

Driving the Shift from Symbol to Substance in Environmental Disclosures: The Governance Role of Non-CEO Executive Constraints

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Abstract

This study, grounded in Veto Player Theory and Upper Echelons Theory, investigates whether non-CEO executives can curb CEO opportunism in environmental disclosures by leveraging their information advantage. Using a sample of Chinese A-share listed companies from 2007 to 2024, we employ IPO-stage equity structure as an instrumental variable, complemented by PDS-Lasso and random forest methods for robustness checks. The findings reveal that the check-and-balance mechanism of non-CEO executives fundamentally reshapes disclosure composition: substantive, verifiable hard information (Sub_EIDQ) increases significantly, while symbolic disclosure (Sym_EIDQ) shows no meaningful change. This “selective enhancement” pattern directly targets the core concern of greenwashing. However, the effectiveness of such constraints depends on two conditions: non-CEO executives must possess both the motivation (career horizon) and the capability (political capital) to challenge the CEO. Mechanism tests demonstrate that internal constraints improve environmental information disclosure quality through four complementary pathways: reducing agency costs, alleviating information asymmetry, strengthening internal controls, and enhancing TMT decision-making participation. Heterogeneity analysis further reveals that this positive effect of non-CEO executive constraints on disclosure quality is more pronounced when external supervision is weak, confirming a substitution effect whereby internal governance compensates for deficiencies in external monitoring. Overall, this study uncovers the micro-political foundations of sustainable reporting and illustrates how internal power balance transforms corporate disclosures from mere rhetoric to substantive content.

Keywords: Environmental Information Disclosure; Internal Governance; Non-CEO Executives; Veto Player Theory; Greenwashing.

JEL Codes: D82, M12, G38



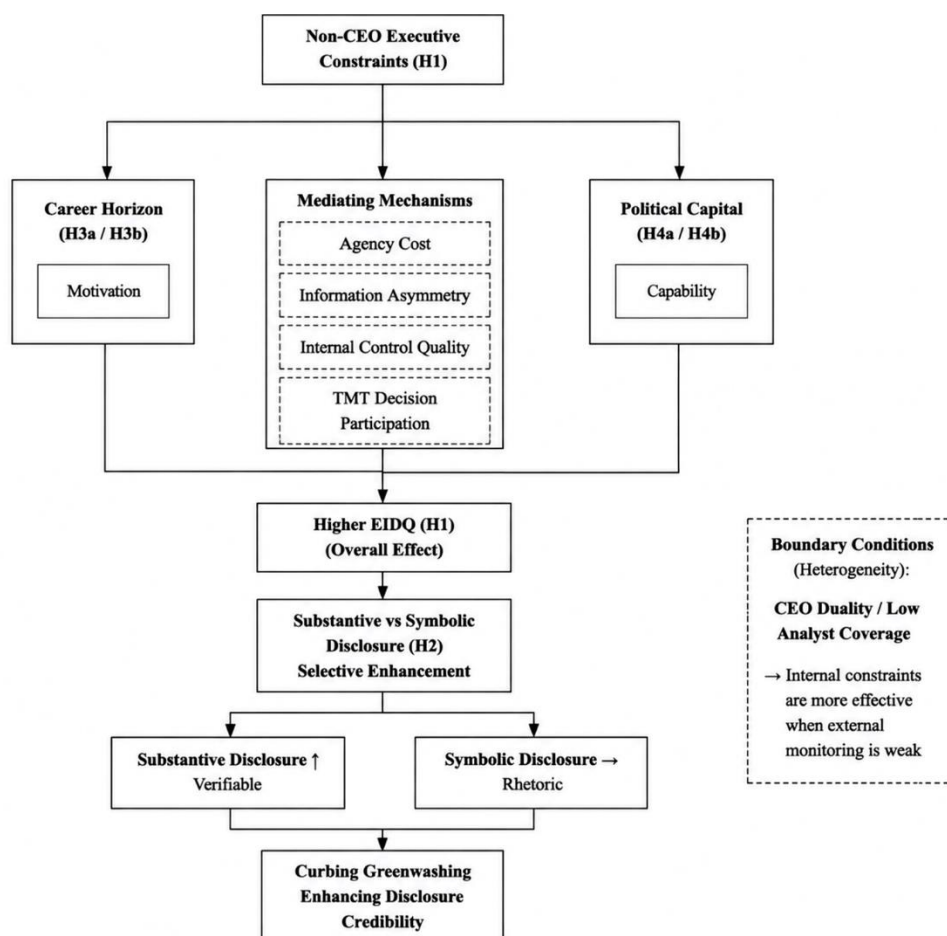
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Graphical abstract



1. Introduction

The credibility of corporate environmental commitments has become a global focal point; however, "greenwashing", the disconnect between symbolic gestures and substantive operational improvements, continues to erode market trust (Delmas & Burbano, 2011; Marquis & Qian, 2014). This phenomenon stems from the time-mismatch in CEO incentives: short-term pressures from capital markets often take precedence over the long-term perspective of sustainable value creation (Gibbons & Murphy, 1992), making symbolic disclosures a low-cost pathway for CEOs to exploit information asymmetry and capture "legitimacy rents." Nevertheless, effectively constraining such opportunistic behavior through internal decision-making dynamics remains a theoretical "black box."

Traditional governance literature views the board of directors as a primary bulwark against CEO opportunism; however, vertical oversight is constrained by an "information gap": as "outsiders" in operations, directors rely on information filtered by the CEO and are unable to distinguish between substantive actions and mere rhetoric (Boivie *et al.*, 2021). The same information void afflicts institutional investors and external regulators, who can observe public disclosures but lack the operational-level data needed to verify their authenticity. This institutional

gap necessitates our attention toward internal actors who possess both information proximity and influence to challenge the CEO's information monopoly.

Drawing on Veto Player Theory (Tsebelis, 2002), we argue that non-CEO executives are not passive executors but rather active vetoers capable of generating constructive political friction. Unlike CEOs whose reputations are tied to short-term stock prices, non-CEO executives face unique professional concerns and legal responsibilities. Leveraging their "private knowledge" regarding the gap between rhetoric and reality, these executives can drive disclosures grounded in verifiable evidence rather than hollow promises. The key point is that such internal friction not only increases the total volume of disclosures but also fundamentally transforms the content of those disclosures—non-CEO executives utilize their information advantage to promote verifiable, auditable hard data (such as emission reductions or certification records), while avoiding engagement with empty rhetoric. This "selective enhancement" model provides a direct criterion for testing greenwashing: if the constraints merely reinforce symbolic statements, it constitutes mere superficiality; if they enhance substantive information, it represents an improvement in corporate governance. The empirical design of this study clearly distinguishes between these

two types of disclosure elements to observe whether non-CEO executives can truly steer the enterprise away from "verbal" reporting toward "substantive" reporting.

The effectiveness of this internal veto mechanism depends on a dual alignment between motivation and capability. Motivation is shaped by the executive's career perspective: executives with a longer career horizon are more motivated to challenge deceptive proposals to avoid reputational damage. However, motivation alone is insufficient; it must be supported by political capital. The executive's relative bargaining leverage—represented by their compensation and status within the Top Management Team (TMT)—provides the necessary influence to ensure that their objections are not easily suppressed by the CEO.

Furthermore, the interactions among these variables are moderated by broader political and ownership structures within enterprises. For instance, high CEO shareholding may align interests with long-term sustainability, but it could also grant the CEO excessive dominance, thereby suppressing internal dissent. Similarly, the presence of short-term-oriented activist investors may exacerbate the CEO's short-sightedness and increase the cost for non-CEO executives attempting to intervene. The study explores how these firm-level characteristics moderate the relationship between horizontal constraints and EIDQ, recognizing that internal veto mechanisms do not operate in a vacuum but are embedded within a network of conflicting institutional pressures.

This study takes Chinese A-share listed companies from 2007 to 2024 as its research subjects, driven by China's unique regulatory push for carbon neutrality, which creates an important context for studying greenwashing. China provides an ideal setting for such research, as its institutional framework is characterized by a coexistence of rapid marketization and strict government intervention. This creates a scenario where enterprises face significant pressure to shape their "green image" to gain political legitimacy and access to capital, while their internal governance infrastructure often lags behind international transparency standards. The diverse coexistence of state-owned and private enterprises enables us to examine how different governance logics—ranging from political alignment to market-driven reputation—influence the effectiveness of checks and balances among senior executives.

This study employs a variety of identification strategies, utilizing the equity structure during the IPO stage as an instrumental variable (IV) to address endogeneity, while additionally employing the Post-Double-Selection Lasso (PDS-Lasso) method to handle high-dimensional control variables. This rigorous approach enables us to identify the causal impact of internal constraints on the quality of environmental information disclosure (EIDQ) within the diverse landscape of state-owned and private enterprises.

The study finds that a robust non-CEO executive check-and-balance mechanism significantly enhances EIDQ, specifically manifested as a shift in disclosure composition toward more verifiable hard information, while having no

impact on symbolic rhetoric; this represents a selective enhancement mechanism. The instrumental analysis confirms that this effect operates by reducing agency costs, alleviating information asymmetry, and strengthening internal control; meanwhile, the heterogeneity analysis reveals an alternative effect: when external supervision is weak, internal constraints prove most effective.

This study makes three key contributions to the literature. First, we extend the veto theory from macro-level political institutions to the micro-level foundations of corporate governance by conceptualizing non-CEO executives as "internal vetoes"—whose veto power stems from information asymmetry and internal bargaining leverage, rather than being granted by formal institutional mechanisms. We further demonstrate that the effectiveness of such vetoes depends on two dual conditions: career horizon shapes the motivation for vetoing, while political capital enhances the corresponding capability. Second, we provide direct evidence for the 'greenwashing' literature: the checks and balances exerted by non-CEO executives do not encourage increased disclosure; instead, they reshape the composition of disclosures—resulting in a significant increase in substantive verifiable information, while having no impact on symbolic rhetoric. This "selective enhancement" pattern transcends mere quantitative observations and directly addresses the disconnect between symbolic claims and substantive actions. Third, we reveal the substitutive effect of internal governance over external institutions: when external supervision is weak (e.g., low analyst attention or a single CEO role), internal constraints prove most effective. This suggests that horizontal executive balance serves as a compensatory governance mechanism in contexts of institutional gaps and is particularly crucial for transitioning economies.

2. Theory Development and Hypotheses

This study examines an internal governance question—whether non-CEO executives can constrain CEO opportunism in environmental disclosure—through the lens of Veto Player Theory (Tsebelis, 2002). In doing so, we extend the applicability of this theory from macro-political institutions to the micro-foundations of corporate governance. We conceptualize non-CEO executives as internal veto players who can block the CEO's pursuit of greenwashing. However, the effectiveness of this veto depends on two conditions: the veto players must have the motivation to exercise their veto and the capability to make it consequential. This dual-condition framework extends the traditional static analysis of veto effectiveness by introducing dynamic organizational contingencies. We argue that career horizons shape motivation, while political capital shapes capability. When both conditions are met, non-CEO executives can shift corporate disclosure from rhetoric to substance. Upper Echelons Theory (Hambrick & Mason, 1984) provides the overarching premise that organizational outcomes reflect the characteristics and power distribution of top management teams, within which this veto mechanism operates.

