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Does financial flexibility affect corporate ESG Performance? Evidence from China

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ABSTRACT

Strategic emerging industries serve as a new driving force for the high-quality development of China's economy, and their Environmental, Social, and Governance (ESG) performance is a crucial standard for assessing their ability to achieve sustainable development. This paper examines the impact of financial flexibility on the ESG performance of Chinese companies, using data from A-share listed companies in China from 2014 to 2023. The study also explores the transmission mechanisms and heterogeneity of this effect across external environments and internal governance. The findings indicate that financial flexibility significantly enhances ESG performance in Chinese listed companies. This conclusion holds after several robustness tests, including Two-Stage Least Squares (2SLS), Propensity Score Matching (PSM), and System Generalised Method of Moments (GMM). Furthermore, the enhancement effect is stronger in firms with higher investor attention, those in heavily polluting industries, companies with better governance, and those facing higher environmental uncertainty. Mechanism analysis reveals that financial flexibility affects ESG performance through green technological innovation and accounting information transparency. The study contributes to the literature on the economic consequences of financial flexibility and extends the understanding of the mechanisms and contexts in which corporate ESG performance can be improved.

1. Introduction

The ESG (Environmental, Social and Governance) concept was first introduced by the United Nations Environment Programme (UNEP) in 2004. It emphasised the need to consider economic growth, ecological protection and social equity simultaneously (Ma et al., 2024; Wu, Zeng, et al., 2025). This ESG concept was highly aligned with the intrinsic requirements of China's development strategy of modernization (Fan et al., 2025; Wu et al., 2024). As China transitions to a new era of high-quality economic development, the traditional factor-driven growth model has shown signs of fatigue (Ma et al., 2025a). To advance the economy in a greener, more efficient, and innovative direction, China is committed to developing internationally competitive advanced industrial clusters in this

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field (Tong et al., 2024; Wen, Ma, & Lyu, 2024). The aim is to establish a range of distinctive, complementary, and structurally sound new growth engines, which will inject vitality into the nation's socio-economic development (Li et al., 2020). Faced with challenges such as rapid technological iteration, environmental uncertainty, and intense market competition, Chinese companies generally exhibit low levels of ESG performance (Anning-Dorson, 2017). Fulfilling ESG responsibilities is pivotal not only for establishing a strong corporate image and creating value but also for promoting the harmonious coexistence of society and the environment, which is essential for sustainable development. In this context, improving and enhancing the ESG performance of Chinese companies is a pressing issue that requires immediate attention (Han, 2024).

In the current complex operating and financing environment, especially in the context of increasing trade frictions, enterprises faced heightened implicit risks (Zeng et al., 2024). These risks brought considerable uncertainty and increased the pressure on corporate financial operations (Stockhammer & Grafl, 2010). They also posed new challenges to the free flow of cash and the value creation process. Financial flexibility, which represented a firm's ability to respond effectively to unexpected shocks to its cash flows or investment opportunities (Flammer & Ioannou, 2021), had a significant impact on corporate sustainability during crises. It enabled firms to maintain flexibility and adapt to changing market conditions in the face of uncertainty and change.

Therefore, in the current economic climate, financial flexibility emerged as a crucial tool for enterprises to cope with external challenges and internal transformations (Li et al., 2024), providing a solid foundation for their long-term development (Al Omoush et al., 2025). The ESG concept offered enterprises a new developmental pathway. By focusing on ESG performance, firms could not only enhance their financial flexibility and better manage uncertainty but also guide themselves towards sustainable development (Andersson et al., 2022). This, in turn, facilitated the harmonious coexistence of economic, social and environmental factors. Thus, an in-depth investigation into the impact of ESG performance on financial flexibility was of great significance for guiding enterprises to achieve high-quality development in the new era (Deng & Karia, 2025).

In recent years, academic research on corporate ESG performance has deepened, with a primary focus on its economic consequences (Wang & Ma, 2024). For example, some scholars have used the resource-based view to explore how ESG performance affects financing costs, corporate performance, and total factor productivity (Yu & Chen, 2024). Others have applied stakeholder theory to uncover the close links between ESG performance and stock return volatility, corporate investment efficiency, and green innovation by suppliers (Lin & Li, 2024; Li et al., 2025). Although existing literature has provided valuable insights, few studies have explored corporate ESG performance from the perspective of internal financial management, based on the resource orchestration theory. This theory emphasises how firms can manage, integrate, and optimise both internal and external resources through systematic strategic thinking, and construct resource configurations and capabilities that adapt to environmental changes (Zhu & Li, 2023; Wen, Ma, Wang, et al., 2025). Within this theoretical framework, financial flexibility is considered a crucial strategic tool, providing the necessary adaptability for firms to manage resource allocation and capability configuration (Arbogast & Kumar, 2018).

Therefore, this study aims to address the existing research gap by examining whether financial flexibility can effectively enhance the ESG performance of strategic emerging industries, from a novel perspective and based on the theory of resource orchestration. Specifically, this study investigates three key questions: First, does financial flexibility influence the ESG performance of Chinese listed companies? Second, through what mechanisms does this relationship operate? Third, how does this relationship vary under different external and internal governance conditions? By addressing these questions, this study provides new insights and theoretical support for understanding the capacity of firms to achieve sustainable development.

Building on the above analysis, this study focuses on A-share listed companies in China from 2014 to 2023 and develops a theoretical model linking financial flexibility and corporate ESG performance. It comprehensively examines the impact of financial flexibility on ESG performance in different internal and external contexts, as well as the underlying mechanisms. The contributions of this paper are as follows: (1) It enriches the study of the economic consequences of financial flexibility. The findings suggest that financial flexibility not only enhances green technological innovation but also improves the transparency of accounting information in Chinese companies. This opens the black box of corporate ESG research and provides theoretical guidance for managers to optimise resource allocation and develop long-term strategies. (2) It offers new insights into the pathways for improving the ESG performance of Chinese companies, which is significant for achieving sustainable development goals, enhancing brand image, and fulfilling social responsibilities. (3) It explores the heterogeneity of the effects of financial flexibility in different contexts. The study investigates how financial flexibility impacts the ESG performance of Chinese companies with varying characteristics, considering factors such as investor attention, industry pollution levels, environmental uncertainty, and corporate governance. The aim is to provide valuable practical insights for companies to develop more scientifically effective financial management strategies.

2. Literature review and theoretical hypotheses

2.1. Literature review

2.1.1. Research on corporate ESG performance

ESG performance can be regarded as both an investment behaviour and an evaluation tool (Horana et al., 2022). As an evaluation tool, it inevitably has a close connection with stakeholders. Companies with strong ESG performance send signals to the outside world that they are suitable for investment (Lee et al., 2022). This, in turn, attracts the inflow of resources and enhances their internal cash reserves and financing capabilities. Additionally, companies with good ESG performance are generally considered to place greater emphasis on long-term sustainable development and risk management (Folqué et al., 2021). As a result, they tend to adopt a more conservative approach to resource allocation, including maintaining sufficient cash flow and financial resources to cope with potential risks and pressures, thereby preserving high financial flexibility (Mertzanis et al., 2024). Therefore, considering the characteristics of

corporate ESG performance, this study primarily analyses the relationship between ESG performance and financial flexibility from two perspectives: resource acquisition and resource allocation.

