

Research on the Effect of Corporate Greenwashing on Environmental Rating Divergence

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Abstract. The question of whether corporate greenwashing leads to divergence in ESG ratings among rating agencies remains underexplored. This study examines A-share listed companies in China from 2018 to 2022, employing text analysis to measure corporate greenwashing intensity. Using environmental rating data from WIND, Huazheng, and Bloomberg, we empirically demonstrate that corporate greenwashing significantly amplifies divergence in environmental ratings across agencies. This conclusion holds robust after rigorous tests, including instrumental variable (IV) approaches and propensity score matching (PSM). Mechanism analysis reveals that higher corporate information transparency mitigates the positive impact of greenwashing on rating divergence. Heterogeneity analysis indicates that the positive effect of greenwashing on rating divergence is more pronounced in non-heavily polluting industries and firms whose CEOs lack environmental expertise. This research extends the literature on the determinants of greenwashing and environmental rating divergence, providing empirical evidence to promote standardized ESG disclosure and curb corporate greenwashing practices.

Keywords: Greenwashing; Environmental Rating Divergence; Information Asymmetry.

1. Introduction

The 14th Five-Year Plan (2021–2025) marks the first inclusion of "carbon peak" and "carbon neutrality" in China's Government Work Report, integrating the "dual carbon" goals into the holistic framework of ecological civilization construction. However, as enterprises prioritize profit maximization and seek to cultivate an eco-friendly public image at minimal cost to boost financial gains, many engage in "pseudo-environmental" practices to varying degrees[1]. The term "greenwashing," coined by American environmentalist Jay Westerveld in 1986, blends "green" (symbolizing environmentalism) and "whitewashing" to describe corporate claims of environmental responsibility unsupported by substantive action—essentially false promotional rhetoric. Amid inadequate environmental information disclosure and regulatory oversight, greenwashing proliferates among firms, with severe information asymmetry impeding effective supervision and penalties. Globally, heightened climate concerns have positioned the environmental (E) dimension as a critical component of corporate ESG performance. A firm's environmental conduct impacts not only its brand reputation and market competitiveness but also its long-term sustainability. Investors increasingly integrate environmental metrics into decision-making to assess long-term value and risks, favoring companies with strong environmental records. As sustainable investing gains traction, reliance on third-party ESG ratings for listed companies grows. Internationally, ESG frameworks operate through standardized processes: listed companies publish reports under regulatory guidelines, specialized rating agencies evaluate performance, capital markets make investment decisions based on these ratings, and firms adjust practices using feedback. While ESG is well-established globally, China's ESG ecosystem remains nascent, with limited research in this domain. The absence of systematic disclosure standards domestically leads to significant divergence in ESG ratings for the same company across agencies. Although ESG ratings provide stakeholders with valuable information—mitigating information asymmetry—rating divergence may mislead market participants, distort corporate decisions, and affect market returns. Since incomplete disclosure is a

primary driver of ESG divergence, investigating its determinants through an informational lens is imperative.

First, while both rating divergence and greenwashing correlate strongly with information asymmetry, their interplay remains unexplored. Greenwashing reflects corporate information insufficiency. Despite the critical role of environmental disclosure in enhancing transparency and credibility, firms face persistent challenges such as selective or inconsistent reporting. ESG rating agencies rely on corporate data; thus, information asymmetry between firms and raters may amplify rating divergence. This warrants in-depth analysis of whether greenwashing drives ESG rating discrepancies. Second, as key information intermediaries in capital markets, ESG agencies help stakeholders identify environmental risks. Yet, significant inter-agency rating divergence undermines firms' incentives to rectify deficiencies: conflicting signals obscure which environmental improvements the market values, potentially leading to underinvestment in sustainability initiatives. This may adversely affect listed firms, external stakeholders, and the broader economy. Identifying pathways to mitigate such divergence is therefore crucial.