2.1. CEO Incentives and Environmental Disclosure Governance

Prior research has extensively documented that the quality of environmental information disclosure is frequently compromised by strategic decoupling. A robust body of studies indicates that firms often produce low-quality disclosures characterized by "greenwashing"—the practice of making symbolic commitments devoid of substantive operational improvements (Delmas & Burbano, 2011; Marquis & Qian, 2014; Cho & Patten, 2007). Such reporting typically manifests as the selective disclosure of positive narratives or vague, unverifiable claims. Furthermore, firms with inferior environmental performance tend to inflate disclosure volume to obfuscate actual deficiencies, thereby degrading the reliability of corporate reports (Li *et al.*, 2024).

The antecedents of this quality degradation are rooted in executive incentive structures. Agency theory posits that CEO short-termism drives the erosion of reporting fidelity (Jensen & Meckling, 1976). When compensation is tied to immediate stock performance, CEOs face immense pressure to prioritize quarterly market reactions over long-term sustainable value (Flammer, 2013). While substantive environmental investments entail significant upfront costs with delayed payoffs, symbolic disclosures offer a low-cost mechanism for harvesting "legitimacy rents" (Kim & Lyon, 2015). This "CEO incentive problem" creates a pervasive tendency to exploit information asymmetry for short-term gain at the expense of reporting integrity.

Existing governance mechanisms, however, face structural limitations in curbing this opportunism. External monitors, such as institutional investors and regulators, often suffer from an "information void." They can observe public disclosures but lack access to the operational-level data required to verify their authenticity (Marquis *et al.*, 2016). Similarly, while internal board oversight is intended to safeguard EIDQ, directors often function as "outsiders" who lack the technical expertise to assess complex environmental metrics. Consequently, boards frequently rely on information pre-filtered by the CEO, rendering them incapable of distinguishing substantive action from symbolic rhetoric (Boivie *et al.*, 2021).

Synthesizing these streams reveals a critical "governance paradox": the actors with the authority to ensure disclosure quality (boards, regulators) lack the necessary information, while the actor with the information (the CEO) lacks the incentive. Resolving this impasse requires an organizational actor who possesses both informational proximity and aligned incentives to prioritize long-term credibility. We contend that non-CEO executives uniquely occupy this position, yet they have remained theoretically invisible in the environmental governance literature.

2.2. Non-CEO Executive Constraints and Environmental Disclosure Quality

We conceptualize the Top Management Team (TMT) not as a monolithic unit, but as a dynamic internal political arena. Drawing upon Veto Player Theory (Tsebelis, 2002), we posit that while the CEO holds the proposal power over strategic

initiatives, EIDQ is rarely a unilateral decree. Instead, non-CEO executives function as internal veto players, possessing the latent authority to block or revise proposals that entail excessive reputational liabilities.

First, effective internal constraints satisfy the "motivation condition" via career concerns. Grounded in Career Concerns Theory (Gibbons & Murphy, 1992), an executive's human capital value is inextricably linked to their perceived integrity in the labor market. Unlike a CEO nearing retirement who may face a "horizon problem," non-CEO executives typically possess longer career horizons. Any strategic decoupling exposed by regulators triggers a reputational contagion that inflicts significant damage on the human capital of all TMT members. To evade this systemic reputational risk, non-CEO executives harbor a strong endogenous motivation to veto deceptive disclosure proposals.

Second, the translation of motivation into action depends on the "capability condition"—the possession of political capital. In organizational politics, power stems from relative bargaining leverage vis-à-vis the CEO (Finkelstein, 1992). Economic status, proxied by relative compensation, serves as a core indicator of this "political capital." Higher relative pay signals an executive's bargaining chips within the decision-making coalition, ensuring their dissent cannot be easily suppressed. Furthermore, financial independence lowers the marginal cost of expressing dissent, providing the psychological safety required to challenge erroneous CEO directives.

Through this internal mechanism, disclosure evolves from symbolic rhetoric to substantive implementation. Therefore, we propose the following hypothesis:

H1: Non-CEO executive constraints are positively associated with environmental information disclosure quality.

The credibility problem in environmental disclosure is not simply that firms disclose too little, but that much of what they disclose is not credible. CEOs, facing short-term performance pressure and enjoying informational advantages over external monitors, have strong incentives to produce vague, unverifiable statements that signal environmental concern without committing the firm to measurable actions. Non-CEO executives, by contrast, possess operational-level informational advantages that enable them to see through these claims. When they are both willing and able to act on this information, they can push for disclosures that are backed by hard data rather than hollow promises. This suggests that non-CEO executive constraints should shift the composition of disclosure rather than merely increase its volume: more verifiable information, fewer rhetorical statements. We therefore distinguish between substantive disclosure, which conveys decision-useful and auditable information, and symbolic disclosure, which consists of aspirational claims without verifiable content. This distinction allows us to test whether non-CEO executives constrain greenwashing in a meaningful way, or merely encourage more reporting. This leads to:

H2: Non-CEO executive constraints increase substantive environmental disclosure while having no significant effect on symbolic disclosure.

2.2.1. The Motivation Condition: Career Horizons

The efficacy of non-CEO executives in curbing greenwashing is fundamentally driven by the alignment of their long-term interests with corporate transparency. In the internal political arena, career horizon acts as a critical determinant of motivation to exercise horizontal monitoring. This incentive stems from a forward-looking calculus: an executive's current strategic choices are heavily influenced by the anticipated impact on their future value in the managerial labor market. Non-CEO executives with longer career horizons possess higher sensitivity to reputational contagion (Acharya *et al.*, 2011). Unlike CEOs nearing retirement who may prioritize short-term symbolic decoupling to maximize departure compensation, younger non-CEO executives view professional reputation as their most valuable asset. If a firm's greenwashing is exposed, the resulting reputational damage could exclude these executives from elite managerial circles. Consequently, a long career horizon transforms the potential cost of greenwashing into a personal liability, creating a strong endogenous incentive to challenge opportunistic disclosure and safeguard their long-term human capital. Based on the critical role of career horizons in aligning non-CEO executives' incentives with high-quality disclosure, we propose the following hypotheses:

H3a: The broader the career horizon, the stronger the positive effect of non-CEO executive checks and balances on EIDQ.

H3b: The broader the career horizon, the stronger the positive effect of non-CEO executive checks and balances on Sub_EIDQ.

2.2.2. The Capability Condition: Political Capital

While career horizon defines the willingness to intervene, political capital determines the ability to make such intervention consequential. In the context of internal governance, political capital represents the structural bargaining power an executive wields within the TMT's dominant coalition (Finkelstein, 1992). Even if an executive is motivated by career concerns to block greenwashing, this motive remains latent unless backed by sufficient influence to challenge the CEO's unilateral mandates. Greater political capital, often signaled by relative compensation and professional status, enhances horizontal monitoring through two mechanisms. First, it grants the executive credibility and voice—dissent regarding environmental reporting carries significant weight, increasing the CEO's internal political cost of ignoring such warnings. Second, it provides insulation from retaliation, reducing the fear of marginalization or dismissal when discrepancies are identified. When non-CEO executives possess substantial political capital, they can effectively leverage their informational advantages to demand rigorous, data-driven evidence, ensuring that final disclosure reflects operational reality. Therefore, based on the critical role of political capital in enabling non-CEO

executives to translate informational advantages into effective constraint, we propose the following hypotheses:

H4a: The higher the political capital, the stronger the positive effect of non-CEO executive checks and balances on EIDQ.

H4b: The higher the political capital, the stronger the positive effect of non-CEO executive checks and balances on Sub_EIDQ.

Based on Veto Player Theory and Upper Echelons Theory, this paper develops a theoretical model linking non-CEO executive constraints to environmental information disclosure quality. The model specifies a direct effect (H1), a mechanism that shifts disclosure from symbolic rhetoric to verifiable substance (H2), and two moderating conditions—career horizons (H3a/H3b) and political capital (H4a/H4b)—that jointly determine the effectiveness of internal constraints. The model also incorporates three mediating channels—reducing agency costs, mitigating information asymmetry, and strengthening internal control—through which constraints improve disclosure quality. The theoretical framework is presented in **Figure 1**.

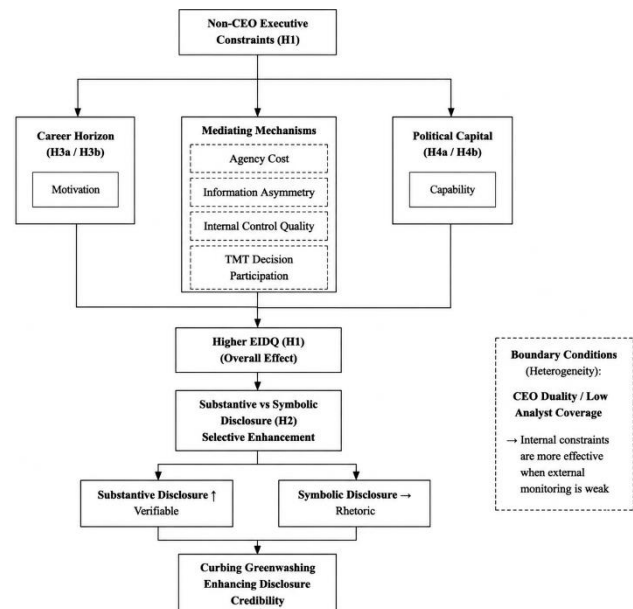


Figure 1. Theoretical Framework. Sources: The authors' own creation.

3. Data and Methodology

3.1. Sample and Data Sources

This study uses Chinese A-share listed companies over the period from 2007 to 2024. This sample period is chosen because environmental information disclosure in China became more systematic and regulated after 2007, following the issuance of relevant guidelines by the Ministry of Environmental Protection and the stock exchanges. Firm-level financial data, governance data, and executive information are primarily obtained from the China Stock Market and Accounting Research (CSMAR) database. Environmental disclosure related data and some supplementary variables are collected from the Chinese Research Data Services (CNRDS) database. To construct the final sample, we apply the following screening procedures. First, we exclude financial institutions (including banks,

insurance companies, and securities firms) because their financial reporting and regulatory environments differ significantly from non-financial firms. Second, we remove observations with special treatment status (ST or *ST firms) to avoid the influence of financially distressed companies. Third, we delete observations with missing values for key variables, including the dependent variable (environmental information disclosure quality), the main independent variable (non-CEO executive constraints), and control variables. Finally, to mitigate the potential impact of outliers and extreme values, all continuous variables are winsorized at the 1st and 99th percentiles of their respective distributions. After implementing these procedures, our final sample contains 43,652 firm-year observations. This unbalanced panel provides a comprehensive and representative dataset for examining the relationship between internal executive constraints and environmental information disclosure quality in the Chinese context.

3.2. Variable Construction

3.2.1. Dependent Variable: Environmental Information Disclosure Quality (EIDQ)

Following prior literature (Cheng *et al.*, 2017), we measure EIDQ using data from the CSMAR Environmental Research Database. We construct the EIDQ index by aggregating the scores of specific items across five categories: environmental management, disclosure vehicle, environmental certification, environmental liabilities, and environmental performance and governance. Specifically, we sum the scores of all items within these categories. The index is defined as $\ln(1 + \text{total score})$.