The concept of ESG initially emerged from ethical investment and socially responsible investing. ESG ratings serve as a comprehensive evaluation standard of a company's environmental, social, and governance performance (Widyawati, 2020). Amid the global push for sustainable development, corporate ESG performance has increasingly become a focal point in academic research, with existing studies predominantly exploring this topic from both societal and corporate perspectives through case analyses and empirical investigations (Zhang et al., 2025).

At the societal level, the advantages of corporate ESG performance primarily lie in fostering a win-win situation for both enterprises and society, thereby promoting overall social welfare. Olteanu and Ionaşcu (2023) demonstrated that in the context of public crises such as the COVID-19 pandemic, firms actively fulfilling their ESG responsibilities not only contribute to societal welfare and environmental protection, but also adopt long-term sustainable investment strategies that help mitigate the negative impacts of the pandemic on shareholder wealth. Zhang (2024) argued that fulfilling ESG responsibilities can significantly enhance employment levels through various means, including expanding production scale, alleviating financing constraints, and attracting the workforce, contributing to social stability (Wang et al., 2024).

At the corporate level, research on ESG performance has primarily focused on areas such as corporate performance, green innovation, and investment efficiency (Xu et al., 2022; Shen et al., 2025). Most scholars assert that corporate ESG performance can significantly enhance company performance; however, some argue that investments in ESG practices may consume essential resources required for business operations, potentially reducing corporate value (Nirino et al., 2021). Yang et al. (2024) confirmed that corporate ESG performance promotes green innovation, and Wei and Zheng (2024) further validated that this positive relationship is more prominent when the institutional environment is optimised and internal redundant resources are effectively utilised. Moreover, studies have shown that strong ESG performance can effectively alleviate issues related to inefficient and excessive investment, thereby improving overall investment efficiency (Kuzey, Uyar, & Karaman, 2023; Benlemlih & Bitar, 2018). Despite these valuable insights, the role of financial flexibility in influencing corporate ESG performance remains unexplored.

2.1.2. Economic consequences of financial flexibility

Financial flexibility is essentially a reserve of financing capacity that companies proactively build to ensure sustainable development. It helps companies manage market fluctuations, reduce financial risks, and seize investment opportunities, making it a critical pathway for emerging strategic firms to simultaneously validate their technologies and market potential under high-investment conditions (Bonaimé et al., 2016). However, there is ongoing debate within academic circles regarding the economic consequences of financial flexibility. On one hand, it is argued that financial flexibility significantly mitigates inefficient investment behaviour (Abd Alia & Alhamad, 2022), enhances continuous innovation capabilities (Kong, 2022; Zou et al., 2024), and alleviates the negative impacts of financing constraints (Hao et al., 2022). These positive effects contribute to improvements in operational efficiency and market value (Islam et al., 2020; Wen, Ma, & Su, 2024). On the other hand, some scholars argue that excessive financial reserves can exacerbate agency problems (El-Ansary & Hamza, 2023), as managers may gain more flexibility to pursue personal interests through aggressive investments (Kaplan, 2016). Furthermore, some studies suggest that when financial flexibility exceeds a certain threshold, it may inhibit corporate growth, exhibiting a curvilinear relationship characterised by an initial positive effect followed by diminishing returns (Liu et al., 2009). These varying perspectives highlight the complexity and diversity of financial flexibility's economic consequences, indicating that further research is needed.

In summary, the significance of ESG performance and financial flexibility in corporate sustainability has increasingly come to the fore. However, existing research has predominantly focused on the impact of ESG performance on firm-level outcomes, such as financial performance, market value, cost of equity, default risk, and financial risk (Wu, Hou, et al., 2025). The majority of studies have supported the notion that improved ESG performance enhances corporate financial performance and reduces financial risk. In contrast, the literature on the impact of ESG performance on financial flexibility has been relatively sparse.

The long-term investment value theory posits that firms with strong ESG performance are likely to achieve better financial performance over the long term. By integrating environmental, social, and governance factors, companies can mitigate potential risks and create value in the realm of sustainable development (Xia et al., 2024). During economic downturns or periods of turbulence, firms with robust ESG performance are generally perceived as placing greater emphasis on long-term sustainability and risk management, thereby demonstrating enhanced resilience and stability. Financial flexibility is crucial for a firm's ability to respond to uncertainty and risk (Duan et al., 2025). While scholars have recognised the need for companies to maintain financial flexibility to bolster their capacity for sustainable development, the role of social responsibility fulfilment in this context has yet to be thoroughly explored through theoretical reasoning and empirical testing.

2.2. Theoretical analysis and research hypotheses

2.2.1. Financial flexibility and ESG performance in Chinese enterprises

Resource orchestration theory posits that managers need to continually orchestrate resources within a dynamic environment, combining and bundling resources to create competitive advantages (Li & Jia, 2018). In the process of resource orchestration, financial flexibility not only plays a crucial role but also serves as a key support to maintain competitive advantage in the market environment (Mahmood et al., 2021). Many large Chinese companies are at the forefront of their industries, often characterised by high investment and high-risk features. In such a highly competitive and uncertain environment, improving ESG performance can enhance the social reputation and brand image of emerging Chinese firms, as well as attract more investors. Financial flexibility plays a crucial role in this

process (Zou et al., 2025).

On one hand, financial flexibility helps firms integrate internal and external resources, enhancing the systematic and collaborative nature of ESG management (Yi, 2020). It enables companies to pool resources from different departments and business lines, focusing on key areas of ESG management, and promoting the achievement of ESG goals through cross-departmental cooperation and resource integration (Leoni, 2024). Additionally, financial flexibility provides firms with greater autonomy, allowing them to rapidly and precisely allocate resources based on actual ESG management needs, offering strong support for ESG practices.

On the other hand, ESG involves various sectors, each with its own requirements and standards, posing multiple risks and challenges during implementation. Ferrando et al. (2017) found that firms with high financial flexibility are more capable of raising funds when facing adverse market shocks. Whether by acquiring undervalued assets to capture more investment opportunities or investing in research and development at a low cost, these firms can adapt flexibly to environmental uncertainties (He & Wintoki, 2016). Therefore, financial flexibility enables firms to effectively mitigate potential risks and seize new opportunities arising from ESG practices (Edunjobi, 2024). Based on this, the following hypothesis is proposed.

H1. Financial flexibility can effectively improve ESG performance in Chinese enterprises.

