

ESG Report Assurance and Corporate Environmental Investment

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Abstract. As a third-party governance mechanism, ESG report assurance can provide a certain guarantee for the authenticity and accuracy of corporate ESG reports and may play a significant role in promoting corporate environmental investment. This study selects A-share listed companies in China from 2014 to 2023 as the sample to empirically examine the impact of ESG report assurance on corporate environmental investment. The results indicate a significantly positive correlation between ESG report assurance and corporate environmental investment. Mechanism analysis demonstrates that ESG report assurance promotes corporate environmental investment by alleviating financing constraints and improving the quality of internal controls. Heterogeneity analysis reveals that ESG report assurance significantly enhances environmental investment in non-state-owned enterprises and heavily polluting enterprises. This study enriches current research on the economic consequences of ESG report assurance, identifies potential pathways to improve corporate environmental investment, and provides insights for guiding substantive corporate environmental governance.

Keywords: ESG report assurance, Corporate environmental investment, Financing constraints, Internal control

1. Introduction

In recent years, as global climate governance has accelerated, the ESG concept has attracted significant attention for its emphasis on green, low-carbon development and human–nature harmony. In corporate practice, ESG frameworks have gradually evolved from CSR, expanding the focus to a wider range of stakeholders. With growing regulatory pressure and heightened CSR awareness, more A-share listed companies are issuing ESG reports. Yet, China’s institutional environment stands out: ESG assurance remains voluntary, with no mandatory third-party verification. As some scholars note, the proportion of Chinese listed firms obtaining assurance is far below the global average, and public awareness remains limited. This unique setting provides a valuable context for examining how ESG assurance may influence corporate environmental governance.

The IAASB defines ESG assurance as independent verification of key disclosures against explicit standards, aiming to enhance user confidence. Empirical research generally finds that assurance: (1) improves disclosure quality by boosting credibility and reducing information asymmetry [1-3],

though reputational gains are mixed [4]; (2) positively impacts capital markets, such as by driving up stock prices [5] and curbing CSR-related crash risk [6]; (3) shapes stakeholder behavior by increasing investor willingness and reducing analyst forecast bias [2,7,8]. However, whether ESG assurance truly drives substantive improvements in environmental outcomes remains unsettled.

The interplay between ESG and corporate environmental investment is also debated [9,10]. On the one hand, ESG can attract talent, accelerate green innovation, and enhance social legitimacy, all of which favor environmental investment and discourage managerial short-termism. On the other hand, agency theory suggests potential conflicts: environmental projects often yield delayed returns and higher risks, which may prompt risk-averse managers to cut long-term investments for short-term targets. Flaws in ESG ratings may even encourage superficial “greenwashing”. Thus, as a key link connecting ESG practice with stakeholder trust, can ESG assurance meaningfully raise environmental investment? By probing the connection between ESG assurance and environmental governance, this study seeks to clarify the economic mechanisms at play and inform better investor decisions.

The marginal contributions of this study are as follows: First, existing research on ESG report assurance primarily focuses on its impact on corporate information disclosure quality, stock value, audit risk, and other dimensions [1,5,6,11]. This study is the first to systematically examine the dynamic relationship between ESG report assurance and environmental investment, providing evidence for a comprehensive understanding of the practical effects of ESG report assurance and enriching current research on its economic consequences. Second, this study expands the literature on the environmental governance function of ESG report assurance. By placing the assurance mechanism within the analytical framework of corporate environmental governance decisions, it reveals the transmission effect of alleviating financing constraints on environmental investment, verifies the environmental governance effect of ESG report assurance, and offers policy insights for guiding substantive corporate environmental governance.