To examine the nature of the information being disclosed, we further decompose EIDQ into two components: substantive disclosure and symbolic disclosure, following Marquis and Qian (2014). Substantive disclosure captures verifiable hard information that reflects firms' actual environmental actions, including environmental certifications (ISO 14001, ISO 9001), quantitative emission data (wastewater, COD, SO₂, CO₂, smoke and dust, industrial solid waste), and environmental performance and governance activities (emission reduction, waste treatment, pollution control, and cleaner production). Symbolic disclosure captures rhetorical soft statements that reflect impression management rather than verifiable actions, including environmental management concepts, goals, systems, education and training, special actions, emergency mechanisms, honors or awards, the "Three Simultaneous" system, and disclosure vehicles (annual report, CSR report, and environmental report). Each symbolic item is scored as 2 if disclosed and 0 if not; each substantive item is scored as 2 for quantitative and qualitative disclosure, 1 for qualitative-only disclosure, and 0 for non-disclosure. The two components are then transformed as $\ln(1 + \text{subtotal score})$ to construct Sub_EIDQ and Sym_EIDQ, respectively. Detailed scoring criteria are reported in **Appendix Table A1**.

3.2.2. Independent Variable: Non-CEO Executive Constraints

We conceptualize non-CEO executive constraints as the effective exercise of checks and balances against CEO opportunism, which requires the confluence of two necessary conditions—motivation and capability—as neither alone suffices (Finkelstein, 1992; Gibbons & Murphy, 1992). Career horizon captures the motivation condition: executives with longer remaining careers bear greater reputational costs from governance failures and thus have stronger incentives to challenge short-termist CEO proposals (Acharya *et al.*, 2011). Political capital, proxied by relative compensation, captures the capability condition: higher relative pay signals structural bargaining leverage and psychological safety, ensuring that dissent translates into consequential constraint rather than being easily dismissed (Finkelstein, 1992). Critically, these two dimensions are complementary rather than substitutable—long horizon without high political capital yields awareness without influence, while high political capital without long horizon yields power without incentive.

We acknowledge that "executive constraints" is a multifaceted construct that may also encompass additional dimensions such as functional background diversity, TMT seniority, or board representation (Finkelstein, 1992; Ke *et al.*, 2021). However, we focus on career horizon and political capital because they represent the two necessary conditions—motivation and capability—without which effective constraint cannot materialize. While other dimensions may enhance the degree of constraint, the joint presence of these two conditions is essential for any constraint to occur. This theoretically focused measurement strategy is consistent with prior internal governance research that operationalizes subordinate executives' monitoring effectiveness through these core dimensions (Cheng *et al.*, 2016; Ke *et al.*, 2021). The composite index thus reflects the joint presence of both conditions, aligning with our theoretical framework that veto effectiveness depends on the alignment of motivation and capability.

$$\text{NonCEO_Constraints}_{it} = Z(\text{Exec_Hrz}_{it}) + Z(\text{Exec_PR}_{it}) \quad (1)$$

3.2.3. Moderating Factors for Mechanism Validation

To empirically validate the "Motivation-Capability" dualism of the internal check-and-balance mechanism, we partition the full sample into subsamples based on the following two dimensions:

(1) Grouping by Monitoring Motivation (Career Horizon)

This study utilizes the Career Horizon (Horizon) of non-CEO executives as the proxy for monitoring motivation. Consistent with Career Concerns Theory (Acharya *et al.*, 2011), it is measured as the average years remaining until the statutory retirement age of 65 for the top four non-CEO executives. This study partitions the sample into the Long-Horizon Group (high motivation) and the Short-Horizon Group (low motivation) based on the annual-industry median. This paper expects the positive impact of non-CEO constraints on EIDQ to be more pronounced in the Long-

Horizon group, where executives have a stronger incentive to hedge against reputational contagion.

(2) Grouping by Monitoring Capability (Political Capital)

This study utilizes Political Capital (Capital) as the proxy for monitoring capability. Following Finkelstein (1992), it is measured as the ratio of the average compensation of the top four non-CEO executives to the CEO's compensation. This relative pay ratio reflects the structural bargaining power and "psychological safety" within the TMT. The sample is divided into the High-Capital Group (high capability) and the Low-Capital Group (low capability) based on the annual-industry median. This paper expects the effect of internal constraints to be more potent in the High-Capital group, where executives possess sufficient political "chips" to challenge the CEO's strategic decoupling.

3.2.4. Control Variables

Consistent with prior research (Cheng *et al.*, 2017; Lewis *et al.*, 2014; Lin *et al.*, 2021), we control for a set of firm-specific characteristics and external monitoring mechanisms that may influence the quality of environmental information disclosure (EIDQ). Specific control variables and their measurements are defined as follows: Firm Size (Size): The natural logarithm of total assets at the end of the year. Financial Leverage (Lev): Asset-liability ratio, calculated as total liabilities divided by total assets at the end of the year. Profitability (ROA): Return on Assets, calculated as net income divided by total assets at the end of the year. Growth Opportunity (Growth): The annual growth rate of operating revenue. Share Concentration (Top1): The shareholding ratio of the largest shareholder. Board Independence (Indep): The number of independent directors divided by the total number of board members. Audit Quality (Big4): A dummy variable that equals 1 if the firm is audited by a Big 4 accounting firm, and 0 otherwise. Detailed definitions and measurements for all control variables are provided in **Table A2 in the Appendix**.

3.3. Models

To test H1, we estimate the following baseline model with EIDQ as the dependent variable:

$$EIDQ_{it} = \beta_0 + \beta_1 NonCEO_Constraints_{it} + \gamma Controls_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

To test H2, we replace the dependent variable with Sub_EIDQ and Sym_EIDQ, respectively, and estimate the following two models:

$$Sub_EIDQ_{it} = \beta_0 + \beta_1 NonCEO_Constraints_{it} + \gamma Controls_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3)$$

$$Sym_EIDQ_{it} = \beta_0 + \beta_1 NonCEO_Constraints_{it} + \gamma Controls_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (4)$$

where $EIDQ_{it}$ measures the quality of environmental information disclosure for firm i in year t . Sub_EIDQ_{it} captures substantive disclosure (verifiable hard information), while Sym_EIDQ_{it} captures symbolic disclosure (rhetorical soft statements). $NonCEOconstraints_{it}$ is our key independent variable, capturing internal checks and balances. $Controls_{it}$ is a vector of firm-level control variables including firm size, leverage, ROA, growth, board independence, share concentration, and Big 4 auditor status. We include firm fixed effects (μ_i) to control for time-invariant unobservable firm characteristics and year fixed effects (δ_t) to control for macroeconomic shocks common to all firms. Standard errors are clustered at the firm level to account for potential serial correlation.

4. Empirical Results

4.1. Baseline Results

Table 1 reports descriptive statistics for the main variables. The mean value of EIDQ is 1.690 with a standard deviation of 0.986, indicating significant variation in environmental disclosure quality among Chinese listed firms. The mean of Sub_EIDQ is 1.204 and Sym_EIDQ is 1.147, suggesting that firms tend to engage in more symbolic disclosure than substantive disclosure on average. Our key independent variable, NonCEO_Constraints, has a mean close to zero (-0.005) due to standardization, with values ranging from -1.237 to 2.051. This wide range suggests considerable heterogeneity in the internal governance structures of the sample firms, providing sufficient variation to identify the effect of non-CEO constraints.

Table 1. Descriptive statistics.

Variable	N	Mean	S.D.	Min	Median	Max
EIDQ	43,652	1.69	0.986	0	1.792	3.401
Sub EIDQ	43,652	1.204	1.045	0.000	1.099	3.296
Sym EIDQ	43,652	1.147	0.648	0.000	1.099	2.485
NonCEO_Constraints	43,652	-0.005	0.616	-1.237	-0.043	2.051
Size	43,652	22.2	1.295	19.406	21.993	26.452
Lev	43,652	0.415	0.206	0.027	0.407	0.935
ROA	43,652	0.043	0.065	-0.375	0.041	0.255
Growth	43,652	0.125	0.259	-0.497	0.101	0.721
Indep	43,652	0.376	0.053	0.333	0.364	0.6
Top1	43,652	0.344	0.149	0.074	0.323	0.758
Big4	43,652	0.064	0.245	0	0	1

Table 2 presents the baseline regression results. In Column (1), the coefficient of NonCEO_Constraints is 0.017 and statistically significant at the 5% level. This suggests that after controlling for firm-level characteristics and fixed effects, the horizontal check-and-balance intensity within the TMT is positively associated with the quality of environmental information disclosure. Specifically, when non-CEO executives possess the motivation and capability to constrain the CEO, firms exhibit higher transparency. This result provides strong empirical support for our core hypothesis (**H1**).

Columns (2) and (3) of **Table 2** present the results for Sub_EIDQ and Sym_EIDQ, respectively, testing H2. The coefficient on NonCEO_Constraints is positive and significant for Sub_EIDQ ($\beta=0.024, p<0.01$), but insignificant for Sym_EIDQ ($\beta=0.007, p>0.10$). This selective enhancement pattern, which increases substantive disclosure while leaving symbolic rhetoric unaffected, supports **H2**.

Beyond statistical significance, the economic magnitude of these effects warrants discussion. For the overall effect (Column 1), the coefficient of 0.017 implies that a one-**Table 2.** Baseline results.

VARIABLES	(1)	(2)	(3)
	EIDQ	Sub_EIDQ	Sym_EIDQ
NonCEO_Constraints	0.017** (2.433)	0.024*** (3.156)	0.007 (1.610)
Size	0.171*** (13.101)	0.130*** (9.136)	0.144*** (17.097)
Lev	0.019 (0.377)	-0.035 (-0.635)	0.003 (0.097)
ROA	0.262*** (3.095)	0.349*** (3.631)	0.162*** (2.992)
Growth	-0.050*** (-3.681)	-0.039*** (-2.579)	-0.043*** (-4.626)
Indep	-0.085 (-0.690)	-0.116 (-0.834)	-0.031 (-0.399)
Top1	-0.028 (-0.329)	-0.106 (-1.092)	0.059 (1.056)
Big4	0.057 (1.359)	0.078 (1.619)	0.049* (1.741)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	43,444	43,444	43,444

Notes: This table reports baseline results for the full sample. Columns (1)-(3) present results for EIDQ, Sub_EIDQ, and Sym_EIDQ, respectively. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

4.1.1. The Moderating Role of Motivation (Career Horizon)

Table 3 reports the subsample results for Career Horizon, corresponding to H3a and H3b. Columns (1)-(2) present the results with EIDQ as the dependent variable; Columns (3)-(4) present the results with Sub_EIDQ as the dependent variable. The coefficient for NonCEO_Constraints is larger and significant in the Long Horizon group ($\beta = 0.018, p < 0.05$), but smaller and insignificant in the Short Horizon group ($\beta = 0.013, p > 0.10$) when EIDQ is the dependent

standard-deviation increase in NonCEO_Constraints (0.616) is associated with a 0.0105 increase in EIDQ, representing approximately 1.07% of the sample mean EIDQ (1.690). For the substantive disclosure effect (Column 2), the coefficient of 0.024 implies a 0.0148 increase in Sub_EIDQ, representing approximately 1.23% of the sample mean Sub_EIDQ (1.204). Although these magnitudes appear modest in absolute terms, they are economically meaningful for two reasons. First, improvements in environmental disclosure quality tend to occur incrementally, with annual changes typically within a narrow range; an effect of this size is consistent with the gradual nature of governance-driven improvements in reporting practices. Second, prior research has shown that improved disclosure quality can reduce the cost of equity capital, implying that the estimated effects carry non-trivial real economic consequences. These magnitudes fall within a reasonable range compared with prior studies examining the real effects of internal governance mechanisms on corporate outcomes.

variable. The pattern is similar for Sub_EIDQ: the coefficient is larger and significant in the Long Horizon group ($\beta = 0.029, p < 0.01$), but smaller and insignificant in the Short Horizon group ($\beta = 0.015, p > 0.10$). These patterns suggest that the effect of non-CEO constraints on both overall and substantive disclosure quality is more pronounced when executives have longer career horizons, consistent with the motivation-based logic of Career Concerns Theory. These results support **H3a** and **H3b**.

