The Impact of ESG Information Disclosure on Corporate Financial Risk—Evidence from Chinese Enterprises

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Abstract. Currently, as society has placed increasing emphasis on environmental, social responsibility, and corporate governance (ESG) issues, a company's performance in ESG has gradually become an important indicator for assessing its sustainable development capabilities. However, there is limited research on how ESG information disclosure affects financial risk. This study empirically analyzes the impact of ESG information disclosure on corporate financial risk based on data from listed companies on the Chinese A-list companies from 2010 to 2022. The findings reveal that robust ESG information disclosure can significantly reduce corporate financial risk. This effect is mainly mediated through alleviating financing constraints and moderated by promoting digital transformation, which further enhances the impact of ESG disclosure in reducing company financial exposure. Further analysis shows that the effect of ESG information disclosure on reducing financial risk is more pronounced in companies located in the central and western regions, in non-highly polluting industries, and among growing and small-scale enterprises. This research provides valuable insights for corporate managers and policymakers seeking to improve ESG practices.

Keywords: ESG Information Disclosure, Financial Risk, Financing Constraints, Digital Transformation.

1. Introduction

With the increasing global prominence of issues such as climate disaster and biodiversity loss, companies are now facing greater social and environmental responsibilities alongside economic growth. In response, the United Nations introduced the Principles for Responsible Investment (PRI) in 2006, encouraging the integration of Environmental, Social, and Governance (ESG) principles into corporate development. ESG disclosure has since become a key indicator of corporate sustainability and plays an important role in investment and financing decisions [1].

As China's market economy rapidly develops, listed companies have frequently faced long-term risks, especially regarding governance in environmental and social responsibility. Despite government policies promoting green finance and the "dual carbon" strategy, Chinese enterprises still struggle with inadequate ESG transparency, which affects their long-term capital market performance [2].

While existing research highlights ESG disclosure's positive effects on corporate performance and financing constraints, studies on its impact on corporate financial risk remain limited. Financial risk, defined as potential economic losses from discrepancies between actual financial outcomes and business objectives [3], is a key factor influencing long-term corporate survival.

Thus, this paper empirically examines the relationship between ESG information disclosure and corporate financial risk, using data from Shanghai and Shenzhen-listed companies from 2010 to 2022. The study analyzes ESG's overall impact on financial risk, exploring mechanisms through which ESG affects financial risk. It also examines the varying effects based on firm size and industry, offering both theoretical insights and empirical evidence for corporate and policy decision-making.

The contributions of this paper include: (1) exploring the understudied relationship between ESG disclosure and corporate financial risk, and (2) constructing a theoretical framework to explain how ESG disclosure mitigates financial risk, providing valuable guidance for management practices and policymaking.

2. Conceptual background and hypotheses development

2.1. ESG Information Disclosure and Corporate Financial Risk

Financial risk refers to the likelihood of a company facing economic losses due to deviations in business outcomes from expected goals, primarily stemming from uncertainties in the business environment and financial activities [4].

From the perspective of information asymmetry theory, information asymmetry may increase a company's financing costs, reduce market confidence, lead to poor decision-making, increase regulatory and cooperation risks, and exacerbate market volatility, ultimately resulting in higher financial risks. However, the implications of non-financial disclosures can provide more comprehensive corporate information, helping to alleviate the information asymmetry problem between companies and investors. In addition to financial information, non-financial information covered by ESG can offer investors crucial insights into a company's future business prospects, allowing them to assess the overall state of the company more comprehensively. Moreover, strong ESG performance serves as a positive signal to the market, boosting confidence in the company [5]

From the perspectives of stakeholder theory and resource dependence theory, a company's efforts in environmental protection, social responsibility, and corporate governance align with stakeholder expectations, helping the company secure vital resources for survival and growth [6]. ESG information disclosure enables stakeholders to understand the company's efforts in fulfilling its environmental, social, and governance responsibilities, directly influencing their trust in the company and their resource allocation decisions, which are closely tied to the company's business environment and investment and financing activities. This ultimately has a profound impact on corporate financial risk. From the preceding analysis, we put forward the following hypothesis:

H1: ESG information disclosure can reduce corporate financial risk.