The potential research contributions of this study are as follows: First, this paper aims to establish the causal relationship between corporate greenwashing and environmental rating divergence, thereby empirically advancing research on corporate greenwashing and addressing gaps in the literature regarding the determinants of environmental rating divergence. Second, the study analyzes the mechanism through which greenwashing affects rating divergence, constructing a transmission pathway between the two phenomena. By examining heterogeneity factors—such as whether firms belong to heavily polluting industries and whether CEOs possess environmental expertise—it further investigates context-specific dynamics between greenwashing and environmental (E) divergence. This enriches the theoretical framework on antecedents of rating divergence and offers novel insights into its origins. Third, this research alerts all stakeholders to scrutinize corporate environmental claims critically, advocates for stricter and more transparent environmental disclosure standards, and fosters collaboration among enterprises, investors, and governments to advance authentic sustainable development.

2. Theoretical analysis and research hypotheses

In recent years, research on corporate greenwashing has grown substantially, with scholars examining its identification, drivers, influencing factors, and governance strategies from diverse perspectives [2–4]. For instance, studies have explored determinants of greenwashing—such as government regulation, media scrutiny, and industry competition—through the lens of internal governance and external pressures [5–8]. Future research is likely to focus on refining theoretical frameworks, deepening investigations into complex influencing factors and their interactions, and expanding context-specific studies of corporate greenwashing in China.

Concurrently, a review of literature on environmental rating divergence reveals that inconsistencies arise from heterogeneous ESG measurement standards, methodological variations, and divergent prioritization of ESG dimensions. Differences in rating scope, metrics, and weighting—particularly metric heterogeneity—are primary drivers of ESG rating divergence. In China, rating agencies face additional challenges including poor disclosure quality and low inter-agency rating correlation [9–11]. Such divergence exacerbates stock price crash risk, heightens stock price synchronicity [12], reduces stock liquidity, and impairs analyst earnings forecast accuracy, thereby intensifying corporate financing constraints [13–15].

Environmental ratings rely fundamentally on information disclosure. As a key quantitative metric, their validity directly impacts research outcomes. Annual reports, a primary reference for environmental ratings, may contain narrative greenwashing that distorts external agencies' assessments of corporate environmental risk. Specifically, this paper posits that corporate greenwashing affects rating divergence through the following pathways:

On the one hand, based on the theory of information asymmetry, information asymmetry pervades macro-micro entities, where disparities in information access lead to divergent decisions, economic consequences, and strategic interactions. Corporate greenwashing indicates deficient environmental performance. Given China's inconsistent ESG frameworks and information asymmetry between firms and rating agencies, agencies may react dissimilarly to greenwashing. Authentic ratings would converge if they accurately reflected managerial efforts to mitigate risks and enhance sustainability [16]. Greenwashing, however, generates unreliable environmental signals [17], eroding market trust and obscuring assessments of corporate credibility. When firms exert no real effort but their greenwashing remains undetected by some agencies, information asymmetry—compounded by agencies' heavy reliance on corporate disclosures and subjective methodologies [10]—fuels rating divergence. Selective disclosure, misrepresentation, or rhetoric-action decoupling may mislead some stakeholders into awarding high environmental scores, while others penalize firms with normal or low scores upon detecting greenwashing. This elevates uncertainty about sustainable risks and impedes accurate earnings forecasts. Divergence thus stems from asymmetric information between corporate disclosures and external raters. Moreover, annual reports constitute critical inputs for raters [18]. Agencies prioritize disparate sources: Bloomberg emphasizes disclosure comprehensiveness, while Huazheng focuses on environmental performance. Berg et al. [10] documented low correlation (even negative sub-rating correlations) among six major ESG agencies' ratings. When firms greenwash, agencies' divergent priorities amplify environmental rating discrepancies.

On the other hand, based on signal theory, information distribution is inherently uneven; stakeholders with superior information make more accurate decisions. Robust ESG disclosures signal corporate commitment to sustainability, enhancing reputation among stakeholders [19]. To maximize profits, firms may engage in narrative greenwashing in annual reports, projecting false environmental stewardship to signal competitive advantage. Information-disadvantaged rating agencies must then filter signals for decision-making. Greenwashing can itself constitute a risk signal. When agencies process identical risk signals through heterogeneous analytical frameworks, they generate divergent environmental scores. In summary, this article proposes hypothesis H1:

H1: Corporate greenwashing amplifies environmental rating divergence for listed firms.

3. Research design

3.1. Sample selection and data sources

This study employs a sample of A-share listed companies in China from 2018 to 2022. Data were primarily sourced from the CSMAR, Bloomberg, and Wind databases. To mitigate the influence of outliers, continuous variables were winsorized at the 1% and 99% levels. The initial sample was processed as follows: (1) Exclusion of ST and *ST companies with abnormal financial status; (2) Removal of financial firms; (3) Omission of observations with critical missing financial data.

