonly constructed through manual collection and specific classification rules in the Chinese literature, this study further follows that broader research practice by relying on hand-collected résumé information, concrete experience categories, and alternative definitions for robustness. Prior Chinese studies on CEO experience likewise emphasize multidimensional operationalization and robustness checks when measuring executive background characteristics.

In addition, ambiguous résumé entries were manually re-examined, and the coding rules were iteratively refined to improve consistency. Although some measurement error may remain, these procedures enhance the transparency and validity of the CEOGreen indicator.

3.2.2. Environmental Protection Tax Burden (EPT)

Building on prior research on environmental protection taxes, this study constructs a firm-level environmental protection tax burden (EPT) indicator. Existing studies mainly adopt two approaches. One approach treats the implementation of the Environmental Protection Tax Law as a quasi-natural experiment and captures the policy shock through institutional dummy variables or interaction terms [1]. Another approach directly uses firm-level pollution discharge fees or environmental protection tax payments, typically standardized by operating revenue, to measure firms' relative environmental tax burden under a unified regulatory regime [18].

Following the latter approach, this study constructs a firm-level indicator based on detailed enterprise-level pollution charge and environmental protection tax data. To ensure intertemporal comparability, pollution discharge fees for 2017 and earlier years are treated as the pre-reform counterpart of environmental protection tax payments for 2018 and later years [1,18]. For each firm–year observation, the payable amount is first calculated as the sum of charges for four pollutant categories: air pollutants, water pollutants, solid waste, and noise. The actual payment amount is then obtained by deducting all eligible reductions from the payable amount. These reductions mainly include centralized pollution treatment, resource utilization of solid waste, and emissions below specified threshold ratios. The resulting actual payment amount for pollution fees or environmental protection tax is used as the benchmark monetary measure of the effective environmental tax (fee) burden borne by the firm.

In the empirical analysis, to improve comparability across firms of different sizes, the actual payment amount is first standardized by operating revenue. The natural logarithm of this ratio is then taken to construct the environmental protection tax burden indicator (EPT). This transformation helps reduce skewness and mitigates the influence of extreme observations. Accordingly, the descriptive statistics reported for EPT reflect the log-transformed measure rather than the raw tax burden ratio.

In this study, EPT is not treated as a proxy for superior environmental performance but as an indicator of heterogeneous firm-level tax-response patterns under the environmental protection tax regime. A lower EPT may result from multiple channels—including substantive pollution abatement, enhanced environmental management, compliance optimization, or strategic tax planning—rather than necessarily reflecting better environmental outcomes.

3.2.3. Environmental Information Disclosure (EID)

Environmental information disclosure is theorized as a key institutional channel linking CEO green experience to firms' environmental tax burden. While prior research often employs multidimensional indices (e.g., based on GRI guidelines) to assess disclosure quality, such measures are less applicable to the Chinese context and entail prohibitively high manual coding costs for large-N, multi-year panel data. As a feasible and valid

alternative, this study uses the issuance of a standalone environmental report as a proxy for a firm's formal commitment to environmental transparency. We construct a dummy variable, EID, that equals 1 if the firm publishes a separate environmental report (including environmental information disclosure reports or sustainability reports with a core environmental focus) and 0 otherwise. This measure directly captures whether environmental disclosure has been institutionalized, reflecting a higher level of organizational prioritization. In our channel analysis, we posit that CEOs with green experience are more likely to institutionalize disclosure by issuing standalone reports (increasing EID), which, in turn, enhances monitoring and internal compliance, ultimately leading to a lower environmental tax burden.

3.2.4. Control Variables

The selection of control variables in this study draws upon relevant research [19] and primarily encompasses the following dimensions. Liquidity (current ratio) is included to capture short-term solvency. Roa (return on assets, net profit divided by total assets) reflects firm profitability. Lev (debt-to-asset ratio, total liabilities divided by total assets) controls for capital structure. Size (company scale, natural logarithm of total assets) accounts for firm-scale effects. Corporate governance characteristics are represented by Top1 (shareholding ratio of the largest shareholder), Board (number of board members), and Indep (proportion of independent directors). For ease of reference, Table 1 summarizes the definitions of the main variables used in this study.

Table 1. Variable definition table.

Variable Type	Symbol	Definition
Dependent Variable	EPT	Natural logarithm of the ratio of a firm's actual pollution fee/environmental protection tax payment to operating revenue.
Core Explanatory Variable	CEOGreen	Dummy variable equal to 1 if the CEO has green-related educational or work experience, and 0 otherwise.
Channel Variable	EID	Dummy variable equal to 1 if the firm issues a standalone environmental report or similar report with a primary environmental focus, and 0 otherwise.
Control Variable	Liquidity	Current assets divided by current liabilities/
	Roa	Net profit divided by total assets.
	Lev	Total liabilities divided by total assets.
	Size	Natural logarithm of total assets.
	Top1	Shareholding ratio of the largest shareholder.
	Board	Number of board directors.
	Indep	Proportion of independent directors on the board.