2.2.2. Mechanisms of financial flexibility’s influence on the ESG performance of Chinese enterprises

(1) Green innovation effect

In the VUCA (Volatility, Uncertainty, Complexity, Ambiguity) era, green innovation has become a central driving force for the sustainable development of enterprises, aligning with national strategic priorities in technological advancement (Shahzad et al., 2020). Green technological innovation activities are characterised by high capital demands and lengthy research and development cycles, which place significant demands on an enterprise’s resource allocation capabilities. However, maintaining a certain level of financial flexibility enables enterprises to effectively withstand financial difficulties when facing potential risks (Feng et al., 2022). When green innovation projects with promising investment returns emerge in the market, enterprises with high financial flexibility are able to swiftly mobilise financial resources, assess project risks accurately, and seize green innovation opportunities, thus further advancing the enterprise’s green innovation development (Arfi et al., 2018). Additionally, financial flexibility can effectively alleviate liquidity constraints encountered during the green innovation process, creating an innovation-friendly economic environment for the enterprise’s green development (Yang & Ni, 2022). By increasing investment in green technological innovation, Chinese enterprises can not only reduce pollution emissions during production processes, enhance resource utilisation efficiency, and decrease energy consumption but also establish a positive social image, earning widespread recognition from the government, society, and consumers. This, in turn, indirectly enhances the enterprise’s ESG performance (Zhu et al., 2021). Based on this, the following hypothesis is proposed.

H2. Under constant conditions, financial flexibility significantly promotes the ESG performance of Chinese enterprises by enhancing green technological innovation.

(2) Information transmission effect

Enterprises with high financial flexibility generally possess stronger financial management capabilities and more robust financial conditions. These enterprises tend to adhere to stringent financial regulations and standards, and it is this rigorous financial information processing mechanism that ensures the availability of high-quality accounting information, which significantly improves the transparency of accounting data. Research has shown that accounting information transparency not only helps alleviate information asymmetry within and outside the enterprise, but also facilitates the transmission of accurate information to stakeholders, supporting them in making decisions beneficial to the enterprise’s development. Furthermore, it enhances corporate governance, reduces operating costs, and consequently improves investment efficiency and market value (Zhai & Wang, 2016). First, environmental information disclosure increases public and investor confidence in a company’s environmental practices, helping to establish a

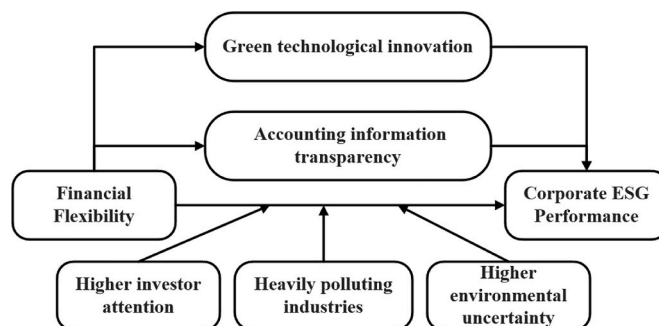


Fig. 1. Theoretical framework diagram.

responsible environmental image. Through signalling mechanisms, this incentivises companies to take concrete actions towards sustainable and green development (Fan et al., 2024). Second, higher transparency in information means greater public disclosure of corporate social responsibility activities and employee welfare, driving enterprises to more actively fulfil their social obligations through external supervision (Yu et al., 2018). Finally, transparent accounting information conveys critical details about corporate governance structures, board operations, and internal control systems to stakeholders, and transparent corporate governance practices help foster investor trust in management, thereby improving the overall governance of the company (Beekes et al., 2016). In summary, accounting information transparency enhances corporate ESG performance significantly across the environmental, social, and governance dimensions through signalling mechanisms. Based on this, the following hypothesis is proposed.

H3. Under constant conditions, financial flexibility significantly promotes the ESG performance of strategically emerging enterprises by enhancing accounting information transparency.

Fig. 1 shows the research framework of this paper.

3. Research design

3.1. Sample selection and data sources

This study selected Chinese listed companies from 2014 to 2023 as the research sample. The basic company information and financial data were primarily sourced from the CSMAR database, while patent data used to measure green technological innovation came from the National Intellectual Property Administration of the People's Republic of China. To avoid data interference from outliers, the following preprocessing steps were applied, in line with common practices in previous literature: (1) exclusion of data from the financial industry; (2) exclusion of companies with *ST or ST status, as well as those with a debt-to-asset ratio exceeding 1; (3) exclusion of companies with extreme outliers or missing variables; (4) application of 1 % trimming for continuous variables. After these treatments, the final dataset included 2659 listed companies with 23,781 observations. The empirical analysis was conducted using Stata 17.0 statistical software.

3.2. Variable description and definition

Dependent variable. ESG Performance (ESG): The ESG performance of enterprises was measured using the Huazheng ESG rating index. This database, which combines China's national conditions and capital market characteristics, constructs a rating system across the three dimensions of environmental, social, and governance performance, providing a comprehensive evaluation of the ESG performance of all A-share listed companies. It offers advantages such as quick updates and high credibility. Following Li et al. (2022), the ratings were assigned values from 1 to 9, with higher scores indicating better ESG performance.

Core explanatory variables. Financial flexibility (FF): Existing literature on the measurement of financial flexibility primarily includes methods such as single-indicator approaches, multi-indicator composite methods, and comprehensive index methods. Compared to the other two methods, the multi-indicator composite method is not only simpler and easier to implement but also mitigates the subjectivity involved in indicator selection. Therefore, this study follows the approach of López-González et al. (2019) and uses a two-indicator method to compute financial flexibility. The formula is as follows: Financial Flexibility (FF) = Cash Flexibility + Debt Flexibility, where Cash Flexibility = Firm Cash Ratio - Industry Cash Ratio Mean, and Debt Flexibility = Max (0, Industry Debt Ratio Mean - Firm Debt Ratio).

Control variables. To control for other factors influencing the ESG performance of enterprises, this study draws on the work of Lynch and Tan (2011) and controls for the following variables: Firm Size (Size), Proportion of Fixed Assets (Tan), Firm Age (Age), Ownership Concentration (Own), Proportion of Independent Directors (Indr), Dual Position (Dual), Revenue Growth Rate (Growth), Total Asset Turnover (Totassrat), and Cash and Cash Equivalents Turnover Rate (Ccerat). Additionally, individual and year fixed effects were incorporated into the model to account for firm-specific characteristics and the impact of macroeconomic conditions in different years on the dependent variable.

3.3. Model design

Given that financial flexibility may have a delayed effect on a firm's ESG performance and that potential endogeneity due to bidirectional causality could arise, this study follows Kumar and Vergara-Alert's (2020) approach by including the lagged financial flexibility variable as an explanatory variable. Similarly, the mediator variables are also treated as lagged by one period. The following multiple regression baseline model is established:

$$ESG_{i,t} = \alpha_0 + \alpha_1 FF_{i,t-1} + \alpha_2 Controls_{i,t} + \sum Year + \sum Firm + \varepsilon_{i,t} \quad (1)$$

In Equation (1), i denotes individual listed companies, t represents the year, $ESG_{i,t}$ signifies the corporate ESG performance, and $FF_{i,t-1}$ indicates financial flexibility. Additionally, Controls refers to a series of control variables, and $\varepsilon_{i,t}$ represents the random disturbance term. Furthermore, this paper controls for both individual fixed effects (Firm) and time fixed effects (Year).