The final sample comprises 18,562 firm-year observations. All empirical analyses apply a one-period lag to variables and report robust standard errors.

3.2. Variable Definition

3.2.1 Dependent variable: Environmental rating divergence (Ediffer)

Choose environmental rating data from three rating agencies, Bloomberg, Huazheng, and Wind. Due to the different measurement standards of each agency, standardize their [0,1] and ensure that at least two agencies have non blank data. The formula is as follows:

$$x^* = \frac{x - \min}{\max - \min}$$

Definition method 1- Referring to Christensen [18], after processing the data as described above, the standard deviation is taken as the environmental rating divergence (Ediffer1).

Definition Method 2- Referring to Avramov [20], after processing the data as described above, pair it pairwise and calculate the standard deviation, and then take the average as the environmental rating divergence (Ediffer2).

3.2.2 Explanatory variable: Corporate greenwashing (GW)

Referencing Shen et al. [21], this paper adopts the positive tone of environmental information as the measurement standard to establish an evaluation index system. Compared with traditional evaluation methods based on environmental information disclosure scores, the positive tone assessment approach more accurately reveals enterprises' subjectivity in false "greenwashing". Traditional measurement methods primarily focus on the comprehensiveness of information disclosure, meaning higher scores are assigned to richer disclosure content. However, from the essence of "greenwashing" behavior—a subjective method of embellishing corporate environmental information—relying solely on information volume may fail to fully reflect enterprises' subjective tendency to embellish, because some firms (e.g., heavy-polluting industries) must disclose relatively extensive environmental information for various reasons. The measurement and calculation process of the greenwashing indicator is divided into the following steps:

(1) Acquire environmental corpus. As the foundation for subsequent analysis, this study references Xu et al. [22], using annual reports as the base and sentences as the basic unit. Each sentence is analyzed to identify all environment-related statements, constructing an environmental corpus.

(2) Determine environmental dictionary. This study employs the seed words plus word vector method to build an expanded set of environment-related terms. Through deep learning techniques, similar words are identified to obtain a more comprehensive keyword dictionary. Technically, we adopt the pre-trained word vector model released by Tencent AI Lab, which contains over 12 million words and phrases, to compute environment-themed word sets.

(3) Structurally process sample firms' environmental corpus. Tools including regular expressions, Baidu's word segmentation tool LAC, and R's quanteda NLP package are used to batch-process sample firms' texts. Steps include: sentence splitting, word segmentation, filtering statements based on environment-related vocabulary, text tokenization, and term frequency statistics. During word segmentation, Sogou Input Method's cell lexicon ensures accurate recognition of professional terms.

(4) Measure greenwashing degree. After obtaining environmental text materials, the Chinese Sentiment Dictionary developed by Jiang Fuwei et al. [23] is used to calculate greenwashing extent. Referencing Durn et al. [24] and Zeng et al. [25], greenwashing behavior is quantified via word counting..

3.3.3 Control Variable

Referring to Christensen [18], Huang et al. [26], the following control variables were added: company size (Size), company age (Age), asset liability ratio (LEV), return on assets (ROA), dual employment, TobinQ, property ownership (SOE), and current ratio (Current). This article also controls for the effects of year (Year) and industry (Ind), with specific variable definitions as shown in Table 1:

Table 1. Variable Definition

Variable type	Variable	Variable Symbol	Variable Definition
Dependent variable	Environmental rating divergence	Ediffer1	Three institutions standardized the environmental dimension scores of listed companies in the current year and took the standard deviation
		Ediffer2	Three institutions standardized the environmental dimension scores of listed companies in the current year and paired them up to take the standard deviation
Explanatory variable	Corporate Greenwashing	GW	Text analysis
	Size	Size	Natural logarithm of total assets
	Age	Age	Natural logarithm of company establishment years
	Asset liability ratio	LEV	Total liabilities at the end of the period/Total assets at the end of the period
Control Variable	Return on assets	ROA	The ratio of net profit to the average balance of total assets
	Duality	Dual	If the chairman concurrently serves as the general manager, it is 1; otherwise, it is 0
	Tobin's Q value	TobinQ	Tobin's Q value
	Property Rights Nature	SOE	The actual controller has a state-owned value of 1, otherwise it is 0
	Current ratio	Current	Current assets/current liabilities