2. Theoretical analysis and research hypothesis

2.1. ESG report assurance and environmental investment

Corporate environmental investment—capital outlays that curb ecological harm and raise resource-use efficiency—signals that a firm has embedded environmental responsibility into core strategy, motivated by both institutional pressure and the search for durable competitive advantage. Such spending projects social-responsibility commitment to shareholders, consumers, and regulators, so identifying levers that expand it is of clear theoretical and practical value. ESG report assurance is a key lever. Independent verification boosts the credibility of ESG disclosures and narrows information asymmetry [11]. Higher transparency lets current investors spot managerial short-termism and discipline under-investment in long-horizon projects, while prospective investors can screen out poor performers ex-ante [12]. Together, these forces pressure firms to sustain or increase green capex.

Assured ESG metrics—covering environment, social responsibility, and governance—are also harder to manipulate than traditional financial data and thus enjoy greater investor trust. Better information lowers perceived sustainability risk and can reduce financing costs, further incentivising managers to allocate resources to environmental projects.

H1. ESG report assurance can increase the level of corporate environmental investment.

2.2. ESG report assurance, financing constraints, and corporate environmental investment

Adequate environmental investment hinges on steady financing. When external funds are tight, firms grow more risk-averse: managers favor short-cycle projects that generate quick cash, shrinking the scale and ambition of green spending and often sacrificing project quality to cost control [13]. Limited resources also force firms to trade off between environmental outlays and core-business growth, creating a persistent allocation dilemma. Easing financing constraints is therefore essential to unlock sustained corporate commitment to environmental projects. Voluntary ESG report assurance can serve as a financing catalyst. Consistent with signaling theory, a clean assurance opinion conveys credible ESG performance to investors and creditors, boosting perceived transparency and responsibility [5]. The stronger trust lowers financing costs, widens funding access, and—by highlighting the reputational and performance benefits of CSR—raises investors' expected returns, further easing capital pressure [7]. In China's non-mandatory assurance setting, firms that seek assurance already display relatively mature governance and robust ESG practices; the certification also cuts regulatory and litigation risk, enhancing the overall financing environment for green projects.

H2. ESG report assurance promote environmental investment by alleviating financing constraints.

2.3. ESG report assurance, internal control, and corporate environmental investment

ESG assurance often upgrades a firm's internal-control architecture. To meet assurance standards, companies must map and assess ESG-related risks—ranging from regulatory shifts to labor-relations shocks—and weave those risks into the enterprise-wide management framework. The process sharpens risk-identification, monitoring, and response mechanisms while forcing high-grade data governance across ESG collection, processing, review, and disclosure. Stronger internal controls, in turn, correlate with heavier environmental investment [14,15]. An integrity-focused control environment nudges boards and managers toward proactive environmental spending to stay compliant and protect reputation. Sound information-flow systems boost the transparency and credibility of environmental disclosures, while segregation-of-duties and authorization checks restrain managerial opportunism, making green-capital-allocation decisions more disciplined.

H3. ESG report assurance promote firm environmental investment by improving the quality of internal control.

3. Research design

3.1. Sample collection and data sources

This study focuses on the relationship between "ESG report assurance—environmental investment" and analyzes data from Chinese listed companies from 2014 to 2023. Corporate micro-financial data are sourced from the CSMAR database. After obtaining the data, the following preprocessing steps were performed: (1) exclude ST and *ST samples; (2) exclude relatively special financial and insurance industries; (3) exclude samples with severe missing financial data. To mitigate the impact of outliers, all continuous variables were winsorized at the 1% and 99% levels.

3.2. Description of variables

3.2.1. Dependent variable

Corporate environmental investment (EP). Drawing on Zhang et al. (2019), I design a vocabulary library to capture environmental-related investment expenditures, covering typical semantic fields such as pollution prevention, ecological restoration, and clean production. Based on the "Construction-in-Progress Details" section of corporate annual reports, a dedicated corpus is constructed. Python is used for preprocessing, including word segmentation, noise removal, word frequency statistics, and fuzzy matching, to automatically identify project names containing environmental keywords. Given the strong heterogeneity of text expression, single-keyword recognition may lead to false matches. Thus, a secondary manual verification process is introduced, with cross-verification by two people to confirm the environmental attributes of investment projects, excluding ambiguous items such as "landscaping" or "factory infrastructure." Finally, all confirmed environmental project expenditures are aggregated to construct the annual corporate environmental investment indicator, reflecting actual capital investment behavior in green governance. This process combines technical automation with semantic accuracy, minimizing mismatches in variable construction and ensuring the validity and robustness of environmental investment measurement. The dependent variable is measured as the natural logarithm of environmental investment plus 1.