4. Empirical analysis

4.1. Descriptive statistics

Table 2 presents the descriptive statistics for the key variables used in this study (see Table 1). From Table 2 and it can be observed that the mean ESG performance of firms was 4, with a standard deviation of 1.022, a minimum value of 1, and a maximum value of 9. This suggests that the overall ESG performance of strategic emerging industries was relatively low, with significant variation in ESG performance across firms. The standard deviation for financial flexibility was 0.211, with a minimum value of -0.230 and a maximum value of 0.723, indicating that financial flexibility was maintained within the strategic emerging industries during the sample period, although there were considerable differences in financial flexibility reserves among the firms. Regarding the control variables, the mean and median were closely aligned, suggesting that there were no significant biases in the sample. The statistical results were consistent with those found in previous studies, indicating that the distribution of the research sample was generally reasonable.

4.2. Correlation analysis

Table 3 presents the results of the Pearson correlation analysis between the key variables. The correlation coefficient between financial flexibility (FF) and corporate ESG performance (ESG) was 0.121, which was statistically significant at the 1 % level, indicating a significant positive correlation between the two variables when other factors were not considered. This preliminary finding supports Hypothesis H1. The absolute values of the correlation coefficients between all variables were less than 0.513, suggesting that there were no highly correlated variables. Additionally, a variance inflation factor (VIF) test was conducted for all variables. The average VIF was 1.24, and the VIF values for each variable were well below the commonly accepted threshold of 10, indicating that there was no severe multicollinearity problem, and regression analysis could therefore be performed.

4.3. Benchmark regression

Building on the correlation analysis, this study employed a multiple regression analysis to examine the relationship between financial flexibility and ESG performance of Chinese enterprises. The regression model utilised company-level clustered robust standard errors, with the benchmark regression results presented in Table 4. Column (1) in Table 4 shows the results without control variables, while column (2) includes control variables. The results indicate that, regardless of whether control variables are included, the regression coefficient for financial flexibility (FF) is significantly positive at the 1 % level. In column (3), the regression model is further refined by incorporating both fixed effects for firms and years, with the regression coefficient for financial flexibility (FF) remaining at 0.332, and still significant at the 1 % level. This suggests that financial flexibility enables companies to allocate resources more effectively to ESG initiatives. Companies with greater financial flexibility are better able to manage their cash reserves, access to capital, and investment opportunities so that they can pursue environmental practices, socially responsible programmes, and good governance structures. This strategic flexibility is critical for companies to adapt to changing market conditions and regulatory requirements, thereby enhancing their overall ESG performance. Thus providing empirical support for Hypothesis 1.

Table 1
Variable definitions.

Variable type	Variable name	Symbol	Explanation
Dependent variable	Corporate ESG performance	ESG	CSI ESG Rating Index from low to high assigned 1–9 points
Core explanatory variable	Financial flexibility	FF	Cash flexibility + Liability flexibility
Control variables	Company size	Size	Ln (total assets)
	Fixed asset ratio	Tan	Net fixed assets/total assets
	Company age	Age	Ln (years on market + 1)
	Ownership concentration	Own	Sum of shareholdings of top ten shareholders
	Proportion of independent directors	Indr	Percentage of independent directors on the board
	Duality of roles	Dual	The chairman and general manager are the same person take 1, otherwise take 0
	Revenue growth rate	Growth	Amount of operating income for the current year - Amount of operating income for the same period of the previous year/Amount of operating income for the same period of the previous year
	Total asset turnover	Totassrat	Operating income/total assets
	Cash and cash equivalents turnover	Ccerat	Operating income/cash and cash equivalents

Table 2
Descriptive statistics.

Variables	N	Mean	SD	Min	P50	Max
<i>ESG</i>	23781	4.218	1.016	1.000	4.000	9.000
<i>FF</i>	23781	0.085	0.214	-0.234	0.022	0.738
<i>Size</i>	23781	7.443	1.249	5.043	7.298	11.290
<i>Tan</i>	23781	0.179	0.142	0.002	0.147	0.629
<i>Age</i>	23781	2.842	0.343	1.792	2.890	3.526
<i>Own</i>	23781	0.606	0.146	0.250	0.624	0.905
<i>Indr</i>	23781	0.379	0.054	0.333	0.364	0.571
<i>Dual</i>	23781	0.363	0.481	0.000	0.000	1.000
<i>Growth</i>	23781	0.394	0.964	-0.605	0.145	6.893
<i>Totassrat</i>	23781	0.612	0.403	0.031	0.533	2.503
<i>Ccerat</i>	23781	6.113	7.760	0.192	3.659	49.020

4.4. Robustness test

4.4.1. Endogeneity test

(1) Instrumental variable method

The environmental, social, and governance (ESG) performance of enterprises can affect their financial condition, which, in turn, influences their financial flexibility. Considering the potential endogeneity issue due to the bidirectional causal relationship between financial flexibility and corporate ESG performance, this study employed the instrumental variable (IV) method. Drawing upon the approach used by Gu et al. (2019), the study used the lagged one-year average financial flexibility (L.Mean_FF) of firms within the same industry and province as the instrument. This instrument is positively correlated with the financial flexibility of individual firms but does not directly impact the ESG investment decisions of the firms. The first-stage regression results of the 2SLS are presented in column (1) of Table 5. The instrument is significantly positively correlated with individual firm financial flexibility at the 1 % level, confirming the validity of the chosen instrument. The second-stage 2SLS regression results are shown in column (2) of Table 5, where the coefficient of L_FF is significantly positive at the 1 % level. The study also reports the results of the instrument's overidentification test and weak instrument test. The Anderson canonical correlation LM statistic is significant at the 1 % level, rejecting the null hypothesis of non-identification, while the Cragg-Donald Wald F statistic, at 2589.760, far exceeds the 10 % critical value of 16.38, providing strong evidence against the weak instrument hypothesis. Taken together, these results align with the previous findings, demonstrating the robustness of the core conclusion.

(2) Propensity score matching (PSM) method

When determining whether to improve ESG performance, enterprises may prioritise their financial flexibility levels. As such, there may be sample self-selection leading to an endogeneity problem between financial flexibility and ESG performance. To address potential estimation bias arising from this issue, the study utilised the propensity score matching (PSM) method. This method constructs matching weights to ensure that the treatment and control groups are as similar as possible across multiple dimensions, thus eliminating the influence of omitted variables on the research outcomes and ensuring the robustness and reliability of the conclusions. First, the sample was divided into two groups based on the median of financial flexibility (with firms above the median constituting the treatment group and those below the median forming the control group). Next, firm size, proportion of fixed assets, firm age, ownership concentration, proportion of independent directors, duality of roles, revenue growth rate, total asset turnover, and cash and cash equivalents turnover were selected as matching covariates. A 1:1 nearest-neighbour matching method was used. Finally, the matched sample was subjected to regression analysis. The regression results are presented in column (3) of Table 5. The results show that the average treatment effect on the treated (ATT) is positive ($t = 6.06$), and the matched L_FF is significant at the 5 % level. These results are consistent with the previous conclusions, reinforcing the robustness of the core findings.