Table 3. Moderating Effect of Career Horizon.

VARIABLES	(1)EIDQ		(2)Sub_EIDQ	
	LongHorizon	ShortHorizon	LongHorizon	ShortHorizon
NonCEO_Constraints	0.018** (2.309)	0.013 (0.930)	0.029*** (3.198)	0.015 (0.986)
Size	0.178*** (12.097)	0.162*** (7.339)	0.137*** (8.531)	0.124*** (5.342)
Lev	0.040 (0.698)	-0.025 (-0.271)	-0.024 (-0.386)	-0.061 (-0.632)
ROA	0.359*** (3.702)	-0.001 (-0.009)	0.423*** (3.839)	0.092 (0.532)
Growth	-0.053*** (-3.247)	-0.031 (-1.173)	-0.032* (-1.792)	-0.038 (-1.292)
Indep	-0.030 (-0.207)	-0.282 (-1.427)	-0.074 (-0.453)	-0.331 (-1.482)
Top1	-0.008 (-0.078)	-0.123 (-0.907)	-0.102 (-0.929)	-0.271* (-1.801)
Big4	0.055 (1.131)	0.049 (0.686)	0.066 (1.235)	0.077 (0.923)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	29,518	12,903	29,518	12,903

Notes: This table reports subsample results by Career Horizon. Columns (1)-(2) present EIDQ results for Long Horizon and Short Horizon groups; Columns (3)-(4) present Sub_EIDQ results accordingly. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.1.2. The Moderating Role of Capability (Political Capital)

Table 4 reports the subsample results for Political Capital, corresponding to H4a and H4b. Columns (1)-(2) present the results with EIDQ as the dependent variable; Columns (3)-(4) present the results with Sub_EIDQ as the dependent variable. The coefficient for NonCEO_Constraints is larger and significant in the High Capital group ($\beta = 0.025, p < 0.01$), but negligible and insignificant in the Low Capital group ($\beta = -0.004, p > 0.10$) when EIDQ is the dependent variable.

Table 4. Moderating Effect of Political Capital.

VARIABLES	(1)EIDQ		(2)Sub_EIDQ	
	HighCapital	LowCapital	HighCapital	LowCapital
NonCEO_Constraints	0.025*** (2.731)	-0.004 (-0.369)	0.028*** (2.792)	0.007 (0.607)
Size	0.210*** (9.856)	0.143*** (8.221)	0.188*** (7.850)	0.092*** (4.966)
Lev	0.039 (0.524)	-0.032 (-0.495)	-0.007 (-0.081)	-0.085 (-1.195)
ROA	0.195* (1.757)	0.182* (1.654)	0.252** (1.965)	0.289** (2.361)
Growth	-0.046** (-2.334)	-0.049*** (-2.626)	-0.032 (-1.436)	-0.045** (-2.223)
Indep	0.225 (1.414)	-0.228 (-1.364)	0.153 (0.858)	-0.216 (-1.157)
Top1	-0.133 (-1.019)	0.064 (0.568)	-0.176 (-1.190)	-0.079 (-0.621)
Big4	0.027 (0.543)	0.082 (1.153)	0.056 (0.934)	0.112 (1.479)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	20,881	21,735	20,881	21,735

The pattern is similar for Sub_EIDQ: the coefficient is larger and significant in the High Capital group ($\beta = 0.028, p < 0.01$), but smaller and insignificant in the Low Capital group ($\beta = 0.007, p > 0.10$). These patterns suggest that the effect of internal constraints on both overall and substantive disclosure quality is more potent when executives possess sufficient political capital, consistent with the capability-based logic of political capital theory. These results support **H4a** and **H4b**.

Notes: This table reports subsample results by Political Capital. Columns (1)–(2) present EIDQ results for High Capital and Low Capital groups; Columns (3)–(4) present Sub_EIDQ results accordingly. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. Robustness Checks

To probe the robustness of our main findings, we conduct several supplementary analyses. PSM (Section 4.2.2) and PDS-Lasso (Section 4.2.3) address potential biases arising from observable differences between treatment and control groups and from functional form misspecification. IV estimation (Section 4.2.5) further mitigates concerns about reverse causality. These approaches are applied to both EIDQ (H1) and Sub_EIDQ (H2) to ensure the credibility of our causal interpretation across different dependent variables. In addition, we employ Random Forest (Section 4.2.4) as a non-parametric check on the predictive importance of NonCEO_Constraints for both EIDQ and Sub_EIDQ (Cai *et al.*, 2026), and placebo tests (Section 4.2.6) to rule out spurious correlations. Together, these analyses complement the main results by demonstrating

that our core conclusions are robust across different identification strategies and modeling assumptions.

4.2.1. Change the explanatory variable

We conducted regressions using functional background diversity (diversity_blau), non-CEO executive ownership ratio (nonCEO_ownership), and executive team tenure diversity (Tenure_Diversity) as explanatory variables for the dependent variable, aiming to further verify the impact of non-CEO executives on corporate greenwashing through these multiple dimensions. The results presented in **Table 5** indicate that all three variables have a significant positive effect on both EIDQ and Sub_EIDQ, demonstrating that the presence of non-CEO executives exerts a positive influence on both the quality of corporate green disclosure and its substantive content.

Table 5. Robustness Checks: Change the explanatory variable.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	EIDQ	Sub_EIDQ	Sym_EIDQ	EIDQ	Sub_EIDQ	Sym_EIDQ	EIDQ	Sub_EIDQ	Sym_EIDQ
diversity_blau	0.250*	0.414***	0.032						
	(1.842)	(2.844)	(0.380)						
nonCEO_ownership				0.002*	0.002**	0.001			
				(1.678)	(2.455)	(1.394)			
Tenure_Diversity							0.038*	0.040*	0.011
							(1.940)	(1.845)	(0.877)
Size	0.173** *	0.134***	0.145***	0.172** *	0.132***	0.145***	0.172** *	0.131***	0.145***
	(13.221)	(9.402)	(16.980)	(13.197)	(9.282)	(17.155)	(13.132)	(9.225)	(17.113)
Lev	0.027	-0.026	0.004	0.021	-0.033	0.004	0.015	-0.041	0.002
	(0.518)	(-0.458)	(0.108)	(0.412)	(-0.583)	(0.132)	(0.286)	(-0.731)	(0.053)
ROA	0.266** *	0.356***	0.167***	0.266** *	0.356***	0.164***	0.281** *	0.373***	0.169***
	(3.140)	(3.702)	(3.075)	(3.150)	(3.696)	(3.015)	(3.328)	(3.886)	(3.115)
Growth	- 0.051** *	-0.039**	-0.042***	- 0.051** *	- 0.040***	-0.043***	- 0.051** *	- 0.040***	-0.043***
	(-3.738)	(-2.564)	(-4.565)	(-3.744)	(-2.668)	(-4.675)	(-3.743)	(-2.646)	(-4.650)
Indep	-0.085	-0.113	-0.033	-0.084	-0.115	-0.031	-0.078	-0.109	-0.029
	(-0.696)	(-0.815)	(-0.423)	(-0.685)	(-0.829)	(-0.396)	(-0.637)	(-0.784)	(-0.374)
Top1	-0.037	-0.122	0.057	-0.033	-0.114	0.057	-0.020	-0.098	0.061
	(-0.424)	(-1.246)	(1.017)	(-0.384)	(-1.163)	(1.014)	(-0.229)	(-1.004)	(1.090)
Big4	0.061	0.079*	0.051*	0.059	0.080*	0.050*	0.059	0.081*	0.050*
	(1.457)	(1.654)	(1.792)	(1.398)	(1.668)	(1.765)	(1.412)	(1.681)	(1.772)
Constant	- 2.320** *	- 2.003***	-2.100***	- 2.113** *	- 1.656***	-2.086***	- 2.126** *	- 1.667***	-2.088***
	(-7.392)	(-5.878)	(-10.379)	(-7.317)	(-5.225)	(-11.180)	(-7.371)	(-5.272)	(-11.188)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,344	43,344	43,344	43,444	43,444	43,444	43,444	43,444	43,444
R-squared	0.717	0.677	0.688	0.716	0.677	0.689	0.716	0.677	0.689

Notes: This table reports robustness checks using alternative measures of the key explanatory variable: *diversity_blau* (Columns 1-3), *nonCEO_ownership* (Columns 4-6), and *Tenure_Diversity* (Columns 7-9). All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2.2 PSM

To mitigate potential self-selection bias arising from observable differences between firms with high and low internal constraints, we employ Propensity Score Matching (PSM). We define the treatment group as firms with above-median NonCEO_Constraints (by industry-year) and match them to a control group using a 1:1 nearest-neighbor matching algorithm with replacement (caliper = 0.05).

Figure 2 presents the covariate balancing test. Prior to matching (dots), significant differences existed between the treatment and control groups across several covariates, particularly in ROA, Growth, and Size. After matching (crosses), the standardized percentage bias for all covariates is substantially reduced to near zero, well below the conventional 5% threshold. T-tests further confirm that no statistically significant differences remain between the matched groups.

Using the matched sample, we re-estimate our baseline models with both EIDQ and Sub_EIDQ as dependent variables. As reported in Table 6 Columns (1)-(2), the coefficients on NonCEO_Constraints remain positive and significant for both EIDQ ($\beta = 0.021$, $p < 0.01$) and Sub_EIDQ ($\beta = 0.024$, $p < 0.01$) and Sub_EIDQ.

VARIABLES	(1)PSM	(2)PSM	(3)PDS-Lasso	(4)PDS-Lasso
	EIDQ	Sub_EIDQ	EIDQ	Sub_EIDQ
NonCEO_Constraints	0.021*** (2.711)	0.024*** (2.773)	0.018*** (3.260)	0.019*** (2.983)
Size	0.179*** (12.752)	0.139*** (9.129)	Included	Included
Lev	-0.008 (-0.153)	-0.078 (-1.310)	Included	Included
ROA	0.265*** (2.871)	0.328*** (3.135)	Included	Included
Growth	-0.061*** (-3.978)	-0.053*** (-3.113)	Included	Included
Indep	-0.087 (-0.654)	-0.110 (-0.747)	Included	Included
Top1	0.051 (0.554)	-0.047 (-0.457)	Included	Included
Big4	0.052 (1.196)	0.069 (1.379)	Included	Included
Controls			PDS Selected	PDS Selected
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	33,412	33,412	43,652	43,652

Notes: Columns (1)-(2) report PSM results (1:1 nearest-neighbor matching, caliper=0.05). Columns (3)-(4) report PDS-Lasso estimates with optimal controls selected from quadratic and cubic terms. "Included" indicates retained controls. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

($\beta = 0.024$, $p < 0.01$), providing suggestive evidence that our main findings are not driven by observable firm characteristics.