3.3. Data Source

This study examines Chinese A-share listed companies on the Shanghai and Shenzhen stock exchanges. A firm–year sample covering the period from 2013 to 2023 is constructed to examine the association between CEO green experience, firms' effective environmental tax burden, and environmental information disclosure. Information on CEO green experience is manually collected and compiled from publicly available CEO résumé disclosures in company announcements, supplemented by résumé information from the CSMAR and Wind databases. Firm-level financial data are obtained from the CSMAR database, while environmental disclosure data are collected primarily from annual reports and social

responsibility reports (or sustainability reports). Environmental protection tax data, together with pollution discharge fee data prior to the "fee-to-tax" reform, are organized and matched using official websites of tax bureaus and ecological environment departments, along with the CNRDS database. Following existing research practices, this study excludes financial firms, ST/*ST companies, and observations with missing core variables. The final dataset comprises 1431 listed companies and 15,741 firm–year observations. To mitigate the influence of extreme values, key continuous variables are winsorized at the 1% and 99% levels. These data sources are directly tied to the institutional context of China's environmental protection tax regime, ensuring that the analysis remains relevant to the Chinese regulatory setting. The explicit documentation of data sources and variable construction enhances transparency and replicability.

Table 2 reports the descriptive statistics for the main variables based on 15,741 firm–year observations. The summary statistics indicate substantial cross-sectional variation in firms' environmental payments and financial characteristics. Importantly, EPT is reported after winsorization and is measured in log-transformed form; specifically, it is constructed as the natural logarithm of the ratio of firms' actual pollution fee/environmental protection tax payments to operating revenue. Accordingly, the descriptive statistics for EPT reflect the transformed measure rather than a raw burden ratio, which helps explain its observed distribution (mean = 15.259; SD = 1.469; min = 10.118; max = 22.100). CEOGreen is a CEO-level indicator constructed from manually reviewed résumé information on green-related educational and work experience, supplemented by context-screened text identification. It equals 1 if a CEO's résumé reflects at least one relevant green-related educational or work experience, and 0 otherwise. The mean value of 0.113 suggests that approximately 11.3% of CEOs in the sample are classified as having green-related backgrounds. Finally, firm size (Size) is also reported after winsorization, which reduces the impact of extreme firm–year observations and yields a more stable distribution (mean = 23.993; SD = 1.353; min = 20.362; max = 30.056). Overall, the descriptive statistics are consistent with plausible variable ranges and support the suitability of the sample for the subsequent empirical analysis.

Table 2. Descriptive statistics summary.

Variable	Obs	Mean	Std. Dev.	Min	Max
EPT	15,741	15.259	1.469	10.118	22.100
CEOGreen	15,741	0.113	0.317	0.000	1.000
Liquidity	15,741	2.212	1.970	0.355	12.880
Roa	15,741	0.024	0.034	−0.281	0.764
Lev	15,741	0.436	0.197	0.008	1.100
Size	15,741	23.993	1.353	20.362	30.056
Top1	15,741	33.545	14.873	0.290	89.990
Board	15,741	8.581	1.657	3.000	18.000
Indep	15,741	0.377	0.058	0.167	0.800

4. Empirical Results and Analysis

4.1. Results for H1 (Main Effect)

Based on Model (1), this study first examines the association between CEO green experience and firms' environmental protection tax burden, with the regression results reported in Table 3. Column (1), which controls only for firm fixed effects, shows that the coefficient on CEOGreen is −0.0881 and statistically significant at the 5% level. This result indicates that firms led by CEOs with green experience tend to exhibit a lower effective environmental protection tax burden than those led by CEOs without such experience. Given that EPT is defined as the intensity of environmental protection tax burden, where

higher values indicate greater effective tax liability, the negative coefficient is consistent with a lower effective environmental tax burden among firms with green-experienced CEOs.

Table 3. Benchmark regression.

Variable	(1) *EPT*	(2) *EPT*
CEOGreen	−0.0881 ** (0.0437)	−0.1057 ** (0.0432)
Liquidity	−0.0474 *** (0.0056)	−0.0458 *** (0.0055)
Roa	3.1454 *** (0.2738)	3.1668 *** (0.2731)
Lev	0.1177 (0.0872)	0.1745 ** (0.0883)
Size	0.8317 *** (0.0169)	0.7549 *** (0.0238)
Top1	−0.0019 * (0.0010)	−0.0001 (0.0010)
Board	0.0096 (0.0073)	0.0158 ** (0.0071)
Indep	0.3029 ** (0.1419)	0.2879 ** (0.1407)
Fixed_effect	Included	Included
Time_effect	Not included	Included
Observations	15,741	15,741
R-squared	0.943	0.944

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

In Column (2), after further incorporating year fixed effects, the coefficient on CEOGreen is −0.1057 and remains statistically significant at the 5% level, with a slightly larger absolute magnitude. This suggests that the negative association between CEO green experience and environmental protection tax burden remains robust after controlling for common annual shocks. Taken together, the results from Columns (1) and (2) indicate that CEO green experience is negatively associated with firms' effective environmental protection tax burden.

At the same time, this finding should be interpreted with appropriate caution. A lower effective environmental tax burden should not be mechanically interpreted as direct evidence of better underlying environmental outcomes or emissions reduction. Rather, it may reflect differences in pollution abatement, compliance practices, reporting, operational adjustment, tax reductions, revenue denominators, or other firm-level response patterns under the environmental tax regime. Accordingly, the evidence is more appropriately interpreted as showing that CEO green experience is systematically associated with different firm-level response patterns under environmental taxation. Overall, the results are consistent with Hypothesis 1.