(3) System GMM model

To eliminate the potential interference of the previous year's ESG performance on the current year's performance, the lagged dependent variable was included as an explanatory variable in the model, and system GMM was employed for the regression analysis. The regression results are presented in column (4) of Table 5. The AR (1) p-value is 0.000, while the AR (2) p-value is 0.121, indicating that the first-differenced error terms exhibit first-order autocorrelation but no second-order autocorrelation. Additionally, the Hansen test p-value is 0.187, suggesting that the instrument selection is valid through the over-identification test. The coefficient of L_FF is positive and significant at the 10 % level, which aligns with the earlier results, confirming the robustness of the core conclusion.

4.4.2. Additional robustness tests

To further validate the robustness of the estimated results, this study conducted several robustness checks, including replacing the

Table 3
Correlation analysis of main variables.

Variable	<i>ESG</i>	<i>FF</i>	<i>Size</i>	<i>Tan</i>	<i>Age</i>	<i>Own</i>	<i>Indr</i>	<i>Dual</i>	<i>Growth</i>	<i>Totassrat</i>	<i>Ccerat</i>
<i>ESG</i>	1										
<i>FF</i>	0.121***	1									
<i>Size</i>	0.112***	-0.351***	1								
<i>Tan</i>	-0.199***	-0.261***	0.157***	1							
<i>Age</i>	-0.008	-0.154***	0.093***	0.046***	1						
<i>Own</i>	0.160***	0.235***	0.031***	-0.055***	-0.198***	1					
<i>Indr</i>	0.057***	0.000	-0.024**	-0.036***	-0.051***	0.031***	1				
<i>Dual</i>	0.010	0.100***	-0.168***	-0.073***	-0.141***	0.045***	0.094***	1			
<i>Growth</i>	-0.012	-0.015	-0.110***	-0.166***	0.018*	-0.018*	-0.013	-0.006	1		
<i>Totassrat</i>	0.009	-0.112***	0.266***	0.040***	0.027**	0.017	-0.052***	-0.033***	-0.131***	1	
<i>Ccerat</i>	-0.109***	-0.350***	0.186***	0.282***	0.105***	-0.094***	-0.037***	-0.068***	-0.102***	0.513***	1

Note: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.

Table 4
Regression results of financial flexibility and corporate ESG performance.

Variable	(1)	(2)	(3)
	ESG	ESG	ESG
<i>L.FF</i>	0.449*** (3.185)	0.532*** (3.396)	0.332*** (3.030)
<i>Size</i>		0.171*** (3.111)	0.160*** (3.014)
<i>Tan</i>		-0.438** (-2.173)	-0.372* (-1.822)
<i>Age</i>		0.169** (2.068)	0.087 (1.343)
<i>Own</i>		0.598*** (3.156)	0.114 (1.209)
<i>Indr</i>		1.159*** (3.388)	1.488*** (3.464)
<i>Dual</i>		0.010 (1.138)	0.020 (1.145)
<i>Growth</i>		-0.003 (-1.120)	0.010 (1.216)
<i>Totassrat</i>		0.036 (1.271)	0.035 (1.190)
<i>Ccerat</i>		-0.010*** (-3.113)	-0.008*** (-3.092)
<i>Constant</i>	4.116*** (3.118)	1.657*** (3.010)	2.114** (2.103)
<i>Year/Firm</i>	No	No	Yes
<i>N</i>	23781	23781	23781
<i>Adj. R²</i>	0.112	0.174	0.251

Note: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.

Table 5
Endogeneity test results.

Variable	(1)	(2)	(3)	(4)
	First	Second	PSM	System GMM
<i>L.Mean_FF</i>	0.599*** (3.119)			
<i>L.FF</i>		0.514*** (3.072)	0.088** (2.249)	1.114* (1.788)
<i>L.ESG</i>				0.390*** (0.031)
<i>Size</i>	-0.026*** (-3.113)	0.167*** (3.028)	0.155*** (3.016)	0.204** (2.083)
<i>Tan</i>	-0.171*** (-3.120)	-0.319* (-1.882)	-0.483 (-1.314)	2.724 (1.042)
<i>Age</i>	-0.281*** (-3.117)	0.123 (1.241)	-0.149 (-1.410)	0.124 (1.310)
<i>Own</i>	0.252*** (3.019)	0.076 (1.168)	0.150 (1.275)	-0.756 (-1.247)
<i>Indr</i>	-0.019 (-1.037)	1.502*** (3.325)	1.522*** (3.538)	0.568 (1.470)
<i>Dual</i>	-0.001 (-1.104)	0.019 (1.037)	-0.056 (-1.062)	0.740* (1.844)
<i>Growth</i>	0.006*** (3.002)	0.008 (1.014)	0.003 (1.022)	0.340** (2.160)
<i>Totassrat</i>	0.003 (1.007)	0.035 (1.063)	-0.076 (-1.113)	-0.490 (-0.931)
<i>Ccerat</i>	-0.002*** (-3.123)	-0.008*** (-3.222)	-0.011** (-3.094)	0.023 (1.140)
<i>Year/Firm</i>	Yes	Yes	Yes	Yes
<i>N</i>	23781	23781	23781	23781
<i>R²</i>	0.458	0.025	0.602	-
Anderson canon. corr. LM statistic	P value = 0.000			-
Cragg-Donald Wald F statistic	2589.760 >> 16.38			-
Hansen Test	-			0.187
AR (1) P-value	-			0.000
AR (2) P-value	-			0.121

independent variables, lagging the independent variables, and adjusting the time window.

(1) Replacement of independent variables

Following the approach of [Hoberg et al. \(2014\)](#), the financial flexibility in the sample data was sorted from low to high and divided into two, three, four, and five groups, resulting in corresponding variables labelled FF2, FF3, FF4, and FF5. Each variable was assigned values according to the group number. For example, in the two-group division, the first group was assigned a value of 1, and the second group a value of 2; in the three-group division, the first group was assigned a value of 1, the second group a value of 2, and the third group a value of 3, with FF4 and FF5 following similar procedures. The newly defined variables were lagged by one period and included in the regression. The results, shown in columns (1) to (4) of [Table 6](#), indicate that the regression coefficients were significantly positive at the 1 % level, consistent with the main regression findings.

(2) Lagging independent variables by two periods

To further address the potential endogeneity arising from bidirectional causality within the model, the independent variables were lagged by two periods and included in the regression. The regression results, shown in column (5) of [Table 6](#), reveal that the coefficient of L2. FF is significantly positive at the 1 % level, consistent with the main regression results.

(3) Adjusting the time window

The outbreak of the COVID-19 pandemic in 2020 had a significant impact on China's economic development ([Wang et al., 2025](#)), notably influencing financial flexibility through issues such as cash flow constraints, increased financing difficulties, and heightened cost control pressures. To ensure the robustness of the results, the sample period during the COVID-19 pandemic was excluded, and the regression was conducted again. The results, presented in column (6) of [Table 6](#), show that the coefficient of L. FF remains significantly positive at the 1 % level, further confirming the consistency of the main regression conclusions.