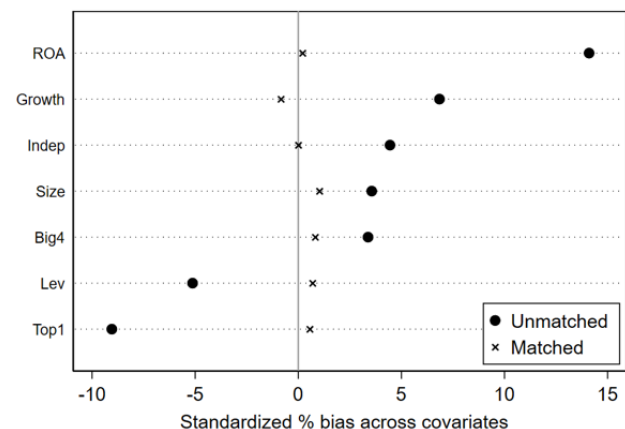


Figure 2. PSM Covariate Balancing Test. Sources: The authors' own estimation.

4.2.2. High-Dimensional Control: Post-Double-Selection Lasso (PDS-Lasso)

To address concerns regarding functional form misspecification and selection on observables, we employ the Post-Double-Selection Lasso (PDS-Lasso) estimator (Belloni *et al.*, 2014). Traditional OLS models may suffer from bias if the true relationship between control variables and EIDQ is non-linear. We expand our set of controls to include quadratic and cubic terms of all continuous company characteristics, creating a high-dimensional feature space. The PDS-Lasso procedure selects the most relevant predictors from this set to be included in the regression. It is important to clarify that PDS-Lasso serves as a complementary validation tool rather than a substitute for our main OLS estimation. This distinction directly addresses a key methodological concern: that machine learning techniques should not replace theoretically grounded econometric models but can usefully supplement them. PDS-Lasso complements our main approach in two ways. First, it mitigates the risk of omitted variable bias by algorithmically identifying the optimal set of control variables from a large candidate pool, reducing reliance on subjective model selection. Second, by allowing for non-linear functional forms, it provides a robustness check against potential misspecification in the baseline model. We apply the PDS-Lasso procedure to both EIDQ and Sub_EIDQ. As reported in **Table 6** Columns (3)-(4), the coefficients on NonCEO_Constraints remain positive and significant for both EIDQ ($\beta = 0.018$, $p < 0.01$) and Sub_EIDQ ($\beta = 0.019$, $p < 0.01$). The consistency between the PDS-Lasso estimates and our baseline results reinforces the reliability of our main findings, providing suggestive evidence that they are robust to non-linear functional forms and high-dimensional control selection.

4.2.3. Non-Parametric Validation: Random Forest Feature Importance

To further validate the robustness of our findings, we employ a Random Forest algorithm as a complementary validation tool. Unlike OLS, which assumes linearity and requires pre-specified functional forms, this non-parametric method captures complex non-linear interactions and higher-order dependencies among variables without imposing any functional restrictions (Chen *et al.*, 2025). As a complement to our main econometric analysis, Random Forest serves two distinct purposes. First, it provides a non-parametric robustness check that does not rely on the linearity assumption underpinning our baseline OLS models. Second, the feature importance scores offer a data-driven ranking of predictor variables, which helps to identify whether the predictive power of NonCEO_Constraints is robust when evaluated alongside a comprehensive set of firm characteristics in a flexible modeling framework. We interpret these importance scores as complementary evidence of substantive significance, not as causal estimates. **Figure 3a and 3b** display the feature importance scores from the Random Forest model for EIDQ and Sub_EIDQ, respectively. In both models, NonCEO_Constraints emerges as the most powerful predictor, surpassing

traditional determinants like Size, Lev, and ROA. This data-driven evidence reinforces the fundamental role of internal governance in shaping both overall and substantive disclosure quality, and further validates the central importance of NonCEO_Constraints as the key driver of environmental disclosure outcomes.

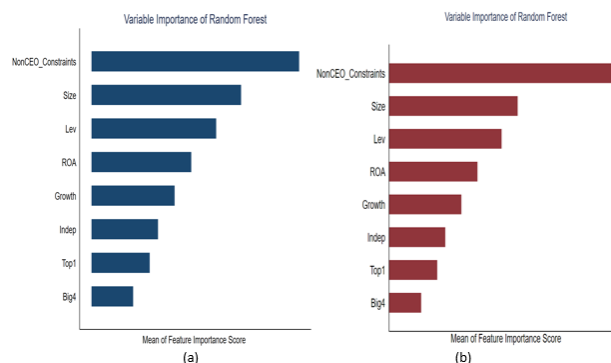


Figure 3. (a). Random Forest Feature Importance: EIDQ. (b). Random Forest Feature Importance: Sub_EIDQ. Notes: Higher scores indicate greater predictive contribution to EIDQ. Sources: The authors' own estimation.

4.2.4. Instrumental Variable (IV) Approach

To address potential reverse causality, where firms with superior disclosure quality might attract specific types of executives, we employ an instrumental variable (IV) approach. Following Jochem *et al.* (2018), we utilize the non-CEO executive shareholding ratio at the time of the IPO (IPO_NonCEO_Shares) as our instrument. This variable is rooted in pre-listing founding dynamics, rendering it pre-determined and exogenous to the firm's current environmental strategies. Furthermore, at the institutional level, the equity structure of China's IPOs is primarily determined by pre-listing negotiations with venture capital firms and regulatory approvals—factors that have been predetermined historically and are likely exogenous to a company's current environmental strategy. Regarding the path dependence of corporate governance: the initial equity allocation creates a persistent "governance imprint," which shapes internal power dynamics for a considerable period after the IPO (Marquis & Tilcsik, 2013). Thus, this instrumental variable exhibits strong exogeneity in theory. The specific imprints we identify (namely, the bargaining power of non-CEO executives relative to the CEO) represent the primary channel through which the IPO equity arrangement influences current decision-making. In the following section, we further verify the exogeneity of this instrumental variable with respect to the dependent variable, as well as its correlation with the explanatory variables, through a series of validity tests.

Table 7 reports the IV estimation results. Column (1) presents the first-stage results, showing that IPO_NonCEO_Shares significantly predicts current internal constraints ($\beta = 0.529$, $t = 5.139$). Regarding instrument validity, the Kleibergen-Paap rk LM statistic is 26.894 ($p = 0.0000$), strongly rejecting the null of underidentification. The Kleibergen-Paap Wald F statistic is 26.41, and the Cragg-Donald Wald F statistic is 34.50, both well above the Stock-Yogo 10% critical value of 16.38, ruling out weak

instrument concerns. The Anderson-Rubin F-tests (16.03 for EIDQ, 9.65 for Sub_EIDQ, both $p < 0.01$) further confirm the significance of the endogenous regressor. Columns (2) and (3) present the second-stage results for EIDQ and Sub_EIDQ, respectively. The coefficients on **Table 7**. Instrumental Variable Approach.

NonCEO_Constraints remain positive and significant for both EIDQ ($\beta = 0.687$, $p < 0.01$) and Sub_EIDQ ($\beta = 0.598$, $p < 0.01$), consistent with the baseline findings.

VARIABLES	(1)First Stage	(2)Second Stage	
	NonCEO_Constraints	EIDQ	Sub_EIDQ
IPO_NonCEO_Shares	0.529*** (5.139)		
NonCEO_Constraints		0.687*** (3.333)	0.598*** (2.789)
Size	0.088*** (8.744)	0.113*** (4.820)	0.080*** (3.280)
Lev	-0.053 (-1.484)	0.037 (0.620)	-0.028 (-0.440)
ROA	0.504*** (7.022)	-0.079 (-0.547)	0.027 (0.174)
Growth	-0.018 (-1.486)	-0.038** (-2.281)	-0.028 (-1.604)
Indep	0.011 (0.115)	-0.109 (-0.756)	-0.136 (-0.864)
Top1	-0.180*** (-2.933)	0.117 (1.083)	0.044 (0.383)
Big4	0.108** (2.284)	-0.003 (-0.056)	0.032 (0.532)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Kleibergen-Paap rk LM		26.894***	26.894***
Cragg-Donald Wald F		34.50	34.50
Kleibergen-Paap Wald F		26.41	26.41
Anderson-Rubin F-test		16.03***	9.65***
Observations	38,898	38,898	38,898

Notes: This table reports 2SLS estimates. Column (1) presents first-stage results with NonCEO_Constraints as the dependent variable. Columns (2)-(3) present second-stage results with EIDQ and Sub_EIDQ. IV = IPO_NonCEO_Shares. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2.5. Placebo Test

To rule out spurious correlation, we conduct a placebo test by randomly permuting the NonCEO_Constraints variable 500 times. **Figures 4a and 4b** plot the kernel density distributions of the 500 placebo coefficients for EIDQ and Sub_EIDQ, respectively. In both panels, the distributions are centered at zero, approximating a normal distribution, while the true estimated coefficients lie far in the extreme right tail. This confirms that our findings for both overall and substantive disclosure quality are not driven by random chance.

4.3. Further Analysis: Mechanism Test

To examine the mechanisms through which non-CEO executive constraints influence the quality of environmental information disclosure, we investigate four potential transmission channels: reducing agency costs, alleviating information asymmetry, strengthening internal controls, and enhancing the decision-making participation of the executive team. For each channel, we first regress the proposed mediating variables against NonCEO_Constraints; subsequently, we incorporate both

the mediating variables and the constraint variables into a second-stage regression model with EIDQ and Sub_EIDQ as the dependent variables. The results are presented in **Tables 8 through 11**.

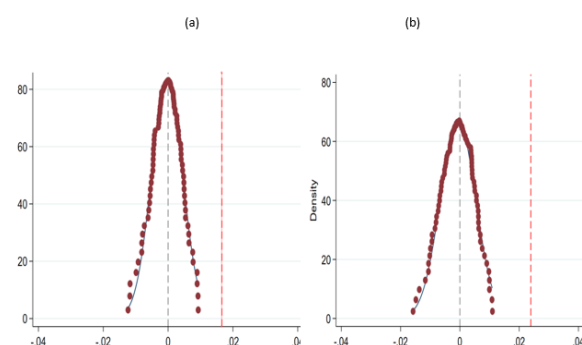


Figure 4. (a) Placebo Test Distribution: EIDQ. (b) Placebo Test Distribution: Sub_EIDQ.

4.3.1. Agency Cost Channel

To empirically examine the pathways through which non-CEO executive constraints affect disclosure quality, we

follow Baron and Kenny (1986) and conduct mediation analyses for four potential transmission channels: mitigating agency costs, reducing information asymmetry, strengthening internal control, and enhancing TMT decision participation. To capture both the overall effect (H1) and the selective enhancement effect (H2), we report mediation results with both EIDQ and Sub_EIDQ as dependent variables. The results are reported in **Tables 8 through 11**.

