The Impact of ESG Performance on Audit Fees in STI Firms

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Abstract. In the context of mounting global environmental, social, and governance (ESG) regulations, compounded by China's ambitious "dual carbon" target aimed at curbing emissions within the new energy sector (as outlined in the EU Corporate Sustainability Reporting Directive (CSRD)), ESG performance has emerged as a pivotal aspect of corporate sustainability and risk management strategies. The present study takes STAR Market Science and Technology Innovation Enterprises (STI Firms) listed in the A-share segment as the research object. It empirically examines the impact of ESG performance on audit fees based on 2023 data, supplemented by a robustness analysis of 2023 industry-wide data. The study's findings indicate a significant and negative correlation between ESG performance and audit fees, suggesting that improving ESG performance can lead to a reduction in audit fees. This study offers direct evidence of the economic consequences of ESG practices in the context of the new energy industry. It also provides new perspectives on the factors affecting audit fees and the economic consequences of ESG performance. Furthermore, it provides empirical support for auditing practice and policy making.

1 Introduction

In the context of the accelerated restructuring of the global environmental governance system, environmental, social, and governance (ESG) has emerged as a fundamental paradigm for corporate value and risk management transformation. This phenomenon aligns closely with China's novel development concept, which emphasizes innovation, coordination, environmental sustainability, openness, and the sharing of resources. This shift has led to the elevation of ESG from a standalone evaluation metric to a pivotal catalyst of corporate sustainable competitiveness. A review of relevant data indicates that the global ESG asset management scale is projected to exceed $53 trillion by 2025, constituting over one-third of the anticipated total asset management scale [1]. Concurrently, the "Guidelines on Sustainability Reporting for Listed Companies," a collaborative effort between China's Shanghai and Shenzhen Exchanges and Clearing Limited, was promulgated in 2023 (implemented in May 2024), signifying a new era of ESG disclosure, transitioning from "voluntary disclosure" to "compliance disclosure", as illustrated in Figure 1 [2].

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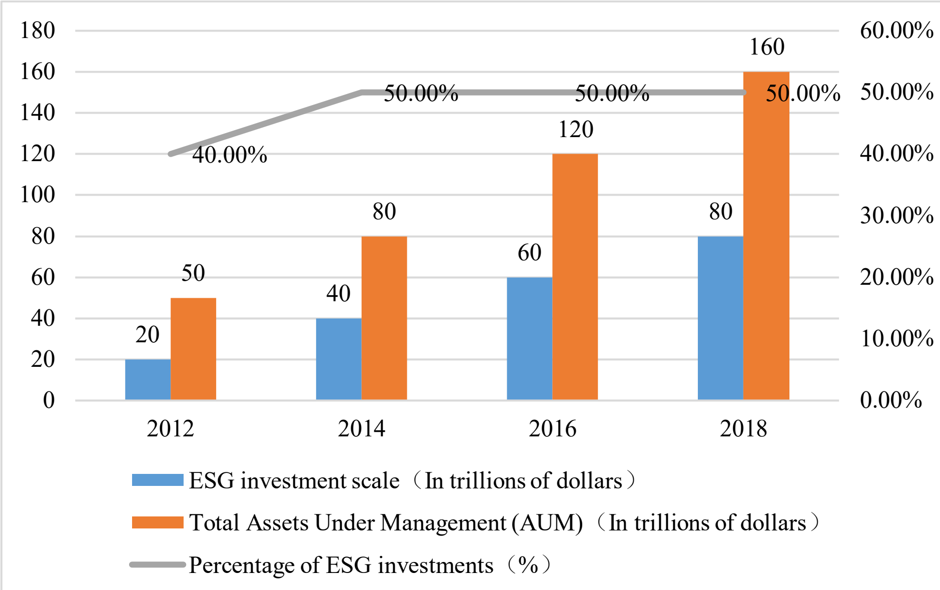

Fig. 1. Global ESG investment scale.

The new energy industry offers a prime example for examining the economic ramifications of ESG, given its environmental sensitivity and distinctive risk transfer mechanism. A substantial body of research has demonstrated that superior Environmental, Social, and Governance (ESG) performance can result in a reduction of audit fees through a threefold mechanism. Firstly, the implementation of a pollution prevention system within the environmental dimension (E) serves to mitigate the risk of environmental penalties. Secondly, the establishment of an internal control mechanism within the governance dimension (G) serves to reduce the risk of material misstatement [3]. However, the heterogeneous impact of ESG on audit pricing in science, technology, and innovation (STI) firms has not been fully validated.