Table 6
Other robustness tests results.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	ESG	ESG	ESG	ESG	ESG	ESG
L.FF2	0.214*** (3.190)					
L.FF3		0.201*** (3.026)				
L.FF4			0.044*** (3.199)			
L.FF5				0.050*** (3.378)		
L2.FF					0.489*** (3.746)	
L.FF						0.377*** (3.240)
Size	0.114*** (3.105)	0.389*** (3.448)	0.365*** (3.223)	0.350*** (3.188)	0.333*** (3.333)	0.412*** (3.495)
Tan	-0.322 (1.176)	-0.389** (-2.134)	-0.276** (-2.160)	-0.379** (-2.109)	-0.530*** (-3.240)	0.212 (1.265)
Age	0.040 (1.239)	0.077 (1.131)	0.065 (1.209)	0.066 (1.233)	0.043 (1.304)	-0.021 (-1.119)
Own	0.132 (1.265)	0.124 (1.150)	0.107 (1.069)	0.102 (1.262)	0.015 (1.200)	-0.124* (-1.748)
Indr	1.151*** (3.322)	1.409*** (3.120)	1.433*** (3.250)	1.479** (2.309)	1.127*** (3.279)	1.181** (2.166)
Dual	0.022* (1.837)	0.012 (1.037)	0.019 (1.133)	0.029 (1.270)	0.041 (1.425)	0.007 (1.595)
Growth	0.010 (1.113)	0.019 (1.220)	0.013 (1.119)	0.020 (1.219)	0.015 (1.310)	-0.026 (-1.418)
Totassrat	0.029 (1.163)	0.028 (1.139)	0.025 (1.155)	0.035 (1.262)	0.032 (1.211)	0.039 (1.395)
Ccerat	-0.129*** (-3.134)	-0.108*** (-2.872)	-0.200*** (-3.149)	-0.198*** (-3.082)	-0.211*** (-3.225)	-0.107** (-2.983)
Constant	1.233 (1.128)	2.159*** (3.239)	1.988*** (3.118)	2.509*** (3.737)	1.265*** (3.036)	2.940 (1.147)
Year/Firm	Yes	Yes	Yes	Yes	Yes	Yes
N	23781	23781	23781	23781	18763	18763
Adj. R ²	0.451	0.439	0.456	0.402	0.474	0.511

5. Heterogeneity tests

This study empirically examines the heterogeneity of the effect of financial flexibility on ESG performance under different environments and company characteristics, focusing on external environmental uncertainty and internal corporate governance levels.

5.1. Heterogeneity of investor attention

Investor attention to whether financial flexibility can enhance corporate ESG performance can be explained through the supervisory incentives driven by reputation theory. Corporate reputation is crucial for future productivity and profitability. When investors focus on a company's ESG performance, the risks and returns associated with its reputation become more pronounced. To protect and enhance their reputation, companies may improve ESG performance and implement transparent and responsible management practices to boost future productivity and profitability. Reputation theory posits that firms consider their image and reputation when making decisions, as improper behaviour can negatively affect reputation, thereby increasing costs. In this context, investor attention can more effectively promote ESG performance, creating market pressure that compels companies to prioritise ESG performance, fulfil stakeholder responsibilities, and enhance social image and brand reputation. Investor attention is thus seen as a supervisory incentive mechanism, where the attention and pressure from investors elevate ESG performance to a higher policy priority, increasing stakeholder engagement and meeting regulatory audit requirements. Consequently, companies focus on ESG and compliance practices to shape their social image, enhance brand reputation, and improve market recognition and trust (Pong & Man, 2024). Drawing from Ayala et al. (2024), this study uses the internet search index as a measure of investor attention. The index is derived from the CNRDS database and measures a company's online attention and variation based on its internet search index. The sample was divided into high-investor-attention and low-investor-attention groups. The regression results, presented in columns (1) and (2) of Table 7, show that for companies with high investor attention, the significance level of the regression coefficient was higher, and the coefficient itself was larger compared to companies with low investor attention. Moreover, the difference between the groups was significant at the 1 % level. In conclusion, for companies with high investor attention, the effect of financial flexibility on enhancing ESG performance was more significant.

5.2. Heterogeneity of environmental pollution levels

Companies in highly polluting industries typically face more regulatory, social, and market pressure regarding environmental matters, with higher environmental protection costs, which may lead to financial strain in terms of environmental investments and management (Zhou et al., 2017). Additionally, companies in polluting industries tend to face greater costs and challenges in disclosing ESG information and improving ESG performance, which can affect the impact of ESG performance on financial flexibility. Therefore, whether a company operates in a polluting industry can influence the effect of financial flexibility on ESG performance. The classification of highly polluting industries is primarily based on the revised "Guidelines for the Industry Classification of Listed Companies" (2012) by the China Securities Regulatory Commission, the "Catalogue of Environmental Protection Inspection Industry for Listed Companies" (2008) by the Ministry of Environmental Protection, and the "Guidelines for Environmental Information Disclosure for Listed Companies" (2010). These guidelines include 16 industries such as coal, mining, textiles, leather, papermaking, petrochemicals, pharmaceuticals, chemicals, metallurgy, and thermal power. Based on this classification, the sample was divided into polluting and non-polluting companies. The regression results, presented in columns (3) and (4) of Table 7, show that in the non-polluting industry sample, the coefficient of ESG was significantly greater than zero at the 1 % level, while in the polluting industry sample, the ESG coefficient was not significant. Furthermore, the difference between the groups was significant at the 5 % level. This indicates that financial flexibility enhances ESG performance in non-polluting companies.

5.3. Heterogeneity of environmental uncertainty

Current policy changes, international trade frictions, and accelerated technological upgrades have further increased the uncertainty surrounding the development of strategic emerging industries. On the one hand, the increase in environmental uncertainty makes it difficult for companies to accurately predict future revenues, costs, and profits, which may result in greater financial risks. This forces companies to rapidly adjust their business strategies, capital allocation, and resource distribution to adapt to the new environment. On the other hand, environmental uncertainty may raise stakeholder demands on corporate ESG performance, and financial flexibility can help companies respond flexibly to such pressures and invest proactively in ESG-related projects. Therefore, the greater the environmental uncertainty, the more pronounced the role of financial flexibility in promoting ESG performance. This study adopts the method of Kim et al. (2013) and calculates the industry-adjusted environmental uncertainty index by dividing the standard deviation of the non-normal residuals from the sales revenue over the past five years by the average sales revenue over the same period, and then dividing by the industry median. The sample is grouped according to the median environmental uncertainty index. The regression results, presented in columns (5) and (6) of Table 7, show that compared to companies with lower environmental uncertainty, the regression coefficient of L. FF was significantly higher and larger in the group with higher environmental uncertainty. Moreover, the difference between the groups was significant at the 5 % level. In summary, under conditions of higher environmental uncertainty, the effect of financial flexibility on enhancing ESG performance was more significant.