First, we examine the "Agency Cost" mechanism. According to agency theory (Jensen & Meckling, 1976), the checks and balances provided by non-CEO executives can effectively curb the CEO's self-interested behavior, thereby reducing corporate agency costs. As shown in **Table 8**, the NonCEO_Constraints variable is significantly negatively correlated with the Management Expense Ratio (Mfee), the Operating Expense Ratio (Ofee), and the Other

Receivables Ratio (Occupy). These negative relationships indicate that stronger non-CEO executive constraints are associated with lower agency costs. In the Chinese listed firm context, Mfee and Ofee primarily capture excessive administrative and operational expenditures linked to managerial perquisite consumption and operational inefficiency, while Occupy serves as a proxy for resource tunneling by large shareholders or management through inter-corporate loans or other receivables (Ang *et al.*, 2000; Singh & Davidson, 2003; Jiang *et al.*, 2010). The mediation results suggest, in a manner consistent with our theoretical predictions, that the reduction in these agency cost indicators is negatively associated with both EIDQ and Sub_EIDQ in the second-stage regressions. This suggests that lower agency costs enable firms to reallocate scarce resources toward environmental governance investments and improved transparency practices, ultimately enhancing both overall and substantive disclosure quality.

Table 8. Mechanism test: Agency cost channel.

VARIABLES	(1) Mfee	(2) EIDQ	(3) Sub_EID Q	(4) Ofee	(5) EIDQ	(6) Sub_EID Q	(7) Occupy	(8) EIDQ	(9) Sub_EID Q
NonCEO_Constraints	- 0.001** *	0.015**	0.023***	-0.002**	0.016**	0.023***	-0.000*	0.016**	0.023***
	(-3.013)	(2.270)	(2.998)	(-2.010)	(2.308)	(3.028)	(-1.777)	(2.303)	(3.035)
Mfee		- 0.475** *	- 0.486***						
		(-2.799)	(-2.579)						
Ofee					-0.164** (-2.028)	-0.179** (-1.986)			
Occupy								- 0.813** *	-0.606**
								(-3.714)	(-2.457)
Size	- 0.012** *	0.166** *	0.126***	- 0.021** *	0.169** *	0.128***	- 0.001** *	0.171** *	0.131***
	(-15.223)	(12.508)	(8.651)	(-11.160)	(12.664)	(8.792)	(-2.579)	(13.057)	(9.165)
Lev	- 0.022** *	0.010	-0.049	- 0.041** *	0.014	-0.046	0.014** *	0.032	-0.030
	(-6.963)	(0.202)	(-0.876)	(-5.383)	(0.270)	(-0.819)	(6.959)	(0.622)	(-0.536)
ROA	- 0.127** *	0.214**	0.303***	- 0.275** *	0.229** *	0.315***	- 0.018** *	0.259** *	0.353***
	(-22.434)	(2.473)	(3.044)	(-19.809)	(2.636)	(3.154)	(-5.451)	(3.043)	(3.635)
Growth	- 0.019** *	- 0.060** *	- 0.049***	- 0.036** *	- 0.057** *	- 0.046***	- 0.002** *	- 0.053** *	- 0.041***
	(-24.564)	(-4.244)	(-3.097)	(-19.962)	(-4.067)	(-2.957)	(-3.939)	(-3.897)	(-2.707)
Indep	-0.002 (-0.346)	-0.096 (-0.779)	-0.126 (-0.905)	-0.013 (-0.915)	-0.097 (-0.789)	-0.127 (-0.916)	0.006 (1.304)	-0.090 (-0.732)	-0.121 (-0.872)
Top1	-0.004	-0.032	-0.105	-0.003	-0.031	-0.103	- 0.011** *	-0.039	-0.110
	(-0.812)	(-0.373)	(-1.078)	(-0.295)	(-0.357)	(-1.062)	(-3.661)	(-0.454)	(-1.123)

Big4	0.001	0.056	0.075	0.012** *	0.057	0.077	-0.003**	0.053	0.073
	(0.557)	(1.337)	(1.585)	(2.810)	(1.372)	(1.618)	(-2.211)	(1.264)	(1.532)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	43,345	43,345	43,345	43,345	43,345	43,345	43,345	43,345	43,345

Notes: This table reports mediation results for agency cost proxies: *Mfee* (Columns 1-3), *Ofee* (Columns 4-6), and *Occupy* (Columns 7-9). For each proxy, Column (1/4/7): *NonCEO_Constraints* → Proxy; Column (2/5/8): *NonCEO_Constraints* + Proxy → EIDQ; Column (3/6/9): *NonCEO_Constraints* + Proxy → Sub_EIDQ. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3.2. Information Asymmetry Channel

Non-CEO executives, as key participants in corporate operations, possess private information that can counter the CEO's information monopoly. Results in **Table 9** (Panels A and B) show that *NonCEO_Constraints* significantly reduces Analyst Forecast Error (FERR1), Forecast Dispersion (FDISP1), Analyst Forecast Optimism (FOPT1), and Stock Price Synchronicity (SYNCH). In the second-stage regressions, these information asymmetry proxies are negatively related to both EIDQ and Sub_EIDQ. This pattern is consistent with the interpretation that non-CEO

executives break the CEO's information monopoly by increasing horizontal information flow and lowering information barriers between insiders and outsiders. Lower forecast errors, dispersion, and optimism bias reflect more accurate and consensus-driven external expectations, while reduced SYNCH signifies greater firm-specific information incorporation into stock prices (Morck *et al.*, 2000; Gul *et al.*, 2010). This enhanced transparency facilitates the disclosure of substantive (rather than symbolic) environmental information, offering empirical support for the predicted role of the mitigation of information asymmetry.

Table 9. Mechanism test: Information asymmetry channel.

Panel A: FERR1 + FDISP1						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	FERR1	EIDQ	Sub_EIDQ	FDISP1	EIDQ	Sub_EIDQ
NonCEO_Constraints	-0.041** (-2.326)	0.018** (2.103)	0.029*** (3.090)	-0.020* (-1.771)	0.017* (1.767)	0.027** (2.575)
FERR1		-0.008*** (-2.689)	-0.007** (-2.000)			
FDISP1				-0.020*** (-3.685)	-0.019*** (-3.218)	
Size	0.003 (0.089)	0.188*** (11.130)	0.125*** (6.749)	0.001 (0.037)	0.201*** (10.515)	0.140*** (6.614)
Lev	-0.150 (-1.230)	0.014 (0.213)	-0.012 (-0.172)	-0.087 (-1.091)	0.044 (0.607)	0.013 (0.159)
ROA	-6.839*** (-24.459)	0.346*** (2.869)	0.429*** (3.148)	-3.554*** (-18.140)	0.344** (2.530)	0.442*** (2.893)
Growth	-0.575*** (-12.805)	-0.063*** (-3.513)	-0.036* (-1.808)	-0.306*** (-10.190)	-0.071*** (-3.526)	-0.041* (-1.821)
Indep	0.474 (1.601)	-0.010 (-0.064)	-0.032 (-0.184)	0.189 (0.918)	-0.076 (-0.455)	-0.167 (-0.918)
Top1	-0.460*** (-2.670)	-0.101 (-0.972)	-0.126 (-1.109)	-0.046 (-0.388)	-0.133 (-1.171)	-0.155 (-1.259)
Big4	-0.100 (-1.118)	0.060 (1.250)	0.078 (1.433)	0.012 (0.203)	0.041 (0.819)	0.071 (1.234)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	27,476	27,476	27,476	22,881	22,881	22,881
Panel B: FOPT1 + SYNCH						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	FOPT1	EIDQ	Sub_EIDQ	SYNCH	EIDQ	Sub_EIDQ
NonCEO_Constraints	-0.039* (-1.819)	0.018** (2.113)	0.029*** (3.097)	-0.030*** (-3.596)	0.015** (2.062)	0.021*** (2.662)
FOPT1		-0.006** (-2.526)	-0.006** (-1.973)			
SYNCH					-0.013*** (-3.183)	-0.012** (-2.517)

Size	0.026 (0.647)	0.188*** (11.143)	0.125*** (6.758)	0.236*** (19.497)	0.175*** (12.722)	0.136*** (9.037)
Lev	-0.422*** (-2.733)	0.012 (0.191)	-0.014 (-0.190)	-0.564*** (-11.616)	-0.001 (-0.021)	-0.030 (-0.512)
ROA	-7.699*** (-24.397)	0.352*** (2.910)	0.432*** (3.165)	-0.063 (-0.630)	0.286*** (3.230)	0.347*** (3.442)
Growth	-0.654*** (-11.936)	-0.062*** (-3.490)	-0.036* (-1.799)	-0.128*** (-6.697)	-0.055*** (-3.817)	-0.043*** (-2.720)
Indep	0.720* (1.857)	-0.009 (-0.059)	-0.031 (-0.179)	0.176 (1.377)	-0.098 (-0.762)	-0.121 (-0.828)
Top1	-0.447* (-1.928)	-0.101 (-0.964)	-0.125 (-1.103)	0.018 (0.230)	-0.019 (-0.205)	-0.102 (-1.007)
Big4	-0.077 (-0.626)	0.060 (1.257)	0.078 (1.438)	0.040 (0.894)	0.047 (1.081)	0.068 (1.371)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	27,476	27,476	27,476	38,955	38,955	38,955

Notes: This table reports mediation results for information asymmetry proxies. Panel A: FERR1 and FDISP1. Panel B: FOPT1 and SYNCH. For each mediator, Column (1): NonCEO_Constraints→Mediator; Column (2): NonCEO_Constraints + Mediator→EIDQ; Column (3): NonCEO_Constraints + Mediator→Sub_EIDQ. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.3.3. Internal Control Quality Channel

Internal political balance serves as an institutional guarantee for rigorous internal control. As shown in **Table 10**, NonCEO_Constraints is significantly positively correlated with the DIB Internal Control Index. This pattern is consistent with the interpretation that when non-CEO executives exert effective oversight, they drive the establishment of a more comprehensive internal control system. In the second-stage regressions, the coefficient of DIB is significantly positive for both EIDQ and Sub_EIDQ, suggesting that high-quality internal control ensures the reliability and substance of environmental reporting. The DIB Internal Control Index, developed by Shenzhen Dibo

Table 10. Mechanism Test: Internal Control Channel.

VARIABLES	(1)	(2)	(3)
	DIB	EIDQ	Sub_EIDQ
NonCEO_Constraints	1.226** (2.365)	0.016** (2.188)	0.023*** (2.873)
DIB		0.001*** (9.422)	0.001*** (8.232)
Size	6.167*** (6.996)	0.162*** (12.126)	0.123*** (8.400)
Lev	-7.868** (-2.206)	-0.003 (-0.051)	-0.029 (-0.509)
ROA	261.216*** (36.171)	0.074 (0.844)	0.135 (1.332)
Growth	38.302*** (32.438)	-0.079*** (-5.500)	-0.065*** (-4.110)
Indep	2.173 (0.260)	-0.069 (-0.547)	-0.113 (-0.792)
Top1	20.689*** (3.692)	-0.030 (-0.347)	-0.124 (-1.256)
Big4	4.806 (1.630)	0.053 (1.218)	0.070 (1.413)
Firm FE	Yes	Yes	Yes

Enterprise Risk Management Technology Co., Ltd., is a comprehensive measure based on the five elements of internal control—control environment, risk assessment, control activities, information and communication, and monitoring (Liu *et al.*, 2022). It is widely adopted in Chinese corporate governance and environmental disclosure studies due to its objective evaluation of internal control effectiveness (Sun *et al.*, 2024).