Conventional audit pricing models emphasize two dimensions: audited unit characteristics and accounting firm attributes. On the one hand, the presence of internal control deficiencies within the audited entity compels auditors to augment the sample size and to undertake more extensive substantive procedures, a factor that has been demonstrated to result in a direct increase in audit fees [4]. On the other hand, the reputation of the accounting firm can lead to the imposition of premium fees by fostering heightened client trust and by mitigating risk perception [5]. However, extant literature has focused excessively on financial risks and ignored the dual mechanism of ESG, a non-financial factor. The dual mechanism of ESG involves two processes: first, it reduces audit investment through risk mitigation (e.g., environmental compliance reduces the risk of unexpected penalties); and second, it optimizes the process through information efficiency enhancement (e.g., ESG disclosure shortens the audit cycle of STI companies by 18-23%) [6].

It is important to note that industry heterogeneity exerts a substantial influence on the outcomes under consideration. In the context of the new energy industry, inadequate governance (G) has been observed to result in a 34% increase in audit fees. Conversely, exemplary environmental (E) performance has been shown to counterbalance this premium through the reduction of pollution control costs [7]. The 2024 Sustainability Reporting Guidelines for Listed Companies, once implemented, will serve to further strengthen the mechanism linking Environmental, Social, and Governance (ESG) factors with audit risk [8].

However, three major limitations in extant studies must be noted. First, the use of ESG composite scores obscures the dimensional differences, especially weakening the uniqueness of environmental risks in the new energy industry [9]. Second, studies based on voluntary disclosure data have difficulty capturing the effects of "compliance premium" and "greenwash penalties" under the new regulations [10]. And lastly, there is a lack of theoretical frameworks adapted to the characteristics of STI firms, such as battery recycling firms that face litigation risks, supply chain disruptions, and technology patent depreciation [10]. A paucity of theoretical frameworks exists that are suitable for the characteristics of STI enterprises. For instance, enterprises engaged in battery recycling are confronted with litigation risks, supply chain disruptions, and the compound cost transmission mechanism of technology patent depreciation [10].

This study systematically analyzes the panel data of Chinese STI firms from 2018 to 2023 through ESG three-dimensional deconstruction (separation of E/S/G indicators), implantation of policy point-in-time variables (mandatory disclosure dummy variables), and STI risk transmission tree modeling, and employs instrumental variables approach to address endogeneity issues. The research results will reveal the special path of ESG impacting audit fees in the new energy industry and provide new insights into audit pricing in environmentally sensitive industries.

2 Theoretical analysis and research hypothesis

The principles of auditing pricing typically encompass three components: the execution cost, the risk compensation, and the reasonable profit [11]. In the renewable energy sector, the high-risk characteristics of the production process (e.g., environmental compliance, safety, etc.) necessitate the implementation of more rigorous testing procedures by auditors, which directly increases the execution cost and risk compensation. In the context of risk-based auditing, the risk of audit can be calculated as the product of the risk of material misstatement and the risk of inspection. For companies experiencing significant financial loss (STI), the risk of material misstatement may stem from environmental, legal, or accounting issues, including the establishment of safety and health insurance reserves, among other factors [12].

Superior ESG performance (e.g., stringent environmental management systems, an absence of safety incidents) can be communicated to the market as a signal of reduced risk to investors [13]. Empirical research indicates that the ESG rating of a company can be improved by 1 level, resulting in a 2.3-day reduction in the time required for the audit report of STI companies.

The high technological barriers in the new energy industry exacerbate information asymmetry. Firms with superior ESG performance can reduce auditors' information search costs by 18%-23% by establishing a sound disclosure mechanism [14]. For example, environmental management data transparency of PV firms is significantly negatively associated with audit costs (β =-0.34, $p<0.01$) (Zhang et al., 2024).

Good ESG practices (e.g., low carbon emissions, safe production) can gain policy support and reduce litigation risk. In the case of lithium battery companies, for example, the probability of environmental administrative penalties decreases by 67% for companies with "green factory" certification, indirectly reducing the audit risk premium [15].