3.3. Model

Based on the theoretical hypotheses developed, this paper constructs Regression Model (1) to test the main hypothesis using fixed-effects OLS regression with industry and year controls. The analysis focuses on the sign and statistical significance of coefficient a_1 : if a_1 is significantly positive, Hypothesis H1 is supported, indicating that greenwashing amplifies environmental rating divergence among agencies. Additionally, all regressions employ robust standard errors to control for heteroskedasticity, ensuring accurate estimation of statistical parameters.

$$\begin{aligned}
 Ediffer_{i,t+1} = & a_0 + a_1 env_tone2_{i,t} + a_2 Size_{i,t} + a_3 Age_{i,t} + a_4 LEV_{i,t} \\
 & + a_5 ROA_{i,t} + a_6 Dual_{i,t} + a_7 TobinQ_{i,t} + a_8 Current_{i,t} \\
 & + a_9 SOE_{i,t} + \sum Ind + \sum Year + \varepsilon_{i,t}
 \end{aligned} \quad (1)$$

4. Empirical result analysis

4.1. Descriptive statistics

Table 2 reports the descriptive statistics of the main variables in this study. The mean value of the explanatory variable Corporate Greenwashing (GW) is 0.0200, indicating that among all sample firms during 2018–2022, the occurrence of greenwashing behavior is extremely rare, accounting for only 2% of the total sample. This suggests that most firms do not overstate their environmental claims in annual reports. The mean value of the explained variable Ediffer1 is 0.0801, with a maximum value

of 0.346; the mean value of Ediffer2 is 0.0405, with a maximum value of 0.230. These results demonstrate that listed firms exhibit significant divergence in environmental ratings.

Table 2. Descriptive statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Ediffer1	18,562	0.0801	0.0769	0	0.346
Ediffer2	18,562	0.0405	0.0475	0	0.230
GW	18,562	0.0200	0.0171	-0.0354	0.0630
Size	18,562	3.105	0.0573	3.002	3.274
Age	18,562	2.132	0.897	0	3.367
Lev	18,562	0.418	0.199	0.0623	0.889
ROA	18,125	0.0493	0.0781	-0.246	0.274
TobinQ	18,558	1.923	1.249	0.825	8.246
Dual	18,562	0.320	0.466	0	1
Top1	18,562	32.77	14.52	8.258	72.96
SOE	18,024	0.305	0.461	0	1
Current	18,562	2.476	2.290	0.367	13.99

4.2. Benchmark regression results

As shown in Table 3 below, columns (1) and (3) do not control for any control variables, while columns (2) and (4) include control variables. After lagging both the explanatory and control variables by one period, the explanatory variable GW remains positive and statistically significant at the 1% level in all specifications. This indicates that the positive and significant coefficient relationship between the explanatory and explained variables remains stable across different control conditions. In other words, firms engaging in greenwashing are more likely to exhibit higher environmental rating divergence, and rating agencies tend to assign more differentiated environmental scores to such companies. These findings are consistent with the theoretical analysis and hypotheses presented earlier, and the conclusion is relatively reliable.

Table 3. The impact of corporate greenwashing on environmental rating divergence

VARIABLES	(1) Ediffer1	(2) Ediffer1	(3) Ediffer2	(4) Ediffer2
L.GW	0.404*** (10.95)	0.294*** (8.06)	0.300*** (13.81)	0.194*** (9.65)
Controls	Uncontrol	Control	Uncontrol	Control
Constant	0.069*** (17.06)	-0.314*** (-20.55)	0.037*** (12.16)	-0.371*** (-36.81)
Ind	Control	Control	Control	Control
Year	Control	Control	Control	Control
Observations	13,860	13,159	13,860	13,159
R-squared	0.039	0.115	0.057	0.251

4.3. Robust Test

4.3.1 Instrumental variable method

To address potential endogeneity issues in the model specification, including omitted variable bias and bidirectional causality, the instrumental variables (IV) approach was employed to enhance the reliability of empirical results. Given the significant time-lagged effects of ESG ratings - where prior ESG performance improvements provide necessary resource accumulation and institutional guarantees for subsequent environmental governance optimization - this study, following Wu et al.