This finding is broadly in line with prior research suggesting that executives with environmentally relevant experience may encourage greener strategic orientations and stronger attention to environmental issues [2,12]. However, in the context of this study, the result is interpreted specifically in terms of firms' effective environmental tax burden under the EPT regime, rather than as direct evidence of superior environmental outcomes.

4.2. Results for H2 (Evidence on the Disclosure Channel)

Table 4 reports the results of the channel analysis for environmental information disclosure (EID). It should be noted that the EID dummy variable used in this study—whether a firm issues an independent environmental report—is a relatively conservative and limited proxy for environmental information disclosure. It captures only the existence of standalone reporting and does not fully reflect the quality, depth, or credibility of firms' disclosure practices. Therefore, the following analysis should be interpreted with appropriate caution.

Table 4. Evidence on the disclosure channel.

Variable	(1) *EPT*	(2) *EID*	(3) *EPT*
CEOGreen	−0.1057 ** (0.0432)	0.0245 * (0.0142)	−0.1041 ** (0.0427)
EID			−0.0628 ** (0.0264)
Liquidity	−0.0458 *** (0.0055)	0.0001 (0.0020)	−0.0458 *** (0.0055)
Roa	3.1668 *** (0.2731)	0.2211 *** (0.0854)	3.1807 *** (0.2752)
Lev	0.1745 ** (0.0883)	−0.1501 *** (0.0342)	0.1651 * (0.0881)
Size	0.7549 *** (0.0238)	0.0558 *** (0.0082)	0.7584 *** (0.0238)
Top1	−0.0001 (0.0010)	0.0018 *** (0.0005)	−0.0000 (0.0010)
Board	0.0158 ** (0.0071)	0.0008 (0.0034)	0.0159 ** (0.0071)
Indep	0.2879 ** (0.1407)	0.1532 * (0.0817)	0.2975 ** (0.1406)
Fixed_effect	Included	Included	Included
Time_effect	Included	Included	Included
Observations	15,741	15,741	15,741
R-squared	0.944	0.452	0.944

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Column (1) reproduces the benchmark regression in which the effective environmental protection tax burden (EPT) is the dependent variable. After controlling for firm and year fixed effects, along with a range of firm-level control variables, the coefficient on CEOGreen is −0.1057 and statistically significant at the 5% level. This result indicates a negative association between CEO green experience and firms' effective environmental protection tax burden.

Column (2) uses the environmental information disclosure dummy variable (EID) as the dependent variable to examine whether CEO green experience is associated with firms' environmental reporting behavior. The coefficient on CEOGreen is 0.0245 and is positive at the 10% significance level. This suggests that firms led by CEOs with green experience are somewhat more likely to issue independent environmental reports, although the statistical evidence is only marginal.

Column (3) includes both CEOGreen and EID in the regression with EPT as the dependent variable. The coefficient on EID is −0.0628 and statistically significant at the 5% level, indicating that firms issuing independent environmental reports tend to exhibit a lower effective environmental protection tax burden. At the same time, the coefficient on CEOGreen remains significantly negative (−0.1041 at the 5% level), although its absolute magnitude is slightly smaller than that reported in Column (1).

Taken together, the results in Columns (1)–(3) provide suggestive evidence consistent with a disclosure-related channel through which CEO green experience may be associated with firms' effective environmental protection tax burden. However, these results should not be interpreted as conclusive proof of a strong mediation effect. The EID measure is binary and limited in scope, the first-stage association is only marginally significant, and the empirical specification is contemporaneous rather than fully sequential in time. Therefore, the findings are more appropriately understood as preliminary evidence on a disclosure-related channel.

This interpretation is broadly consistent with prior research suggesting that executives with stronger environmental awareness or green experience may be more likely to encourage formal environmental reporting and greater external transparency within firms. In the context of the environmental protection tax system, the publication of independent environmental reports may represent one observable pathway linking CEO green experience to firms' effective environmental protection tax burden, although the strength and timing of this pathway require further examination using richer disclosure measures and stronger identification strategies.

4.3. Results for H3 (Subsample Heterogeneity Tests)

To examine Hypothesis 3, which proposes that the negative association between CEO green experience and environmental protection tax burden may vary across CEO- and firm-level contexts, this study conducts subsample-based heterogeneity analysis along three dimensions: CEO educational attainment, firm size, and industry pollution intensity. Rather than estimating interaction-term models, the analysis re-estimates the baseline regression separately for each subgroup and uses bdiff tests to assess whether the estimated coefficient on CEOGreen differs significantly across groups. The results are reported in Tables 5 and 6.

Table 5. Heterogeneity in the effect of CEO green experience: CEO educational attainment.