3.2.2. Independent variable

The independent variable is ESG report assurance. Relevant data are manually collected by checking whether listed companies' annual ESG reports include independent assurance reports. Accordingly, a dummy variable (Assurance) is constructed, it takes the value of 1 if the company's ESG report for the year is assured by a third party, and 0 otherwise.

3.2.3. Control variables

Referencing former literature[16], the following control variables are included: firm size (Size), return on equity (ROE), shareholding ratio of the largest shareholder (Top1), equity balance (BAN), board size (Bsize), audit opinion (AO), and management shareholding (MAG).

3.3. Model specification

To examine the impact of ESG report assurance on environmental investment, the model is:

$$EP_{i,t} = \alpha_0 + \alpha_1 Assurance_{i,t} + \alpha_2 Controls_{i,t} + YEAR_t + INDUS_i + \epsilon_{i,t} \quad (1)$$

EP represents the corporate environmental investment, Assurance represents the ESG report assurance situation of the enterprise, Controls is the control variable group, i is the enterprise, and t is time. ϵ is the random error term. Furthermore, the model also controls for time and industry fixed effects and performs clustering adjustments for standard errors at the industry level.

Table 1: Variable definitions

Variable type	Variable code	Definition
dependent variable	EP	Natural logarithm of environmental investment plus 1.
independent variable	Assurance	= 1 if ESG report is assured by a third party, otherwise 0.
Control variables	Size	Natural logarithm of total assets.
	ROE	Net profit divided by equity.
	Top1	Number of shares held by the largest shareholder divided by total shares.
	Bsize	Natural logarithm of the number of board members.
	AO	= 1 if the audit opinion is unqualified, otherwise 0.
	MAG	Proportion of shares held by management.
	BAN	Combined shareholding of 2 nd -5 th largest shareholders divided by the largest shareholder's shareholding.

4. Empirical results

4.1. Descriptive statistics

Table 2 reports the descriptive statistics of the main variables. As shown, EP indicator varies significantly across companies. The mean value of ESG report assurance (Assurance) is 0.018, indicating that the proportion of companies conducting ESG report assurance in China is currently low. Additionally, the results show that companies exhibit certain differences in Size, ROE, Top1, Bsize, AO, MAG, and BAN, suggesting broad coverage of the sample data.

Table 2: Descriptive statistics

Variable	N	Mean	Std. Dev.	Min	Median	Max
EP	10181	3.827	7.030	0	0	20.538
Assurance	10181	0.018	0.134	0	0	1
Size	10181	22.830	1.395	20.348	22.624	26.631
ROE	10181	0.068	0.124	-0.617	0.076	0.363
Top1	10181	0.356	0.151	0.089	0.337	0.757
Bsize	10181	0.926	0.085	0.699	0.954	1.176
AO	10181	0.975	0.157	0	1	1
MAG	10181	0.115	0.184	0	0.003	0.686
BAN	10181	0.722	0.576	0.037	0.569	2.698

4.2. Baseline regression

Table 3 tests the relationship between "corporate ESG report assurance—environmental investment." In the empirical analysis, Equation (1) controls only for the core independent variable and year and industry fixed effects, while Equation (2) includes the full set of control variables. The results show that, regardless of the variable specification in the baseline regression, the coefficient for ESG report assurance (Assurance) is positive and statistically significant at the 1% level. These consistent results indicate that ESG report assurance helps enhance corporate environmental investment intensity, providing empirical support for the core hypothesis.