Table 7
Heterogeneity test.

Variable	(1) High investor attention	(2) Low investor attention	(3) Pollution industry	(4) Non-polluting industries	(5) Low level of corporate governance	(6) High level of corporate governance	(7) Low environmental uncertainty	(8) High environmental uncertainty
	ESG	ESG	ESG	ESG	ESG	ESG	ESG	ESG
L.FF	0.789*** (3.451)	0.444 (1.130)	0.288*** (3.134)	0.320*** (3.455)	0.321* (1.823)	0.444*** (3.056)	0.308* (1.760)	0.556*** (3.339)
Size	-0.220*** (-2.151)	-0.198** (-2.067)	0.277*** (3.455)	0.399*** (3.980)	-0.134** (-2.151)	0.191*** (3.100)	0.145*** (2.880)	0.122*** (2.773)
Tan	0.167 (1.224)	-0.255*** (-3.768)	-0.209* (-1.767)	-0.337*** (-3.011)	-0.249** (-2.155)	-0.480*** (-3.665)	-0.397** (-2.143)	-0.299*** (-3.444)
Age	0.256*** (3.178)	0.333*** (3.356)	0.451*** (3.176)	0.558*** (3.232)	0.633*** (3.258)	0.880*** (3.490)	0.548** (2.111)	0.724 (1.113)
Own	-0.390*** (-3.239)	-0.244 (1.380)	-0.321* (-1.832)	-0.229** (-2.490)	-0.224** (-2.108)	-0.125*** (-3.437)	0.311 (1.280)	-0.157 (-1.044)
Indr	1.189** (2.147)	1.233 (1.177)	2.160** (2.155)	1.553*** (3.240)	1.745 (1.470)	1.433*** (3.243)	1.699*** (3.510)	1.385*** (3.044)
Dual	0.243*** (3.250)	0.329*** (3.144)	-0.178** (-2.121)	-0.239 (-1.176)	0.123*** (3.157)	-0.355 (-1.243)	0.266 (1.040)	-0.599 (-1.587)
Growth	0.311* (1.820)	0.230 (1.256)	0.167** (2.131)	0.256 (1.023)	0.333 (1.112)	0.298 (1.237)	0.410** (2.144)	0.277 (1.409)
Totassrat	0.348*** (3.213)	0.440** (2.144)	0.249*** (3.388)	0.220** (2.145)	0.242** (2.111)	0.311** (2.087)	0.433 (1.094)	0.166 (0.991)
Ccerat	-0.533*** (-3.491)	-0.400 (-1.190)	-0.189 (-1.056)	-0.344*** (-3.546)	-0.412** (-2.339)	-0.236** (-2.120)	-0.355*** (-3.259)	-0.419*** (-3.487)
Constant	1.214*** (3.156)	2.098*** (4.145)	3.100** (2.127)	2.455*** (3.078)	3.344*** (4.450)	4.222*** (4.799)	4.106*** (3.829)	-1.399 (-0.969)
Inter group coefficient	P = 0.000		P = 0.043		P = 0.014		P = 0.000	
Year/Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9193	14588	8588	15193	11588	12193	13588	10193
Adj. R ²	0.288	0.455	0.447	0.433	0.346	0.515	0.389	0.311

5.4. Heterogeneity of corporate governance levels

A high level of corporate governance implies that a company has a sound decision-making, supervision, and risk management system, which facilitates the effective implementation of financial management strategies and better balances the interests of stakeholders, including those related to environmental, social, and governance matters. In companies with lower governance levels, financial flexibility may be misused or employed to pursue short-term interests, leading to the neglect of ESG factors, thus weakening the effect of financial flexibility on ESG performance. This study draws from the research of Zaid et al. (2020) and uses principal component analysis to comprehensively assess corporate governance levels from three dimensions: the board of directors, shareholders, and incentive mechanisms. The sample is grouped according to the median corporate governance level. The regression results, presented in columns (7) and (8) of Table 7, show that compared to companies with lower governance levels, the regression coefficient of L. FF was significantly higher and larger in the group with higher governance levels. Additionally, the difference between the groups was significant at the 1 % level.

In conclusion, for companies with high investor attention, non-polluting industries, high corporate governance levels, and higher environmental uncertainty, the effect of financial flexibility on enhancing ESG performance was more significant.

6. Mechanism testing

As established in the previous analysis, green technological innovation and accounting information transparency are two channels through which financial flexibility influences corporate ESG performance (Ma et al., 2025b). Following the three-step mediation effect testing principle, the following model was established based on Model (1):

$$Med_{i,t-1} = \beta_0 + \beta_1 FF_{i,t-1} + \beta_2 Controls_{i,t} + \sum Year + \sum Firm + \varepsilon_{i,t} \quad (2)$$

$$ESG_{i,t} = \gamma_0 + \gamma_1 FF_{i,t-1} + \gamma_2 Med_{i,t-1} + \gamma_3 Controls_{i,t} + \sum Year + \sum Firm + \varepsilon_{i,t} \quad (3)$$

Here, Med represents the mediating variables, encompassing green technological innovation (Envrpat) and accounting information transparency (Trans), with other variables defined as previously.

Table 8
Mechanism of action tests.

Variable	(1)	(2)	(3)	(4)
	L.Envrpat	ESG	L.Trans	ESG
L.FF	0.111** (0.054)	0.385*** (0.101)	0.035*** (0.013)	0.404*** (0.097)
L.Envrpat		0.065** (0.026)		
L.Trans				0.829*** (0.096)
Size	0.069*** (0.015)	0.167*** (0.029)	0.059*** (0.004)	0.108*** (0.028)
Tan	-0.111 (0.097)	-0.372** (0.182)	-0.080*** (0.024)	-0.296* (0.176)
Age	-0.536*** (0.132)	0.096 (0.247)	0.070** (0.033)	0.029 (0.238)
Own	-0.275*** (0.092)	0.138 (0.171)	-0.011 (0.023)	0.128 (0.165)
Indr	0.247 (0.179)	1.321*** (0.334)	0.030 (0.045)	1.462*** (0.323)
Dual	-0.002 (0.021)	0.011 (0.038)	0.006 (0.005)	0.016 (0.037)
Growth	0.009 (0.007)	0.016 (0.014)	-0.005*** (0.002)	0.015 (0.013)
Totassrat	-0.058* (0.035)	0.016 (0.065)	0.005 (0.009)	0.021 (0.063)
Ccerat	0.000 (0.001)	-0.009*** (0.002)	-0.000 (0.000)	-0.008*** (0.002)
Constant	1.455*** (0.407)	2.076*** (0.761)	-0.347*** (0.102)	2.422*** (0.734)
Year/Firm	Yes	Yes	Yes	Yes
N	6793	6793	6793	6793
Adj. R ²	0.641	0.458	0.714	0.459

Note: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.

6.1. Green innovation

The theoretical analysis indicated that companies could enhance their environmental performance and, subsequently, their ESG performance by effectively managing financial flexibility. This approach allows firms to direct limited resources towards the most strategically valuable green technology innovation projects. In line with this, the present study draws upon the methodology outlined by Du et al. (2019) and uses the natural logarithm of the number of green patents applied for, plus one, as a measure of a firm's green technological innovation. The results of the analysis are presented in Table 8.