Variable	(1) Low-Educated	(2) High-Educated
CEOGreen	−0.1998 (0.1629)	−0.1016 ** (0.0436)
Liquidity	−0.0627 *** (0.0109)	−0.0463 *** (0.0057)
Roa	4.4525 *** (0.7420)	3.0067 *** (0.2760)
Lev	0.8665 *** (0.3049)	0.1358 (0.0896)
Size	0.6095 *** (0.0819)	0.7619 *** (0.0241)
Top1	−0.0101 (0.0063)	0.0003 (0.0010)
Board	−0.0326 (0.0230)	0.0196 *** (0.0075)

Table 5. *Cont.*

Variable	(1) Low-Educated	(2) High-Educated
Indep	−0.4930 (0.6582)	0.3540 ** (0.1438)
Fixed_effect	Included	Included
Time_effect	Included	Included
Observations	9790	5951
R-squared	0.939	0.947
Differences (*p*-values)	0.259	

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$.

Table 6. Heterogeneity in the effect of CEO green experience: firm size and pollution intensity.

Variable	(1) Small Enterprise	(2) Large Enterprise	(3) Polluting Industries	(4) Non-Polluting Industries
CEOGreen	0.0156 (0.0446)	−0.3835 ** (0.1578)	−0.0806 * (0.0435)	−0.1637 (0.1038)
Liquidity	−0.0301 *** (0.0066)	−0.0748 *** (0.0285)	−0.0393 *** (0.0060)	−0.0539 *** (0.0099)
Roa	3.2077 *** (0.3795)	2.8465 *** (0.5827)	3.2004 *** (0.2236)	2.9853 *** (0.6256)
Lev	0.2422 (0.1620)	0.1078 (0.2673)	0.0962 (0.0922)	0.3744 ** (0.1875)
Size	0.6811 *** (0.0511)	0.5928 *** (0.0662)	0.7577 *** (0.0233)	0.7502 *** (0.0515)
Top1	−0.0004 (0.0021)	0.0001 (0.0024)	0.0003 (0.0011)	−0.0008 (0.0023)
Board	0.0076 (0.0113)	0.0103 (0.0142)	0.0040 (0.0080)	0.0414 *** (0.0142)
Indep	0.1489 (0.2527)	0.2441 (0.3159)	0.0039 (0.1594)	0.8733 *** (0.2826)
Fixed_effect	Included	Included	Included	Included
Time_effect	Included	Included	Included	Included
Observations	3857	3898	10,956	4785
R-squared	0.830	0.865	0.946	0.929
Differences (*p*-values)	0.001 ***		0.072 **	

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

4.3.1. Heterogeneity by CEO Educational Attainment

To examine the boundary conditions proposed in Hypothesis 3, this study first investigates whether the mitigating effect of CEO green experience on environmental protection tax burden varies with CEO educational attainment. The full sample is divided into two subsamples according to CEOs' education levels, and the regression results are reported in Table 5.

Column (1) shows that, in the low-education group, the coefficient on CEOGreen is negative (−0.1998) but statistically insignificant. This indicates that CEO green experience does not exert a stable and statistically identifiable effect on firms' environmental protection tax burden when CEOs have relatively low educational attainment. By contrast, Column

(2) reports that the coefficient on CEOGreen is −0.1016 and significant at the 5% level in the high-education group, suggesting that CEO green experience is associated with a significantly lower environmental protection tax burden among firms led by highly educated CEOs.

Although the subgroup pattern is broadly consistent with the expectation of Hypothesis 3, the bdiff test yields a *p*-value of 0.259, indicating that the coefficient difference between the two groups is not statistically significant. Therefore, the evidence does not support a formally significant heterogeneous effect by CEO educational attainment. In other words, while the mitigating effect of CEO green experience appears more evident among highly educated CEOs, this difference cannot be statistically confirmed at conventional levels.

4.3.2. Heterogeneity by Firm Characteristics

Hypothesis 3 further predicts that the mitigating effect of CEO green experience may vary across firm characteristics. To test this proposition, this study examines heterogeneity along two dimensions: firm size and industry pollution intensity. The results are presented in Table 6.

First, Columns (1) and (2) report the subgroup regression results for small and medium-sized enterprises (SMEs) and large enterprises. In the SME group, the coefficient on CEOGreen is 0.0156 and statistically insignificant, indicating that CEO green experience does not produce a measurable effect on environmental protection tax burden in smaller firms. In contrast, in the large-firm group, the coefficient on CEOGreen is −0.3835 and significant at the 5% level, suggesting that CEO green experience significantly reduces environmental protection tax burden in larger firms. More importantly, the bdiff test reports a *p*-value of 0.001, confirming that the difference in coefficients between the two groups is statistically significant. This result provides strong evidence that the mitigating effect of CEO green experience is more pronounced in large firms, consistent with the boundary-condition argument of Hypothesis 3.

Second, Columns (3) and (4) present the results for heavily polluting and non-heavily polluting industries. In heavily polluting industries, the coefficient on CEOGreen is −0.0806 and significant at the 10% level, suggesting that CEO green experience helps reduce environmental protection tax burden under stronger environmental constraints. In non-heavily polluting industries, the coefficient on CEOGreen is also negative (−0.1637) but statistically insignificant. The bdiff test yields a *p*-value of 0.072, indicating that the coefficient difference between the two groups is significant only at the 10% level. Thus, the evidence suggests only weak or marginal heterogeneity across industry pollution intensity. This finding is directionally consistent with Hypothesis 3, but the result should be interpreted with caution.