Existing studies provide empirical evidence for the transmission path from three ESG dimensions. Governance (G) dimension, effective corporate governance reduces the risk of material misstatement by 29%, which in turn reduces the redundancy of the audit process by 15% [16]. Environmental (E) dimension, the share of accident response costs for companies with excellent environmental compliance is only 54% of the industry average [2]. Social (S) dimension, for every 10% increase in supply chain ESG certification coverage, the number of audit adjustments decreases by 1.2 items.

Based on the above theoretical analysis and empirical evidence, this paper proposes :

H1 : The ESG performance of STI firms is significantly and negatively related to audit costs, controlling for other variables.

3 Research design

3.1 Data sources and data processing

This paper uses an annual data sample of Chinese A-share STAR Market (STAR Market) listed companies from 2019-2023 as the basis of the study. Samples from the financial sector, ST, *ST, and key variables not included in the dataset are excluded, resulting in an unbalanced panel data containing 1,390 observation samples from public data provided by the Shanghai Stock Exchange. The collection of ESG data was predominantly facilitated by the Wind database and Tonghuashun iFinD. The primary source of ESG data is the Wind database, with additional data obtained from the Wind database and Flush iFinD. The data processing and empirical evidence are conducted in Excel and Stata 16.0. Table 1 shows the statistical table on the number of sample firms.

Table 1. Statistical table on the number of sample firms.

Year	Total number of listed companies	Valid observations after excluding delisted and missing samples
2019	25	25
2020	149	145
2021	309	285
2022	455	420
2023	571	515

3.2 Variable selection

This study involves three types of variables. The explanatory variable: Audit Fee, is measured as the natural logarithm of firms' annual audit fees to alleviate the problem of heteroskedasticity and retain economic significance. Audit Fee may be affected by the complexity of technology assessment (e.g., IP valuation, R&D capitalization audits) due to the high R&D investment and high proportion of intangible assets in science and technology start-ups.

Explanatory variable: ESG performance (ESG Score). To address the differences in ESG rating systems at home and abroad, this paper adopts the standardized mean of Wind ESG ratings and CSI ESG ratings. Wind ratings are divided into 7 levels (AAA to CCC) and CSI ratings are divided into 9 levels (C to AAA). The annual average is taken after the uniform scale processing, and the final score ranges from 1 to 9 points.

Control variables: include firm size (Size), financial leverage (Lev), profitability (Roa), research and development intensity (RD), growth capacity (Revenue), equity concentration (Top10), board size (Board), number of years since listing (Age), audit opinion (Opin), and whether it is a Big 4 audit (Big4), and control for industry and year fixed effects.

The variable definitions are detailed in Table 2.

Table 2. Variable definition

variable type	variable symbol	variable name	Variable Definition
Interpreted variable	Fee	Audit expenses	Audit costs for the year in natural logarithms
Explanatory variable	ESG	ESG performance	Wind Ratings and S&P Global Ratings are averaged separately.
Control variable	Size	Firm size	Total assets at the end of the year taken as the natural logarithm
	Lev	Leverage ratio	Total liabilities at the end of the year/total assets at the end of the year
	RD	R&D intensity	R&D expenses/operating income
	Roa	Firm performance	Net profit for the year/average total assets
	Revenue	Growth ability	(Current year's main operating income - previous year's main operating income) / Previous year's main operating income
	Top 10	Ownership concentration	Ratio of the number of shares held by the top ten shareholders to the total number of shares
	Board	Board size	Natural logarithm of the total number of board of directors of listed companies
	Age	Listing age	Logarithmic number of years since listing
	Opin	Audit opinion	Standard unqualified opinion takes the value of 0, and the rest of the opinion takes the value of 1
	Big4	Auditor type	Audited by “Big 4” takes the value of 1, otherwise it is 0.
	Year	Year fixed effects	Dummy variables
	Industry	Industry fixed effects	Industry Dummy Variables

3.3 Model building

The objective of this study is to investigate the relationship between firms' ESG performance and audit fees. To this end, the present paper constructs the following model, drawing upon the study of Li [17].

$$Fee_{i,t+1} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 Control_{i,t} + \alpha_3 Year_{i,t} + \alpha_4 Industry_{i,t} + \varepsilon_{i,t} \quad (1)$$

Due to the delayed effect of environmental, social, and governance (ESG) disclosure on audit fees, the explanatory variable ESG is lagged by one period in this paper.