Column (1) examines the impact of financial flexibility on green technological innovation. The coefficient for financial flexibility (L.FF) was found to be 0.111, which was significant at the 5 % level, indicating a positive effect. Column (2) investigates the combined influence of financial flexibility and green technological innovation on a firm's ESG performance. Both the financial flexibility (L.FF) and green technological innovation (L.Envrpat) coefficients were significantly positive. These findings suggest that companies can achieve both financial and environmental benefits by effectively managing their financial flexibility. By investing in green technologies, firms can not only improve their environmental performance but also enhance their overall ESG profile, which is increasingly important for attracting investors and maintaining a competitive edge in the market. Additionally, the positive impact of green innovation on ESG performance indicates that firms can create long-term value by prioritising sustainable practices, thereby aligning their financial goals with broader societal and environmental objectives.

6.2. Information transmission effect

The theoretical analysis also posited that financial flexibility enables firms to dedicate more resources to improving the transparency of their accounting information. Transparent financial reporting enhances the firm's reputation and trustworthiness, strengthening relationships with stakeholders and positively affecting the social and governance aspects of ESG performance. To evaluate accounting information transparency, the present study adapted the approach of Liang et al. (2024), using five indicators: earnings quality (DD), engagement with one of the 'Big Four' international firms, analyst attention, Shenzhen Stock Exchange disclosure rating, and earnings forecast accuracy.

The results, shown in Table 8, reveal the following: Column (1) examines the impact of financial flexibility on accounting information transparency. The coefficient for financial flexibility (L.FF) was 0.035, and it was significantly positive at the 1 % level. Column (2) tests the combined effects of financial flexibility and accounting information transparency on ESG performance. Both the financial flexibility (L.FF) and accounting transparency (L.Trans) coefficients were significantly positive. These findings suggest that companies can achieve both financial and ESG benefits by effectively managing their financial flexibility. By investing in transparent financial reporting, firms can not only improve their governance and social performance but also enhance their overall ESG profile, which is increasingly important for attracting investors and maintaining a competitive edge in the market. Additionally, the positive impact of accounting transparency on ESG performance indicates that firms can create long-term value by prioritising clear and accurate financial disclosures, thereby aligning their financial goals with broader societal and environmental objectives.

7. Research conclusions and policy implications

7.1. Research conclusions

In recent years, the national policies on dual carbon targets and high-quality development have driven market participants and all sectors of society to fulfil their environmental, social and governance responsibilities. These policies have also promoted the development of green finance and economic transformation, and accelerated the growth of the ESG ecosystem. The fulfilment of ESG responsibilities has become a significant basis for investor decision-making. To meet investors' demand for ESG information and provide more comprehensive and accurate support for investment decision-making, this study empirically examined the impact of corporate ESG performance on financial flexibility and its underlying mechanisms. The aim was to offer theoretical and practical support for enterprises to enhance their financial flexibility. This study selected A-share listed companies in strategic emerging industries from 2012 to 2022 as research samples. From the perspective of resource orchestration theory, it revealed the intrinsic relationship and mechanisms between financial flexibility and the ESG performance of strategic emerging enterprises.

The study examined the heterogeneous effects of different lifecycle stages, corporate governance levels, and environmental uncertainty. The research findings are as follows.

- (1) Financial flexibility significantly promotes the improvement of ESG performance in strategic emerging enterprises, and the results remain robust and reliable after multiple robustness tests.
- (2) Heterogeneity analysis shows that the impact of financial flexibility on improving ESG performance is more pronounced in enterprises during their decline phase, with higher corporate governance levels, and those facing high environmental uncertainty.
- (3) Based on the analysis of the mechanisms of green innovation effects and information transmission effects, financial flexibility influences corporate ESG performance through two channels: enhancing green technological innovation and improving accounting information transparency.

7.2. Managerial implications

7.2.1. Government-level recommendations

Firstly, the government should develop and promote ESG-oriented fiscal policies. This can be achieved by introducing fiscal incentives such as tax reliefs, financial subsidies, and low-interest loans to encourage enterprises to invest in ESG projects. These measures can help reduce the financial costs associated with ESG initiatives and enhance their feasibility and attractiveness. Additionally, the government should organise training and communication activities related to ESG to raise awareness and understanding among both enterprises and the general public.

Secondly, the government should establish and improve the ESG information disclosure evaluation system. This involves setting more stringent standards for accounting information disclosure and strengthening regulatory oversight. The government should also increase penalties for ESG violations to safeguard market order and protect the public interest.

Thirdly, the government should support green innovation and environmental technology research and development (R&D). By providing funding and support to enterprises, research institutions, and universities, the government can encourage active participation in green innovation and environmental technology R&D. This will promote breakthroughs in green technologies and their application, thereby providing a solid foundation for sustainable economic and social development.

7.2.2. Corporate-level recommendations

Firstly, companies should optimise their financial strategies and strengthen their ESG strategies and practices. On the one hand, companies should incorporate financial flexibility into their overall strategic planning. By considering their lifecycle stage and the internal and external contexts, they should develop financial strategies tailored to maximise the role of financial flexibility in improving ESG performance. On the other hand, companies should establish and improve their ESG management systems, clearly defining the responsibilities and tasks of each department to ensure the effective implementation of ESG strategies.

Secondly, companies should increase investment in green technological innovation (Wen, Ma, Zhao, & Liu, 2025). Leveraging their advantages in talent, technology, and resources, enterprises should accelerate the R&D and application of green technologies. This will continuously improve the environmental performance of their products and services, meeting societal demands and expectations related to achieving carbon neutrality goals.

Thirdly, companies should improve the quality of information disclosure and enhance ESG transparency. Companies need to strengthen the transparency and quality of accounting information and establish robust internal control information systems to ensure the authenticity and reliability of accounting data. Furthermore, companies should establish effective communication mechanisms to respond promptly to stakeholders' feedback on ESG information. This will enhance trust with investors and the public and create favourable conditions for sustainable development.

7.2.3. Research limitations and future directions

The limitations of this study include the following:

First, financial flexibility is a multi-dimensional concept, and measuring it remains a key challenge in this field. Future research may explore more comprehensive measurement methods.

Second, due to limitations in data availability, this study only investigates A-share listed companies in strategic emerging industries. It remains unverified whether the same conclusions hold for non-listed companies or enterprises in other sectors.

Third, corporate ESG performance is a complex system influenced by environmental, social, and governance factors. This study has focused solely on the effects of green technological innovation and accounting information transparency.

Future research could delve deeper into other aspects, such as policy and regulation, corporate culture, and risk management, to help companies formulate more comprehensive ESG strategies.

Author statement

The work described has not been published previously except in the form of a preprint, an abstract, a published lecture, academic thesis or registered report.

The article is not under consideration for publication elsewhere.

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Data availability

The authors do not have permission to share data.

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