Overall, the heterogeneity analysis provides partial support for Hypothesis 3. Specifically, the mitigating effect of CEO green experience is significantly stronger in large firms, only weakly stronger in heavily polluting industries, and does not differ significantly across CEO education groups. These findings suggest that the environmental governance role of CEO green experience is more likely to become observable when firms possess stronger organizational capacity or face stricter environmental constraints, but not all proposed boundary conditions receive equally strong empirical support.

4.4. Robustness Checks

4.4.1. Replacing Core Variables

To examine whether the main findings are sensitive to the measurement of CEO green experience, this study conducts substitution tests for the core explanatory variable based on the benchmark model. The results are reported in Table 7.

Table 7. Robustness Test for Substitution of Core Variables.

Variable	(1) *EPT*	(2) *EPT*
CEOGreen	−0.1057 ** (0.0432)	
Green_3		−0.1073 ** (0.0432)
Liquidity	−0.0458 *** (0.0055)	−0.0459 *** (0.0055)
Roa	3.1668 *** (0.2731)	3.1671 *** (0.2731)
Lev	0.1745 ** (0.0883)	0.1742 ** (0.0883)
Size	0.7549 *** (0.0238)	0.7649 *** (0.0238)
Top1	−0.0001 (0.0010)	−0.0011 (0.0010)
Board	0.0158 ** (0.0071)	0.0150 ** (0.0070)
Indep	0.2879 ** (0.1407)	0.2873 ** (0.1406)
Fixed_effect	Included	Included
Time_effect	Included	Included
Observations	15,741	15,741
R-squared	0.944	0.944

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$.

Column (1) reproduces the benchmark regression using CEOGreen as the core explanatory variable. After controlling for firm and year fixed effects, along with a set of firm-level controls, the coefficient on CEOGreen is −0.1057 and remains statistically significant at the 5% level. This result suggests that firms led by CEOs with green experience tend to exhibit a lower effective environmental tax burden under the EPT regime.

Column (2) replaces the baseline measure with the composite indicator Green_3, which captures CEO green experience more comprehensively by combining green-related educational background, green-related work experience, and context-screened résumé keywords. The coefficient on Green_3 is −0.1073, which is likewise negative and statistically significant at the 5% level, and its magnitude is very close to that reported in Column (1). The signs and significance levels of the control variables remain broadly similar, and the model fit also remains stable.

Overall, these results indicate that the negative association between CEO green experience and firms' effective environmental tax burden remains robust to alternative variable constructions. Therefore, the main finding of this study does not depend on a specific operationalization of CEO green experience.

4.4.2. Sample Restriction

Considering that 2018 marked the formal implementation of the environmental protection tax, earlier indicators primarily reflected pollution discharge fee burdens. To mitigate interference from this institutional transition, this study further tests the robustness of conclusions by narrowing the sample period. Specifically, while Column (1) employs the

full sample (2013–2023) for regression, Column (2) retains only observations from 2018 onwards to re-estimate the model, with results shown in Table 8.

Table 8. Robustness test for reducing the sample size.

Variable	(1) *EPT*	(2) *EPT*
CEOGreen	−0.1057 ** (0.0432)	−0.1314 ** (0.0550)
Liquidity	−0.0458 *** (0.0055)	−0.0433 *** (0.0080)
Roa	3.1668 *** (0.2731)	1.7223 *** (0.2576)
Lev	0.1745 ** (0.0883)	−0.0727 (0.0948)
Size	0.7549 *** (0.0238)	0.5427 *** (0.0367)
Top1	−0.0001 (0.0010)	−0.0013 (0.0018)
Board	0.0158 ** (0.0071)	0.0100 (0.0088)
Indep	0.2879 ** (0.1407)	0.2397 (0.1680)
Fixed_effect	Included	Included
Time_effect	Included	Included
Observations	15,741	8586
R-squared	0.944	0.963

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$.

The table shows that Column (1) replicates the benchmark regression results, with CEOGreen yielding a coefficient of −0.1057, significant at the 5% level. After reducing the sample to post-2018 data in Column (2), CEOGreen's coefficient becomes −0.1314, which is still significant at the 5% level with an increased absolute value. This indicates that even when examining only the period after the formal implementation of the environmental protection tax system, CEOs with green experience can significantly reduce a company's environmental tax burden and enhance underlying environmental outcomes. Moreover, this mitigating effect becomes more pronounced once the system is fully established. Consequently, the core conclusion of this paper—that "CEO green experience promotes corporate underlying environmental outcomes"—is not driven by data from the earlier pollution fee phase.

In summary, by excluding data prior to 2018 and retaining only observations after the environmental protection tax implementation, the empirical results maintain high consistency in sign, significance, and economic interpretation, further validating the robustness of the conclusions.

4.4.3. Replacing the Mediating Variable

To assess the sensitivity of the mechanism findings to the measurement of the mediating variable, this study conducts a robustness analysis by replacing the mediating variable in addition to the baseline mechanism test (which measures environmental information disclosure using EID). In the baseline model, EID is operationalized as a dummy variable

indicating whether a firm publishes a standalone environmental report (or a sustainability report with a focus on environmental issues), thereby capturing the institutionalization of disclosure practices. As reported in Table 9, the results show that CEOGreen significantly increases the likelihood of disclosure, and EID is significantly negatively associated with the environmental tax burden (EPT), supporting an indirect effect transmitted through environmental disclosure.