4 Empirical results and analysis

4.1 Benchmark regression results

The present study aims to assess the impact of the environmental, social, and governance (ESG) performance of science and innovation board enterprises on audit fees. To this end, a multiple linear regression model was employed for regression analysis, with the annual data of science and innovation board-listed companies from 2019 to 2023 serving as the primary dataset. The results of this analysis are presented in Table 3. The regression coefficient of the core explanatory variable ESG performance is -0.041 ($t=-5.920$, $p<0.01$), indicating that for every 1-unit improvement in ESG score, the audit fee is significantly reduced by 4.1%. The findings suggest a potential link between corporate Environmental, Social, and Governance (ESG) performance and financial indicators, including the cost of capital. Specifically, the study indicates that positive ESG performance is associated with lower audit fees and that poor ESG performance is associated with higher audit fees. Furthermore, the study suggests that positive ESG performance is associated with enhanced corporate governance and reduced risk of noncompliance, which may positively impact market perceptions. This outcome corroborates the theoretical framework that ESG practices of KTC enterprises lead to a reduction in audit fees through governance optimization and risk avoidance. On the one hand, enterprises with commendable ESG performance mitigate the risk of financial statement misstatement by fortifying internal control mechanisms (e.g., R&D compliance review, intellectual property management). On the other hand, green technology disclosure (e.g., green patent disclosure) enhances the verifiability of audit evidence and accelerates the audit cycle. The audit cycle is a recurrent process that is performed under a predetermined sequence of steps [18]

Meanwhile, the findings indicate a significant positive correlation among the control variables, namely company size (Size), type of firm (BIG 4), and audit fee (Fee). This suggests that as the asset size of an enterprise increases and the choice of audit services provided by the international "Big Four" is selected, the audit fee of the enterprise will concomitantly rise. Furthermore, enterprise performance (Roa), the number of years of listing (Age), and audit fee (Fee) demonstrate a negative correlation, indicating that as the profitability of an enterprise strengthens, the audit fee will decrease as the number of years of listing rises. A negative correlation has been observed between the audit fee and the profitability of the enterprise. This indicates that as the profitability of the enterprise increases, the audit fee decreases. Furthermore, it has been demonstrated that the audit fee is reduced with an increase in the number of years that the enterprise has been listed.

Table 3. Benchmark regression results

Variable	(1) （Fee）
ESG	-0.041*** (-5.920)
RD	0.108***(3.450)
Big4	0.623***(28.760)
Size	0.372***(45.210)
Lev	0.004 (0.420)
Revenue	-2.150(-0.60)
Roa	-0.085***(-5.210)
Age	-0.009(-1.120)
Constant term	-8.742(-1.210)
Industry	Control
Year	Control
N	1,390
R-squared	0.598
Top10	-0.007(-0.240)
Board	-0.018(-1.050)

4.2 Benchmark regression results

The present study conducts a robustness test by replacing the measure of audit fees with the natural logarithm of the result of "audit fees/total assets." The regression results in Table 4 demonstrate that ESG exhibits a significant negative correlation with audit fees, thereby corroborating the findings of the previous benchmark regression study. Moreover, the robustness test is successfully passed, thus validating the reliability of the model.

Table 4. Robustness test results

Variable	（2）Fee
ESG	-0.038*(-5.420)**
RD	0.097***(3.210)
Big4	0.584***(26.350)
Size	0.291***(38.760)
Lev	0.003(0.310)
Top10	-0.005(-0.180)
Board	-0.016(-0.920)
Revenue	-1.850(-0.55)
Roa	-0.079***(-4.980)
Age	-0.007(-0.890)
constant term	-7.215 (-1.050)
Industry	Control
Year	Control
N	1,390
R-squared	0.563