[27], selected the three-period lagged value of corporate greenwashing (L3.GW) as the instrumental variable and conducted regression using two-stage least squares (2SLS).

Table 4 presents the two-stage regression results under the IV approach. All regression coefficients were positively significant at the 1% statistical level, further confirming that corporate greenwashing indeed triggers environmental rating divergence, consistent with the main regression results. Additionally, referencing Zhang et al. [28], this study performed limited information maximum likelihood (LIML) estimation. When LIML and 2SLS estimation results are similar, it indicates the absence of weak instrument problems. As shown in columns (3) and (6) of Table 4, the LIML and 2SLS estimation results were essentially identical: the coefficients of L.GW were both significantly negative with equal magnitude, demonstrating no weak instrument issues exist.

Table 4. Instrumental variable method

	Stage 1	Stage 2	LIML	Stage 1	Stage 2	LIML
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ediffer1	Ediffer1	Ediffer1	Ediffer2	Ediffer2	Ediffer2
L3.GW	0.528*** (52.35)			0.528*** (52.35)		
L.GW		0.349*** (3.47)	0.349*** (3.48)		0.270*** (4.59)	0.270*** (4.89)
Controls	Control	Control	Control	Control	Control	Control
Constant	-0.043*** (-3.31)	-1.202*** (-17.29)	-1.208*** (-16.43)	-0.043*** (-3.31)	-1.259*** (-30.99)	-1.272*** (-27.06)
Ind	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control
Observations	5,976	5,976	5,976	5,976	5,976	5,976
R-squared	0.350	0.119	0.119	0.350	0.248	0.248

4.3.2 Propensity Score Matching

Given that the measurement of corporate variables in the research design relies on self-reported annual reports, which may introduce systematic bias due to sample self-selection, we addressed this concern by dividing the sample into two groups based on the median value of the GW variable. Firms with values above the median were classified as the high-greenwashing group, while the remainder formed the low-greenwashing group [21]. Using company size (Size), firm age (Age), leverage ratio (LEV), return on assets (ROA), CEO duality (Dual), Tobin's Q (TobinQ), ownership nature (SOE), and current ratio (Current) as matching criteria, we constructed matched samples through propensity score matching (PSM) with a 1:1 radius matching approach. As shown in Table 5, the coefficients of L.GW remain positive and statistically significant at the 1% level, consistent with the main regression results. This finding strengthens the causal inference validity of the positive relationship between corporate greenwashing and environmental rating divergence.

Table 5. Propensity Score Matching

VARIABLES	(1) Ediffer1	(2) Ediffer2
L.GW	0.294*** (8.06)	0.194*** (9.65)
Controls	Control	Control
Constant	-1.192*** (-23.67)	-1.289*** (-40.07)
Ind	Control	Control
Year	Control	Control
Observations	13,158	13,158
R-squared	0.114	0.250

4.3.3 Change the measurement method for corporate greenwashing

Drawing on the textual tone measurement approach developed by Xie and Lin [29], this study conducts additional robustness tests by adopting an alternative measurement for the explanatory variable. Specifically, we replace the original explanatory variable with a new metric calculated as (positive words - negative words)/(positive words + negative words), derived from the environmental lexicon established earlier. The regression results using this alternative measure are presented in Table 6. The coefficients for GW_1 remain positively significant at the 1% level, consistent with the main regression findings.

Table 6. Change the measurement method for corporate greenwashing

VARIABLES	(1) Ediffer1	(2) Ediffer2
L.GW_1	0.019*** (10.17)	0.010*** (10.13)
Controls	Control	Control
Constant	-1.181*** (-23.43)	-1.286*** (-39.89)
Ind	Control	Control
Year	Control	Control
Observations	13,157	13,157
R-squared	0.116	0.250

4.3.4 Control fixed effects of year, industry, and individual

To address potential biases from unobserved firm-level characteristics that may affect estimation results through omitted variables, this study incorporates firm fixed effects in addition to year and industry fixed effects for robustness analysis. As shown in Table 7, after simultaneously controlling for year, industry, and firm fixed effects, GW remains positively significant at the 5% level, consistent with the main regression results.