Table 3: Baseline regression

	(1) EP	(2) EP
Assurance	2.460*** (3.871)	1.824*** (2.876)
Controls	YES	YES
Industry	YES	YES
Year	YES	YES
N	10181	10181
Adj. R ²	0.24	0.24

Note: ***, **, and * indicate the significance levels of 1%, 5%, and 10%, respectively.

4.3. Robustness tests

4.3.1. Replacing the dependent variable

Measurement bias in variables may affect the empirical results. Referring to former literature [17], this study adopts the dummy variable Dum_EP representing corporate willingness to invest in environmental protection to remeasure the explained variable. If a company's environmental investment amount is not zero, Dum_EP is assigned a value of 1; otherwise, it is assigned 0. After replacing the measurement method of the explained variable, a Logit regression is conducted. The empirical results in Table 4 show that in column (1), the regression coefficient of the replaced variable is 0.0953 and significantly positive, which is consistent with the baseline regression results. The practice of ESG report assurance by enterprises still promotes the level of environmental investment, and the research conclusion remains valid.

4.3.2. Cross-fixed effects

To address the endogeneity issue caused by omitted variables, this paper follows the approach of former literature [18] and others by further controlling for the cross-fixed effects of provinces and years on the basis of the baseline regression model. As shown in Column (2) of Table 4, the coefficient for Assurance remains significantly positive, indicating the reliability of the baseline results.

Table 4: Robustness tests

	(1) Dum_EP	(2) EP
Assurance	0.095*** (2.848)	1.734*** (2.767)
Industry	YES	YES
Year	YES	YES
Cross-Fixed Effects	NO	YES
N	10181	10175
Adj. R ²	0.27	0.25

4.3.3. Endogeneity

When examining the link between ESG report assurance and environmental investment, this study addresses potential endogeneity—specifically, omitted variable bias and reverse causality—by employing an instrumental variable (IV) approach. Following former literature [19], the industry average of ESG report assurance (In_Assurance) is chosen as the IV. This variable meets both IV criteria: it is strongly correlated with a firm’s own assurance behavior (since firms often follow industry peers), and it plausibly affects environmental investment only through its impact on the firm’s assurance decision, satisfying exogeneity. Regression results (Table 5) show that In_Assurance significantly predicts individual firm assurance in the first stage, with strong statistical tests (e.g., LM statistic = 31.48, $p < 0.001$; Cragg-Donald $F = 398.38$; Kleibergen-Paap $F = 44.62$ —all well above weak-IV thresholds), confirming instrument validity. In the second stage, ESG report assurance remains significantly and positively related to environmental investment, indicating that the main findings are robust to endogeneity concerns.

4.3.4. Propensity Score Matching (PSM)

To address potential sample selection bias due to the low proportion of assured ESG reports, this study uses PSM with kernel matching. After obtaining the propensity scores for matching, the results of the balance test showed there was no significant difference in the values of the covariates between the two groups after pairing. The balanced sample regression in Column (3) of Table 5 shows that Assurance remains significantly positive, confirming the robustness of the results.

Table 5: Robustness Tests II

	(1)	(2)	(3)
	First-Stage	Second-Stage	PSM
	Assurance	EP	EP
Assurance		6.371** (2.223)	1.763*** (2.712)
In_Assurance	0.996*** (6.680)		
Controls	YES	YES	YES
Industry	YES	YES	YES
Year	YES	YES	YES
N	10181	10181	8626

5. Mechanism analysis

Based on the theoretical analysis presented earlier, ESG report assurance promotes higher levels of corporate environmental investment by alleviating financing constraints and improving internal control quality. Following the approach of former literature [20], this study constructs the following model to empirically examine these two mechanisms:

$$Mec_{i,t} = \alpha_0 + \alpha_1 Assurance_{i,t} + \alpha_2 Controls_{i,t} + YEAR_t + INDUS_i + \varepsilon_{i,t} \quad (2)$$