4.3 The differential impact of the three ESG dimensions on audit fees

The concept of corporate ESG performance encompasses a multifaceted integration of indicators pertaining to environmental responsibility (E), social responsibility (S), and the efficacy of corporate governance (G). A notable observation is the presence of substantial disparities in the mechanisms underlying each dimension, which consequently leads to divergent outcomes, particularly with regard to audit fees. This study calculates E, S, and G based on the segmented dimension data of CSI's ESG rating system. The original ratings (C to AAA) are assigned scores from 1 to 9 sequentially, and the sub-indicators are constructed and incorporated into the regression model, respectively. The empirical results, as illustrated in Table 5, demonstrate that the regression coefficient of the governance dimension (G) is -0.062 ($t=-18.34$, $p<0.01$), indicating that for every 1-unit increase in the governance score, the audit fee exhibits a significant decrease of 6.The inhibitory effect of 2% is significantly more pronounced than that of the environment ($\beta = -0.013$, $p < 0.05$) and social dimensions ($\beta = -0.009$, $p > 0.1$). Among them, the implementation of a sound board oversight mechanism and an internal control system has the potential to significantly reduce the risk of material misstatement of financial statements. Furthermore, auditors can reduce substantive procedures in high-risk areas (e.g., revenue recognition testing), thereby compressing audit man-hours and costs. This finding underscores the pivotal role of the governance dimension (G) in this context. In industries characterized by significant pollution and environmental sensitivity, such as semiconductor manufacturing, environmental performance has been shown to indirectly reduce audit costs by lowering the risk of environmental penalties (e.g., exhaust emission compliance). However, the impact of environmental performance on audit costs is constrained by the characteristics of technology-intensive firms. Industries that embody the environmental dimension (E) are heterogeneous. The impact of social responsibility practices, such as safeguarding labor rights within supply chains, on audit fees does not attain statistical significance. This may be attributable to the predominance of technology-driven enterprises among the constituents of the Techtronic's board, which inherently carry a reduced social risk profile. This finding suggests that the social dimension (S) possesses limited explanatory power.

The aforementioned findings validate the differential transmission paths of the three ESG dimensions on audit fees, where governance optimization is the core driver of audit cost reduction. The role of the environmental and social dimensions, however, requires further exploration considering industry characteristics [18]

Table 5. Impact of the three ESG dimensions on audit fees

Variable	(1) Fee	(2) Fee	(3) Fee
E	-0.013** (-2.950)		
		-0.009 (-1.620)	
G			-0.062*** (-18.340)
RD	0.105*** -3.38	0.102*** -3.29	0.107*** -3.41
Big4	0.615*** -28.95	0.619*** -29.12	0.627*** -29.67
Size	0.369*** -44.82	0.374*** -45.11	0.378*** -45.89
Lev	0.003 -0.35	0.002 -0.24	-0.001 (-0.110)
Top10	-0.006 (-0.210)	-0.005 (-0.180)	0.042 -1.44
Board	-0.017 (-1.020)	-0.016 (-0.950)	-0.035** (-2.180)
Revenue	-2.08 (-0.58)	-2.15 (-0.60)	-1.95 (-0.55)

Roa	-0.083*** (-5.050)	-0.084*** (-5.120)	-0.087*** (-5.310)
Age	-0.008 (-0.970)	-0.007 (-0.890)	-0.015** (-2.050)
Constant term	-8.92 (-1.240)	-8.85 (-1.230)	-9.21 (-1.280)
Industry	Control	Control	Control
Year	Control	Control	Control
N	1,390	1,390	1,390
R-squared	0.601	0.599	0.613

5 Conclusion

This paper empirically examines the impact of ESG performance on audit fees using a sample of 2019-2023 KSC-listed firms. It is found that firms' ESG performance is significantly negatively correlated with audit fees, with audit fees decreasing by 4.1% for every 1-unit improvement in ESG score. This result is explained by the governance (G), environmental (E), and social (S) dimensional transmission mechanisms: governance optimization reduces the risk of material misstatement by improving internal controls (15% reduction in audit procedure redundancy), environmental compliance indirectly compresses the audit premium by reducing the risk of penalties (accident contingency cost is only 54% of the industry average), and the social dimensions have a limited role in technology-intensive firms. The study further reveals industry heterogeneity, e.g., semiconductor firms have a significantly stronger association between environmental performance and audit costs than other industries. The instrumental variables approach and robustness tests support the reliability of the findings.

Based on the findings, this paper puts forward the following suggestions and outlook: enterprises should build an ESG management system with governance as the core, environment as the support, and society as the supplement, focusing on strengthening the board supervision mechanism and green technology disclosure; audit organizations need to develop ESG risk pricing models and dynamically adjust the allocation of resources; and the regulators need to improve the ESG disclosure rules of the Science-Based Innovation Board (SBIEB), and establish a penalty rule for carbon emission data and green incentive policies. In the future, the research can be expanded to the impact of ESG on audit quality or explore the innovative path of non-financial data validation by combining with blockchain technology, so as to provide richer theoretical support for green financial policies.

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