Table 9. Robustness test for replacing the mediating variable.

Variable	(1) *EPT*	(2) Assurance	(3) *EPT*
CEOGreen	−0.3718 ** (0.1700)	0.0212 * (0.0124)	−0.3710 ** (0.1701)
Assurance			−0.1019 * (0.1218)
Liquidity	−0.0367 *** (0.0138)	−0.0017 (0.0024)	−0.0366 *** (0.0138)
Roa	3.1668 *** (0.2731)	0.2421 ** (0.1191)	3.8533 *** (0.3870)
Lev	3.8780 *** (0.3927)	−0.0448 (0.0469)	0.3768 * (0.2247)
Size	0.7102 *** (0.0564)	0.0407 ** (0.0157)	0.7061 *** (0.0570)
Top1	−0.0001 (0.0034)	−0.0014 *** (0.0005)	0.0000 (0.0033)
Board	0.0213 (0.0150)	−0.0044 (0.0042)	0.0217 (0.0153)
Indep	0.2876 (0.3193)	0.1096 (0.0924)	0.2764 (0.3177)
Fixed_effect	Included	Included	Included
Time_effect	Included	Included	Included
Observations	3927	3927	3927
R-squared	0.925	0.509	0.925

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

In the robustness check, the mediating variable is replaced with third-party verification to examine the mechanism from the perspective of disclosure credibility. It should be noted that third-party assurance information was manually collected from firms' independently disclosed CSR reports; accordingly, assurance status (1 = assured, 0 = not assured) is identified only for the subsample of firms that published such reports. As shown in Table 8, after replacing the mediator, CEO green experience exhibits a marginally significant positive association with third-party verification, and third-party assurance is marginally significantly negatively associated with environmental tax burden. However, the main effect of CEOGreen remains virtually unchanged after including assurance, suggesting that third-party verification contributes limited explanatory power to the mechanism through which CEO green experience reduces environmental tax burden.

Overall, the robustness test results indicate that the mechanism linking CEO green experience to environmental tax burden operates primarily through the institutionalization and visibility of disclosure behavior, whereas the credibility-enhancing role of external assurance plays a relatively marginal role in this pathway.

5. Conclusions and Implications

5.1. Conclusions

Based on data from Chinese A-share listed companies from 2013 to 2023, this paper examines the association between CEO green experience and firms' environmental protection tax burden within the institutional context of China's 2018 "fee-to-tax" reform. To do so, the study constructs core indicators of CEO green experience, effective environmental protection tax burden, and environmental information disclosure and estimates a two-way fixed effects panel model with firm and year fixed effects. It further examines whether the findings are consistent with a disclosure-related channel linking CEO green experience to firms' environmental tax burden and whether this association varies across different firm contexts, including CEO educational attainment, firm size, and industry pollution attributes.

The empirical results yield three main findings. First, after controlling for firm characteristics and fixed effects, CEO green experience is significantly associated with lower environmental tax burden intensity. This result suggests that firms led by green-experienced CEOs tend to exhibit different response patterns under the environmental tax regime. Because firm-level emission intensity data are not available in a consistent manner for the full sample period, the present study cannot cleanly distinguish whether the observed reduction in environmental tax burden reflects substantive pollution abatement or more effective compliance and tax-response strategies. The result remains robust across different measures of CEO green experience, reduced sample periods, and additional robustness tests.

Second, the channel analysis provides preliminary evidence suggesting that environmental information disclosure serves as an important channel in this relationship. CEOs with green experience are more likely to promote standalone environmental reporting and environmental information disclosure, and stronger disclosure, in turn, is associated with a lower environmental protection tax burden. When both CEO green experience and environmental disclosure are included in the model, the estimated coefficient on CEO green experience is attenuated, indicating that disclosure helps explain part of the association between CEO green experience and firms' environmental tax burden. In this paper, environmental disclosure is interpreted as an informational and governance channel rather than as definitive evidence of actual emissions reduction.

Third, the heterogeneity analysis provides partial support for Hypothesis 3. Specifically, the negative association between CEO green experience and environmental protection tax burden is more pronounced in large firms, does not differ significantly across CEO education groups, and is only marginally more pronounced in heavily polluting industries. These findings suggest that the association between CEO green experience and environmental protection tax burden is contingent rather than uniform and becomes more visible in organizational contexts characterized by greater resource availability and stronger environmental constraints.

Finally, the robustness checks confirm the stability of the main findings. Specifically, when the core explanatory variable CEOGreen is replaced with an alternative measure, Green_3, or when the sample is restricted to the post−2018 period following the "fee-to-tax" reform, the results remain qualitatively consistent. Overall, the evidence indicates that CEO green experience is systematically associated with heterogeneous firm-level responses under the environmental tax regime, while the precise balance between substantive pollution abatement and other compliance- or tax-response strategies remains beyond the direct scope of the present design. However, these results should be interpreted as indicative of response patterns rather than as direct evidence of superior environmental performance.