Mec represents the mechanism variables, including financing constraints (FC) and internal control quality (IC). This study employs the SA index to measure corporate financing constraints, calculated

as: $SA = -0.737Size + 0.043Size^2 - 0.04Age$. The original SA values are negative, so for ease of interpretation, they are converted to absolute values. A larger absolute SA value indicates more severe financing constraints. Additionally, to measure the internal control quality of an enterprise, the internal control index disclosed by the Dibo database is adopted, and the logarithm of this index is taken by adding 1 to depict the internal control quality. The larger the value, the higher the internal control quality of the enterprise. The regression results, presented in Table 6, show that ESG report assurance has a significant impact on both mechanism variables. First, regarding financing constraints, the regression coefficient of ESG assurance is negative at the 1% significance level, indicating that third-party-assured ESG reports help alleviate corporate financing difficulties, likely due to enhanced capital market trust stemming from improved information transparency. Second, concerning internal control mechanisms, the regression coefficient of ESG assurance on internal control quality is significantly positive at the 1% level, suggesting that companies are more likely to strengthen internal governance systems and improve management standardization and operational efficiency after undergoing assurance. Both mechanism effects align with the theoretical pathways proposed in this paper, demonstrating that ESG report assurance indirectly drives higher corporate environmental investment by improving external financing conditions and strengthening internal governance.

Table 6: Mechanism analysis

	(1) FC	(2) IC
Assurance	-0.126*** (-3.291)	0.150** (2.390)
Controls	YES	YES
Industry	YES	YES
Year	YES	YES
N	10181	9756
Adj. R ²	0.25	0.22

6. Heterogeneity analysis

6.1. Ownership heterogeneity

Table 7 Columns (1)-(2) present results for state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs) separately. Assurance is significantly positively associated with environmental investment in both groups, but the effect is much stronger for non-SOEs. The Chow test confirms that this difference is statistically significant. This finding may reflect that non-SOEs, facing fiercer market competition and tighter financing constraints, benefit more from ESG assurance, which reduces information asymmetry and helps secure green financing and policy support. Their more flexible governance and market-driven decisions also facilitate translating ESG benefits into real environmental investments. In contrast, SOEs—with government support and less flexible structures—are less dependent on assurance to fund environmental projects, making the effect weaker.

Table 7: Heterogeneity test

	(1)	(2)	(3)	(4)
	EP	EP	EP	EP
	SOEs	Non-SOEs	Heavy Polluters	Non-Polluters
Assurance	1.698* (1.796)	2.128** (2.209)	2.283** (2.470)	1.501* (1.792)
Controls	YES	YES	YES	YES
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
N	4110	6071	3394	6787
Adj. R ²	0.19	0.29	0.15	0.32

6.2. Pollution heterogeneity

The sample is further divided into “heavily polluting” and “non-heavily polluting” enterprises, with regression results shown in Table 7 Columns (3)-(4). Assurance is significantly positively associated with environmental investment in both groups, but the effect is notably stronger for heavily polluting firms—a difference confirmed by the Chow test. This suggests that ESG assurance has a greater impact on heavily polluting enterprises, likely because they face stronger regulatory and legitimacy pressures, and greater scrutiny from investors. Assurance signals green commitment to external stakeholders, boosting investor confidence and motivating these firms to increase environmental investment.

7. Conclusions

As ESG has gained widespread attention, ESG report assurance has also become a growing focus in academic research. As a third-party governance tool, ESG assurance can enhance the credibility of ESG reports and may play a key role in promoting environmental investment by firms. This study uses data from A-share listed companies in China (2014–2023) to empirically examine this effect. Results show that ESG assurance is significantly and positively associated with increased environmental investment. This finding remains robust across various tests, including alternative specifications, cross-fixed effects, instrumental variables, and propensity score matching. Mechanism analysis suggests ESG assurance promotes investment by easing financing constraints and improving internal controls. The effect is especially pronounced for non-state-owned and heavily polluting enterprises.

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