These results are consistent with internal control serving as a mediating pathway through which horizontal governance restrains disclosure distortions and procedural loopholes.

Year FE	Yes	Yes	Yes
N	39,865	39,865	39,865

Notes: This table reports mediation results for internal control (DIB). Column (1): NonCEO_Constraints→DIB; Column (2): NonCEO_Constraints + DIB→EIDQ; Column (3): NonCEO_Constraints + DIB→Sub_EIDQ. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3.4. TMT Decision Participation Channel

To provide more direct evidence regarding how non-CEO executives influence the disclosure decision-making process—beyond the governance outcomes examined above—we further investigate the role of TMT decision-making participation. This approach addresses a concern: while agency costs, information asymmetry, and internal control quality reflect the outcomes of oversight, they do not fully reveal how non-CEO executives actively participate in the formulation of disclosure strategies (Boivie *et al.*, 2021).

We argue that an effective non-CEO executive check-and-balance mechanism reshapes the power dynamics within TMT organizations, thereby enhancing decision-making participation. When non-CEO executives possess both motivation (professional perspective) and capability (political capital), they are more likely to gain a voice in strategic decisions regarding environmental disclosure. This enhanced participation undermines the CEO's information monopoly and ensures that diverse perspectives are incorporated into the reporting process. To capture this mechanism, we employ TMT salary dispersion (TMT_salary) as a proxy variable for decision-

making participation. Building on previous research (Carpenter & Sanders, 2002; Siegel & Hambrick, 2005), we define salary dispersion as the coefficient of variation of the total compensation amounts received by the top five non-CEO executives. Lower salary dispersion reflects a more equitable compensation structure, indicating higher levels of decision-making participation and information sharing among non-CEO executives.

As shown in **Table 11**, Column (1) demonstrates that NonCEO_Constraints is significantly negatively correlated with TMT compensation dispersion ($\beta = -0.015$, $p < 0.01$), indicating that effective internal checks and balances reduce the compensation gap among non-CEO executives. Columns (2) and (3) show that TMT compensation dispersion is also significantly negatively correlated with both EIDQ ($\beta = -0.069$, $p < 0.01$) and Sub_EIDQ ($\beta = -0.069$, $p < 0.01$), suggesting that greater power concentration undermines disclosure quality. These findings provide more direct evidence that non-CEO executives enhance disclosure quality by actively participating in decision-making, thereby supplementing the aforementioned governance outcome channels.

Table 11. Mechanism Test: TMT Decision Participation Channel.

VARIABLES	(1)	(2)	(3)
	TMT_salary	EIDQ	Sub_EIDQ
NonCEO_Constraints	-0.015*** (-5.179)	0.016** (2.279)	0.023*** (3.016)
TMT_salary	-0.069*** (-3.310)	-0.067*** (-2.838)	-0.069*** (-3.310)
Size	0.171*** (13.101)	0.130*** (9.141)	0.171*** (13.101)
Lev	0.016 (0.324)	-0.038 (-0.684)	0.016 (0.324)
ROA	0.266*** (3.145)	0.354*** (3.672)	0.266*** (3.145)
Growth	-0.048*** (-3.557)	-0.037** (-2.470)	-0.048*** (-3.557)
Indep	-0.095 (-0.775)	-0.126 (-0.909)	-0.095 (-0.775)
Top1	-0.037 (-0.422)	-0.114 (-1.171)	-0.037 (-0.422)
Big4	0.063 (1.482)	0.083* (1.717)	0.063 (1.482)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	43,443	43,443	43,443

Notes: This table reports mediation results for TMT decision participation (TMT_salary). Column (1): NonCEO_Constraints→TMT_salary; Column (2): NonCEO_Constraints + TMT_salary→EIDQ; Column (3): NonCEO_Constraints + TMT_salary→Sub_EIDQ. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3.5. Summary

In summary, the above analysis reveals an empirical pattern consistent with four complementary mechanisms: reducing agency costs, alleviating information asymmetry, strengthening internal control, and enhancing TMT decision-making participation. The first three channels capture the governance outcomes arising from effective supervision, whereas the TMT participation channel provides more direct evidence regarding how non-CEO executives transform their informational advantage into decisions that improve disclosure practices. We interpret these findings as exploratory evidence supporting the theoretical pathway outlined in the conceptual framework, while acknowledging that these tests are based on observational correlations and should not be interpreted as conclusive causal mediation evidence.

4.4. Heterogeneity Analysis: Substitution Effect

We select CEO duality and analyst coverage as moderating conditions because they capture the two fundamental pillars of the governance environment—internal board oversight and external market discipline—which together define the institutional space for CEO opportunism. CEO duality impairs board monitoring by consolidating decision-making and oversight in one individual, amplifying CEO discretion over disclosure (Fama & Jensen, 1983). Analyst coverage, as the primary external information intermediary, curbs managerial discretion by disseminating firm-specific information to capital markets. These two mechanisms operate through distinct channels—structural versus informational—allowing us to demonstrate that the substitution effect holds across different types of governance failures. Moreover, both are well-established governance proxies with sufficient cross-sectional variation in our sample, facilitating comparability with prior studies (Rediker & Seth, 1995). We acknowledge that other governance conditions—ownership structure, industry characteristics, and institutional maturity—may also moderate this relationship, which we discuss in Section 6.1 (second limitation).

4.4.1. The Role of CEO Power

First, we examine the role of CEO power. When the CEO holds both the CEO and Chairman positions (i.e., dual CEO roles), the independence of the board of directors is often compromised (Fama & Jensen, 1983). Under such circumstances, the board's supervisory function is weakened, rendering internal executive checks and balancing the final line of defense in internal governance. **Table 11A** presents the results: columns (1)–(2) report findings using EIDQ as the dependent variable, while columns (3)–(4) report findings using Sub_EIDQ as the dependent variable. The coefficient for NonCEO_Constraints is positive and statistically significant for both EIDQ ($\beta = 0.031$, $p < 0.01$) and Sub_EIDQ ($\beta = 0.028$, $p < 0.05$) in firms with dual CEO roles; however, in the subsample without dual CEO roles, the coefficients for both dependent variables are close to zero and not statistically significant (EIDQ: $\beta = -0.003$, $p > 0.10$; Sub_EIDQ: $\beta = 0.013$, $p > 0.10$). This pattern indicates that internal constraints can

compensate for deficiencies in board supervision, and this substitution effect holds true for both overall disclosure quality and substantive disclosure quality.

4.4.2. The Role of External Monitoring Pressure

Secondly, we examine the role of external supervision by analysts. When analyst attention is low, the external information environment is opaque, granting the CEO greater discretion to manipulate disclosures (Yu, 2008). **Table 11B** presents the results: columns (1)–(2) report findings where EIDQ serves as the dependent variable, while columns (3)–(4) report findings where Sub_EIDQ serves as the dependent variable. The coefficient for NonCEO_Constraints is significantly large for both EIDQ ($\beta = 0.015$, $p < 0.10$) and Sub_EIDQ ($\beta = 0.025$, $p < 0.01$) in the low-analyst-attention subsample; in contrast, in the high-analyst-attention subsample, the coefficients for both dependent variables are small and not statistically significant (EIDQ: $\beta = 0.004$, $p > 0.10$; Sub_EIDQ: $\beta = 0.004$, $p > 0.10$). This pattern supports the substitution effect hypothesis: precisely when external market constraints are weak, internal constraints become more crucial for ensuring both overall disclosure quality and substantive disclosure quality.

4.5. Further Analysis: Additional Evidence on Greenwashing Mitigation

To provide supplementary evidence on whether checks and balances among non-CEO executives can mitigate 'greenwashing', thereby extending beyond the transition from symbolic rhetoric to substantive disclosure already confirmed in principal component analysis (Tashman *et al.*, 2019), we examine two complementary proxies for substantive environmental actions: green innovation and environmental penalties. Building on existing literature, we employ the number of green patent applications (LnGreen) to capture a firm's substantive environmental innovation, and utilize records of environmental penalties (Ln_Penalty_Count and Ln_Penalty_Amount) to capture regulatory enforcement outcomes. The results are presented in **Table 12**.

Column (1) presents the results for green innovation (LnGreen). The coefficient for NonCEO_Constraints is positive and statistically significant ($\beta = 0.017$, $p < 0.05$), indicating that non-CEO executive checks and balances are associated with higher green patent output. This suggests that internal constraints not only enhance disclosure quality but also encourage substantive environmental actions. Columns (2) and (3) report the results for environmental penalties. The coefficient for NonCEO_Constraints is significantly negative for both the frequency of penalties ($\beta = -0.016$, $p < 0.01$) and the penalty amount ($\beta = -0.067$, $p < 0.01$). These findings indicate that firms with stronger non-CEO executive checks and balances face fewer and milder environmental penalties, suggesting that internal constraints help enterprises avoid regulatory enforcement actions. Overall, these findings provide supplementary evidence that non-CEO executive checks and balances are linked not only to higher-quality disclosures but also to better substantive environmental

performance. While our main analysis (**Table 2**) demonstrates that such constraints shift disclosures from mere rhetoric to substantive content, these further analyses show that such constraints may also translate into

tangible improvements in environmental actions, thereby helping to curb greenwashing.

Table 12. Heterogeneity Analysis.

VARIABLES	Panel A: CEO Duality			
	EIDQ		Sub_EIDQ	
	(1)CEO Duality	(2)No Duality	(3)CEO Duality	(4)No Duality
NonCEO_Constraints	0.031*** (2.625)	-0.003 (-0.419)	0.028** (2.105)	0.013 (1.469)
Size	0.168*** (6.111)	0.159*** (10.446)	0.153*** (4.777)	0.115*** (6.922)
Lev	0.067 (0.699)	0.049 (0.818)	-0.034 (-0.328)	0.017 (0.251)
ROA	0.020 (0.142)	0.310*** (3.016)	0.051 (0.315)	0.401*** (3.497)
Growth	-0.026 (-1.049)	-0.059*** (-3.691)	-0.013 (-0.479)	-0.049*** (-2.731)
Indep	-0.062 (-0.264)	-0.105 (-0.716)	-0.254 (-0.893)	-0.128 (-0.792)
Top1	-0.108 (-0.537)	-0.016 (-0.167)	-0.165 (-0.735)	-0.149 (-1.351)
Big4	0.060 (0.815)	0.048 (0.952)	0.091 (0.987)	0.068 (1.187)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	12,295	30,589	12,295	30,589
VARIABLES	Panel B: Analyst Coverage			
	EIDQ		Sub_EIDQ	
	(1)Low Analyst	(2)High Analyst	(3)Low Analyst	(4)High Analyst
NonCEO_Constraints	0.015* (1.811)	0.004 (0.315)	0.025*** (2.641)	0.004 (0.285)
Size	0.136*** (8.539)	0.228*** (8.792)	0.095*** (5.451)	0.164*** (5.674)
Lev	0.002 (0.032)	0.225** (2.367)	-0.028 (-0.423)	0.097 (0.915)
ROA	0.230** (2.465)	0.292* (1.665)	0.318*** (2.999)	0.299 (1.499)
Growth	-0.036** (-2.223)	-0.078*** (-2.987)	-0.037** (-2.050)	-0.018 (-0.620)
Indep	-0.133 (-0.887)	-0.064 (-0.304)	-0.096 (-0.576)	-0.234 (-1.015)
Top1	0.040 (0.393)	-0.011 (-0.067)	-0.118 (-1.015)	0.046 (0.261)
Big4	0.049 (0.820)	0.042 (0.730)	0.034 (0.505)	0.091 (1.365)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	28,250	14,320	28,250	14,320

Notes: Panel A partitions by CEO duality (Dual=1: CEO also serves as Chairman). Panel B partitions by median analyst coverage. Columns (1)-(2) use EIDQ; Columns (3)-(4) use Sub_EIDQ. All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Discussion

5.1. Theoretical Implications

This paper offers the following theoretical insights.