5.2. Implication

This study has three main theoretical implications. First, by introducing CEO green experience into the context of environmental taxation, it extends the application of upper echelons theory to firms' responses under a tax-based environmental regulatory regime. In doing so, it shows that executives' backgrounds are relevant for understanding differences in how firms respond to environmental tax pressure. Second, by focusing on environmental information disclosure as an informational and governance channel, this study helps clarify one possible micro-level pathway linking CEO green experience to firms' environmental tax burden. This contributes to the literature by providing preliminary evidence on one observable channel connecting managerial characteristics to firm behavior under environmental regulation. Third, by examining variation across CEO education, firm size, and industry pollution attributes, this study further clarifies the boundary conditions under which CEO green experience may matter for firms' responses to environmental taxation. The evidence suggests that such heterogeneous associations are most clearly observed in large firms, while the roles of CEO education and industry pollution intensity are less robust and should therefore be interpreted with caution.

At the policy and management level, the findings should be interpreted with appropriate caution. These findings are derived from the institutional setting of China's environmental protection tax regime and should not be interpreted as universally applicable across different legal or regulatory systems. While the analytical framework may offer comparative value for future research, its application to other jurisdictions should be adapted to local environmental laws, disclosure rules, and governance arrangements. Because the empirical evidence in this study is primarily correlational, it should not be used to justify direct regulatory classification, preferential tax treatment, or risk labeling based solely on CEO green experience. Moreover, because the present study cannot directly distinguish substantive pollution abatement from compliance optimization or tax-response strategies, the findings are more informative for improving disclosure and governance frameworks than for supporting any direct regulatory use of executive characteristics. Rather, the results suggest that managerial characteristics may be relevant for understanding why firms respond differently to environmental tax pressure. From a regulatory perspective, one practical implication is that policymakers may further improve environmental information disclosure frameworks and data comparability, particularly in large firms and, to a lesser extent, in heavily polluting industries, where disclosure appears to play a more visible role. Strengthening the integration of environmental reporting and regulatory information may help improve transparency, reduce information asymmetry, and enhance the functioning of market-based environmental regulation.

From the perspective of corporate governance, the findings suggest that firms may benefit from paying greater attention to environmental competence and sustainability awareness in executive recruitment, leadership development, and internal governance arrangements. However, such characteristics should be viewed as one component of broader governance capacity rather than as a standalone indicator of underlying environmental outcomes. Boards may therefore consider environmental expertise alongside other managerial and governance attributes when evaluating executive capabilities and designing internal oversight mechanisms. In this sense, the main contribution of this study is not to recommend the mechanical policy use of executive traits but to show that managerial backgrounds constitute an important part of the micro-level heterogeneity in firms' responses to environmental regulation. In addition, this study contributes to the sustainability literature by showing how executive backgrounds can shape disclosure practices and governance responses under tax-based regulation, thereby linking managerial traits to broader sustainability-oriented governance.

5.3. Deficiencies and Future Prospects

Although this study contributes to the literature on environmental protection taxes and managerial characteristics, several limitations should be acknowledged.

First, in terms of sample scope, this study relies exclusively on Chinese A-share listed companies. As a result, the findings are most directly applicable to relatively large listed firms with more standardized disclosure practices and comparatively stronger governance structures. Caution is therefore warranted when extending the conclusions to small and medium-sized unlisted firms or to institutional settings outside China. In particular, differences in environmental tax design, enforcement intensity, disclosure requirements, and corporate governance institutions may limit the direct transferability of the present findings to other national contexts.

Second, with respect to variable measurement, CEO green experience is constructed from publicly available résumé information on green-related educational and work experience, supplemented by context-screened text identification. Although this procedure improves transparency and consistency, it may still involve measurement error and may not fully capture the implicit or deeper dimensions of managerial green cognition. Similarly, the effective environmental tax burden indicator and the environmental disclosure proxy are derived from tax records, annual reports, and social responsibility or sustainability reports and therefore cannot fully reflect the entire scope of firms' environmental compliance costs or the multidimensional quality of disclosure. In addition, because firm-level emissions intensity data are not consistently available for the full sample period, the present study cannot cleanly distinguish whether the observed reduction in environmental tax burden reflects substantive pollution abatement or other response patterns, such as compliance optimization, reporting differences, or tax-response strategies. These measurement limitations should be taken into account when interpreting the mechanism and outcome variables.

Third, regarding methodology, although the empirical analysis controls for firm and year fixed effects and employs multiple robustness checks, it cannot fully rule out endogeneity arising from unobserved selection in CEO appointments. In particular, firms facing stronger environmental pressure, possessing better pre-existing governance structures, or having greater disclosure capacity may be more likely to appoint CEOs with green-related backgrounds. While the fixed-effects design and robustness checks help reduce bias associated with time-invariant firm heterogeneity and some observable differences, they cannot eliminate potential bias stemming from unobservable CEO–firm matching, dynamic selection, or other contemporaneous policy shocks. Accordingly, the findings of this study should be interpreted primarily as systematic associations rather than definitive causal estimates.

Given these limitations, future research could proceed in several directions. First, future studies may combine firm-level emission monitoring data with tax payment records to better distinguish whether changes in environmental tax burden are driven mainly by substantive pollution abatement or by compliance- and tax-response strategies. Second, researchers may adopt stronger identification strategies, such as CEO turnover-based designs, lagged specifications, or other approaches better suited to addressing appointment endogeneity and dynamic selection. Third, future work may incorporate richer micro-level and unstructured data, such as executive speeches, interviews, and more detailed biographical materials, to refine the measurement of CEO green experience and the quality of environmental disclosure. Fourth, cross-country or regional comparative analyses may help clarify whether the role of CEO green experience varies across different environmental tax systems and institutional environments, thereby improving the external validity of the findings. Finally, subsequent studies could expand the analysis beyond CEOs to include top management teams and boards of directors and could further explore how environmental

taxation interacts with other environmental policy instruments, such as emissions trading schemes, within a broader regulatory portfolio.