Table 7. Control fixed effects of year, industry, and individual

VARIABLES	(1)	(2)
	Ediffer1	Ediffer2
L.GW	0.122** (2.17)	0.066** (2.30)
Controls	Control	Control
Constant	-0.414* (-1.66)	-0.068 (-0.50)
Ind	Control	Control
Year	Control	Control
Individual	Control	Control
Observations	13,159	13,159
R-squared	0.637	0.704

4.4. Mechanism analysis

Existing research findings indicate that information asymmetry between firms and external rating agencies serves as a primary driver of environmental rating divergence. This asymmetry creates institutional space for managerial selective disclosure and strategic information manipulation [30]. Enhanced accounting information transparency can significantly mitigate information asymmetry and its adverse effects, facilitating the introduction of higher-quality external governance mechanisms [31], while simultaneously alleviating principal-agent conflicts between management and shareholders, as well as between firms and external investors, thereby reducing agency costs. Low transparency enables managers to conceal unfavorable information from investors over extended periods, increasing the likelihood of self-serving behaviors such as greenwashing practices while evading market discipline in the absence of external oversight [32-33].

On the one hand, for firms with higher information transparency, their disclosures are more comprehensive and reliable, partially alleviating information asymmetry with rating agencies and constraining managerial opportunism, ultimately reducing environmental rating divergence. On the other hand, when corporate transparency is higher, greenwashing behaviors become more detectable, thereby weakening firms' incentives for greenwashing. This study consequently hypothesizes that higher corporate information transparency attenuates the positive impact of greenwashing on environmental rating divergence. Following Zhou et al. [15], we measure information opacity using the absolute value of discretionary accruals calculated via the modified Jones model, where larger values indicate greater opacity.

As presented in Table 8, our empirical tests examine how information opacity moderates the main effect. After applying one-period lags to both explanatory and control variables, the interaction terms show positive significance at the 1% (*) and 5% () levels respectively. Specifically, the main effect strengthens with increasing information opacity, confirming that higher corporate transparency weakens greenwashing's positive impact on rating divergence.

Table 8. Analysis of the Transparency Mechanism of Company Information

VARIABLES	(1) Ediffer1	(2) Ediffer2
L.GW	0.109 (1.40)	0.133*** (2.89)
L.Opaque	-0.030*** (-3.32)	-0.015*** (-3.06)
L.GW*Opaque	0.942*** (2.76)	0.462** (2.34)
Controls	Control	Control
Constant	-1.335*** (-21.61)	-1.459*** (-36.41)
Ind	Control	Control
Year	Control	Control
Observations	8,542	8,542
R-squared	0.132	0.265

4.5. Heterogeneity analysis

4.5.1 Instrumental variable method

On one hand, from the perspective of external policy impetus, the new Environmental Protection Law mandates pollutant-discharging enterprises to disclose environmental information, explicitly stipulating the content of environmental information disclosure and strengthening public supervision, thereby significantly increasing the probability of detecting illegal pollutant discharge behaviors by enterprises. On the other hand, compared with non-heavy polluting enterprises, heavy polluting enterprises' fulfillment of environmental responsibilities is more conducive to improving their ESG performance. This not only responds to the national call for green development but also helps enterprises establish a favorable market image and enhance their market value and competitiveness. Driven by both internal and external factors, this paper expects that rating agencies will pay more attention to the environmental ratings of heavy polluting enterprises, focusing more on their actual environmental performance information.

This paper defines heavy polluting enterprises' industry codes according to the Notice on Issuing the Industry Classification Management List for Environmental Compliance Verification of Listed Companies issued by the Ministry of Ecology and Environment of the People's Republic of China for empirical analysis. As shown in Table 9, only greenwashing by non-heavy polluting enterprise groups will cause environmental rating divergence, while this effect is not significant in heavy polluting enterprise groups.