First, by distinguishing between substantive disclosure and symbolic disclosure, we provide direct evidence that

internal governance can effectively mitigate greenwashing. Contrary to previous studies that viewed environmental information disclosure as a unidimensional concept, this research demonstrates that checks and balances among non-CEO executives do not merely encourage increased information disclosure; rather, they fundamentally reshape

the composition of corporate disclosures. The study finds that such constraints enhance verifiable hard information while having no impact on symbolic language—what we term the “selective enhancement” pattern—thereby directly addressing the core issue of greenwashing: the disconnect between symbolic statements and substantive actions. This selective pattern is not merely a statistical nuance but serves as a key empirical basis for how internal governance drives enterprises to transition from “oral commitments” to “actual actions.”

Second, beyond the shift in disclosure composition, the constraining mechanism of non-CEO executives also differs fundamentally from traditional governance channels. Unlike board monitoring, institutional investor intervention, or external regulatory pressure—all of which face an “information void” that prevents them from verifying the authenticity of public disclosures—non-CEO executives possess operational-level information advantages that enable them to identify the gap between rhetoric and reality. This information-based, *ex ante* constraining mechanism constitutes a distinct governance channel that complements rather than substitutes for existing oversight mechanisms.

Third, by employing a heterogeneity analysis to uncover the substitution effect, we provide new insights into the corporate governance literature for emerging markets. Our heterogeneity analysis reveals a systematic pattern of substitution effects: the positive impact of non-CEO constraints on EIDQ and Sub_EIDQ is significantly stronger in firms with a single CEO role and in sub-samples

characterized by lower analyst attention; conversely, this effect is weak and insignificant in sub-samples with higher analyst attention—results that collectively support the governance substitution hypothesis. From the perspective of agency theory, the integration of CEO roles concentrates both decision-making and supervisory authority under one individual, rendering board supervision virtually ineffective, while low analyst attention undermines the information transmission and disciplining functions of capital markets; both scenarios amplify the scope for CEO opportunism and information manipulation, thereby creating a governance vacuum that non-CEO executives can fill by participating in decision-making, questioning information, and exercising checks and balances. Institutional theory further elucidates the boundary conditions under which this substitution effect manifests: when external institutional pressures are strong (e.g., high analyst attention), CEO behavior is already regulated by the external environment, and the marginal contribution of internal constraints becomes limited; whereas in the absence of such pressures, the internal power structure serves as the sole “institutional substitute” mechanism, thereby highlighting the check-and-balance role of non-CEO executives. The substitution effect essentially reflects the functional compensation provided by internal governance in weak institutional environments; when formal institutional mechanisms are inadequate, informal power checks and balances act as an alternative governance mechanism, thereby elevating our findings from empirical observations to a theoretically generalizable governance logic.

Table 13. Further Analysis: Additional Evidence on Greenwashing Mitigation.

VARIABLES	(1)LnGreen	(2)Ln_Penalty_Count	(3)Ln_Penalty_Amount
NonCEO_Constraints	0.017** (2.200)	-0.016*** (-2.807)	-0.067*** (-4.345)
Size	0.392*** (19.894)	0.034*** (4.108)	0.069*** (3.135)
Lev	-0.065 (-1.057)	-0.001 (-0.050)	-0.077 (-0.988)
ROA	0.129 (1.308)	0.078 (1.471)	0.172 (1.269)
Growth	-0.028* (-1.790)	-0.018* (-1.741)	-0.027 (-1.026)
Indep	0.255 (1.562)	-0.013 (-0.152)	-0.106 (-0.498)
Top1	0.013 (0.113)	0.128** (2.242)	0.378*** (2.692)
Big4	-0.177*** (-2.593)	-0.058* (-1.759)	-0.120 (-1.510)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	43,418	26,743	25,987

Notes: Column (1): green innovation (LnGreen). Columns (2)-(3): environmental penalties (Ln_Penalty_Count and Ln_Penalty_Amount). All models include firm and year fixed effects. Robust t-statistics clustered at the firm level are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Fourth, our findings are rooted in China's institutional context, yet this does not diminish their value for theoretical transfer. The Chinese context provides this

study with a “strong test” scenario: in an environment characterized by strong government intervention and an evolving market-oriented structure, if internal checks-and-

balances mechanisms can still effectively enhance disclosure quality, such mechanisms should exhibit stronger theoretical explanatory power in economies with more mature institutions. Meanwhile, the prevalence of institutional gaps and regulatory arbitrage in China's transitioning economy precisely highlights the practical value of internal governance as a "institutional complement" mechanism—a phenomenon that aligns closely with the contexts of many emerging markets and developing economies. Therefore, we argue that the core finding of this study—namely, that power checks within executive teams can compensate for external governance deficiencies through information advantages—holds theoretical universality across different countries.

5.2. Practical Implications

For regulators, our findings indicate that policies aimed at improving disclosure quality should consider promoting independence within the executive team and ensuring compensation fairness, as these conditions enable non-CEO executives to exercise effective constraint. Specifically, reducing TMT compensation dispersion and enhancing the substantive involvement of non-CEO executives in decision-making should serve as key focal points for governance reforms.

For investors, the degree of power decentralization within the executive team can serve as a signal of disclosure credibility; companies with stronger checks and balances among non-CEO executives are more likely to produce reliable environmental reports.

For boards of directors, designing a TMT structure that prevents excessive concentration of power is crucial. Ensuring that non-CEO executives possess both the motivation and the capability to challenge the CEO's information monopoly can serve as an internal checks-and-balances mechanism to curb greenwashing.

6. Conclusions

Based on a large sample of A-share listed companies in China from 2007 to 2024, this study finds that the check-and-balance mechanism involving non-CEO executives significantly enhances the quality of environmental information disclosure—specifically, there is an increase in substantively verifiable information, while symbolic rhetoric shows no significant change. This mechanism provides direct evidence for internal governance in curbing "greenwashing". Specifically, the moderation effect analysis reveals that when non-CEO executives possess a longer career horizon and higher political capital, the effect of internal constraints becomes significantly stronger. These findings expand the Career Concerns Theory and the TMT Power literature by demonstrating how motivation and ability jointly shape internal governance outcomes. The mechanism testing identifies four complementary channels through which internal constraints improve disclosure quality: reducing agency costs, alleviating information asymmetry, strengthening the internal control system, and enhancing TMT decision-making participation. These pathways indicate that non-CEO executives not only constrain opportunistic behavior but also improve the

overall information environment and reporting infrastructure of the firm. The heterogeneity analysis further demonstrates that internal constraints exert a stronger effect on firms with dual CEO roles and those with low analyst attention, thereby validating the substitute function of internal governance in addressing insufficient external supervision.

In addition to the findings regarding disclosure transformation, we also identify supplementary evidence linking non-CEO executive checks with greenwashing suppression. Enterprises with stronger internal constraints tend to generate more green innovation and face fewer and milder environmental penalties. These patterns complement the results derived from the main finding regarding how constraints influence disclosure content, while simultaneously demonstrating that such constraints may impact the actual actions taken by firms. Overall, these results point toward a consistent interpretation: non-CEO executive checks help bridge the gap between environmental commitments and substantive action.

Overall, by integrating the Veto Player Theory with the Upper Echelons Theory, this study extends beyond traditional theories of vertical oversight to provide an observation-based micro-level political foundation for corporate sustainable development. It demonstrates that the distribution of power within the executive team constitutes a critical yet previously under-researched determinant of environmental responsibility.

6.1. Limitations and Future Research

This study has several limitations, which warrant further attention in future research.

First, the sample is limited to Chinese A-share listed companies, whose institutional context is characterized by government-led environmental regulation, a mixed ownership structure where state-owned and private enterprises coexist, as well as a rapidly developing yet still imperfect market mechanism. These contextual features influence our findings' external validity in two aspects. On one hand, the core mechanism identified in this study: non-CEO executives suppressing CEO opportunistic behavior through information advantage and internal checks and balances, is grounded in the internal power distribution and agency dynamics within organizations and should theoretically exhibit cross-context universality; this mechanism is not unique to China but represents a universal pattern that may exist in any organization with CEO information monopoly and internal decision-making conflicts. On the other hand, the magnitude of the effect and its boundary conditions may vary depending on differences in the institutional environment. Therefore, we advocate for future research to adopt a transnational comparative design, testing the consistency of these findings across different institutional contexts—such as common law versus civil law systems, developed versus emerging markets—to clarify the universal boundaries of this mechanism.

Second, while the substitution effect has been validated in this study (being more pronounced in firms with a dual CEO

role and those receiving low analyst attention), its robustness may be moderated by other institutional factors. Regarding ownership structure, administrative intervention in state-controlled enterprises may undermine the independence of non-CEO executives, whereas shareholding concentration in private enterprises may also constrain the checks-and-balances mechanism; concerning industry characteristics, the strategic importance of green issues may amplify this effect in high-pollution industries, but may not necessarily do so in clean industries; as for institutional maturity, in regions with stringent environmental regulations and a high degree of marketization, the formal institutional framework itself can already effectively constrain CEO behavior, potentially narrowing the room for substitution through internal constraints. These potential moderating factors collectively point to a central proposition: the substitution effect of internal governance is not unconditional; rather, it is most prominent within specific institutional voids. Future research should conduct systematic heterogeneity tests across different institutional contexts to clarify the applicable boundaries and condition-dependent nature of this mechanism.

Third, the mediation analysis employed in this paper is based on observational data; while it can reveal empirical patterns consistent with theoretical mechanisms, it struggles to establish rigorous causal mediation relationships. We recommend that future research adopt methods such as chain mediation analysis, quasi-experimental designs, or structural equation modeling to conduct more rigorous causal identification of the specific pathways through which non-CEO executives' checks-and-balances influence disclosure quality (Cai *et al.*, 2025).

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Data availability

Data is available from the corresponding author on reasonable request.

Declarations

This research is based exclusively on publicly available, anonymized secondary data and does not involve any direct interaction with human participants. Consequently, the study is exempt from ethical review approval, and no informed consent was required.

Informed consent

The study does not involve human participants or their data.

Conflict of interest

The authors declare no competing interests.

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