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References

1. Long, F.; Lin, F.; Ge, C. Impact of China's environmental protection tax on corporate performance: Empirical data from heavily polluting industries. *Environ. Impact Assess. Rev.* **2022**, *97*, 106892. [CrossRef]
2. Wang, J. Assessing environmental protection tax's impact on firms' green practices: The mediating effect of green innovation and the moderating effect of executive green awareness. *J. Clean. Prod.* **2024**, *474*, 143593. [CrossRef]
3. Clark, M. Corporate environmental behavior research: Informing environmental policy. *Struct. Change Econ. Dyn.* **2005**, *16*, 422–431. [CrossRef]
4. Crossland, C.; Hambrick, D.C. Differences in managerial discretion across countries: How nation-level institutions affect the degree to which CEOs matter. *Strateg. Manag. J.* **2011**, *32*, 797–819. [CrossRef]
5. Hambrick, D.C.; Mason, P.A. Upper echelons: The organization as a reflection of its top managers. *Acad. Manag. Rev.* **1984**, *9*, 193–206. [CrossRef]
6. Babiak, K.; Trendafilova, S. CSR and environmental responsibility: Motives and pressures to adopt green management practices. *Corp. Soc. Responsib. Environ. Manag.* **2011**, *18*, 11–24. [CrossRef]
7. Huang, R.; Wei, J. Does CEOs' green experience affect environmental corporate social responsibility? Evidence from China. *Econ. Anal. Policy* **2023**, *79*, 205–231. [CrossRef]
8. Li, X.; Guo, F.; Wang, J. A path towards enterprise environmental performance improvement: How does CEO green experience matter? *Bus. Strategy Environ.* **2024**, *33*, 820–838. [CrossRef]
9. Arena, C.; Michelon, G.; Trojanowski, G. Big egos can be green: A study of CEO hubris and environmental innovation. *Br. J. Manag.* **2018**, *29*, 316–336. [CrossRef]
10. Liao, Z.; Wu, Y. CEO background experience and firms' environmental innovation: The moderating effect of tenure. *Corp. Soc. Responsib. Environ. Manag.* **2024**, *31*, 5801–5814. [CrossRef]
11. Jia, F.; Li, G.; Lu, X.; Xie, S. CEO given names and corporate green investment. *Emerg. Mark. Rev.* **2021**, *48*, 100808. [CrossRef]
12. Homroy, S.; Slechten, A. Do board expertise and networked boards affect environmental performance? *J. Bus. Ethics* **2019**, *158*, 269–292. [CrossRef]
13. D'Amico, E.; Coluccia, D.; Fontana, S.; Solimene, S. Factors influencing corporate environmental disclosure. *Bus. Strategy Environ.* **2016**, *25*, 178–192. [CrossRef]
14. Du, L.; Ren, S. CEO poverty experience and corporate environmental violations. *Bus. Strategy Environ.* **2024**, *33*, 1853–1864. [CrossRef]
15. Duanmu, J.-L.; Bu, M.; Pittman, R. Does market competition dampen environmental performance? Evidence from China. *Strateg. Manag. J.* **2018**, *39*, 3006–3030. [CrossRef]
16. Berrone, P.; Fosfuri, A.; Gelabert, L.; Gomez-Mejia, L.R. Necessity as the mother of "green" inventions: Institutional pressures and environmental innovations. *Strateg. Manag. J.* **2013**, *34*, 891–909. [CrossRef]
17. He, Z.-X.; Xu, S.-C.; Shen, W.-X.; Long, R.-Y.; Chen, H. Factors that influence corporate environmental behavior: Empirical analysis based on panel data in China. *J. Clean. Prod.* **2016**, *133*, 531–543. [CrossRef]
18. Liu, L.; Li, X.; Jiang, P. Impact of environmental protection tax on enterprises' green technology innovation: Causal mediation effect analysis based on environmental protection investment. *J. Hohai Univ. Philos. Soc. Sci.* **2022**, *24*, 50–59.
19. Zhang, Q.; Yu, Z.; Kong, D. The real effect of legal institutions: Environmental courts and firm environmental protection expenditure. *J. Environ. Econ. Manag.* **2019**, *98*, 102254. [CrossRef]

20. Chen, J.C.; Roberts, R.W. Toward a More Coherent Understanding of the Organization–Society Relationship: A Theoretical Consideration for Social and Environmental Accounting Research. *J. Bus. Ethics* **2010**, *97*, 651–665. [CrossRef]
21. Flammer, C. Corporate social responsibility and shareholder reaction: The environmental awareness of investors. *Acad. Manag. J.* **2013**, *56*, 758–781. [CrossRef]
22. Lu, J.; Jiang, G. Can CEOs' Green Experience Promote Corporate Green Innovation? *Econ. Manag.* **2022**, *44*, 106–121. [CrossRef]

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