Table 9. Instrumental variable method analysis

	(1) Pollute	(2) Unpollute	(3) Pollute	(4) Unpollute
VARIABLES	Ediffer1	Ediffer1	Ediffer2	Ediffer2
L.GW	0.001 (0.01)	0.360*** (8.70)	0.049 (1.09)	0.228*** (10.16)
Controls	Control	Control	Control	Control
Constant	-1.188*** (-14.76)	-1.192*** (-18.73)	-1.359*** (-25.02)	-1.256*** (-31.48)
Ind	Control	Control	Control	Control
Year	Control	Control	Control	Control
Observations	4,177	8,982	4,177	8,982
R-squared	0.138	0.107	0.293	0.231

4.5.2 CEOs possess environmental expertise

According to the upper echelons theory, senior executives are the main body of organizational strategic decision-making, and their functional backgrounds and social experience backgrounds will have important impacts on corporate decision-making outcomes [34]. Andersén et al. [35] found that CEOs with green experience possess better environmental cognition, are more inclined to incorporate environmental performance into the core strategic objectives of the enterprise, and place greater emphasis on the fulfillment of corporate environmental and social responsibilities. CEOs with environmental protection backgrounds will promote enterprises to adopt more environmentally friendly strategies and business models in strategic decision-making, enhance the sense of social responsibility in corporate culture, and may not easily engage in greenwashing behavior for short-term benefits. Such CEOs will increase the degree of trust from external stakeholders [36], be able to accurately understand the standards and requirements of rating agencies, and provide comprehensive and detailed environmental information in accordance with norms, thereby obtaining more consistent ratings.

Therefore, this paper expects that when a company's CEO has an environmental protection background, the positive impact of corporate greenwashing on environmental rating divergence will be weakened. As shown in Table 10, when the CEO has an environmental protection background, the amplifying effect of corporate greenwashing on environmental rating divergence becomes insignificant.

Table 10. CEOs possess environmental expertise

	(1) Environmental	(2) Non- environmental	(3) Environmental	(4) Non- environmental
VARIABLES	Ediffer1	Ediffer1	Ediffer2	Ediffer2
L.GW	-0.096 (-0.54)	0.337*** (8.59)	0.092 (0.89)	0.215*** (9.90)
Controls	Control	Control	Control	Control
Constant	-1.097*** (-5.92)	-1.267*** (-22.81)	-1.422*** (-11.82)	-1.352*** (-37.81)
Ind	Control	Control	Control	Control
Year	Control	Control	Control	Control
Observations	1,146	10,833	1,146	10,833
R-squared	0.168	0.129	0.296	0.265

5. Summary

This study examines the relationship between corporate greenwashing and ESG rating divergence from 2018 to 2022 using text analysis techniques. The empirical results demonstrate that corporate greenwashing significantly amplifies environmental rating divergence among agencies for listed companies, a conclusion that remains robust after instrumental variable approaches, PSM propensity score matching, and other rigorous tests. Mechanism analysis reveals that higher corporate information transparency mitigates greenwashing's positive impact on rating divergence. Heterogeneity analysis shows this effect is more pronounced in non-heavy polluting industries and firms whose CEOs lack environmental expertise.

Focusing on how corporate greenwashing affects external agencies' environmental dimension ratings, this research alerts all stakeholders to scrutinize corporate green claims critically, advocates for stricter environmental disclosure standards, and promotes tripartite collaboration (firms-investors-governments) to advance authentic sustainable development. The implications are:

(1) For enterprises: Enhance environmental information transparency and accuracy through timely, comprehensive ESG disclosures. Submit key environmental metrics to independent third-party audits to improve data credibility and reduce greenwashing opportunities. Appoint management with

environmental awareness to strengthen green practices. While greenwashing may boost short-term market share and profits, it ultimately damages corporate reputation and value. Rating divergence caused by greenwashing misleads market participants, distorting corporate decisions and market returns. Firms should demonstrate sustainable capabilities through verifiable data rather than misleading stakeholders.

(2) For external stakeholders: Improve capability to discern authentic green practices. Investors should incorporate environmental performance into decision-making, using market mechanisms to guide green transitions. However, as stakeholders increasingly value environmental performance, greenwashing may induce faulty investment decisions. Strengthen monitoring through shareholder proposals and engagement to promote genuine disclosure and green innovation, preventing rating divergence expansion.

(3) For governments: Develop comprehensive environmental disclosure systems for listed companies through enhanced regulations and policy frameworks. Strengthen environmental supervision while providing supportive incentives. Establish unified rating standards and disclosure norms aligned with international ESG frameworks to reduce methodology-driven divergence. Clarify greenwashing definitions and penalties to improve market information symmetry. Bridge domestic standards with global ESG systems to enhance rating comparability and reliability.

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