2.2. ESG Information Disclosure, Financing Constraints, and Corporate Financial Risk

Effective ESG performance not only optimizes a company's capital structure and attracts long-term investments but also directly alleviates financing constraints, enabling more efficient resource allocation.

Because investors are often reluctant to invest in firms with uncertain prospects, information asymmetry between firms and investors is a major barrier to firms seeking external financing. ESG disclosure plays a key role in reducing financing constraints by addressing information asymmetry between firms and investors. In addition, the increased transparency through ESG disclosure increases scrutiny and attention from analysts and institutional investors. This heightened attention enhances investor confidence and reduces information asymmetry, which can ultimately lower a firm's cost of capita [7]. As a result, companies with sound ESG practices have easier access to external financing, which eases constraints and reduces overall financial risk.

Moreover, good ESG information disclosure conveys a positive corporate image, acting as an effective signal [2]. First, it demonstrates that the company has a strong sense of social responsibility, making it more likely to gain the trust of investors, particularly those who prefer responsible investing. Second, it signals that the company has robust sustainable development capabilities, indicating abundant future cash flows and offering investors the expectation of higher returns. Third, it shows that the company has well-established governance mechanisms, which better protect investor interests. Moreover, considering the influence of the Chinese government in the allocation of financial resources, particularly in the supply of bank credit, companies that fulfill social responsibility can strengthen their political connections and thus receive more government support in financing [8]. Therefore, Considering the analysis above, the following hypothesis is proposed:

H2: ESG information disclosure can reduce corporate financial risk by alleviating financing constraints.

2.3. ESG Information Disclosure, Corporate Digital Transformation, and Corporate Financial Risk

By leveraging the convenience of digital platforms, large customer bases, high-value-added and low-cost replicable products, companies can accurately predict customer needs and preferences. At the same time, digital platforms increase information transparency, reducing information asymmetry between companies and customers. Therefore, digital platforms enhance companies' ability to adapt to market changes and optimize transaction efficiency, which improves the accuracy of financial risk identification [9].

Additionally, highly digitalized companies possess more optimized combinations of production factors and more advanced digital technologies, significantly improving the efficiency of data collection, analysis, and forecasting [10]. This forward-looking data analysis capability allows digital technology to integrate with ESG practices, helping companies better assess the rationality of decisions related to environmental regulation, social responsibility, and internal governance. This shifts companies from a reactive to a proactive strategic approach, enhancing their ability to generate profits, thus creating a favorable information environment for the development of ESG concepts and the achievement of strategic objectives.

Furthermore, ESG disclosure encourages companies to adopt more sustainable and responsible technological solutions, reducing long-term environmental and social risks. Drawing from the earlier analysis, we propose the following hypothesis:

H3: ESG information disclosure can reduce corporate financial risk by enhancing the level of digital transformation.

3. Model, data and methodology

3.1. Variables

Dependent Variable: Corporate Financial Risk (Z-score). This study adopts the risk Z-score method proposed by [11] for measurement. The specific calculation method is as follows:

$$Zscore = \frac{1.2 \times WorkingCapital + 1.4 \times \mathrm{R}etain\ Earnings + 3.3 \times EBIT + 0.6 \times Market\ Value\ of\ Equity + 0.999 \times Sales}{Total\ \ Assets} \tag{1}$$

Simultaneously, this paper follows the Z-score classification method [4] for processing: a Z-score below 1.81 is assigned a value of 2; a Z-score above 2.67 is assigned a value of 0; and a Z-score between 1.81 and 2.67 is assigned a value of 1. In this case, a higher assigned value indicates greater financial risk.

Independent Variable: ESG Information Disclosure (ESG). This paper utilizes the ESG rating data from the China Securities Index (CSI), which includes 26 key indicators and more than 130 sub-indicators. It is the most widely used and comprehensive ESG rating system in China. CSI classifies ESG ratings into nine levels: AAA, AA, A, BBB, BB, B, CCC, CC, and C. In this study, these ratings are converted into numerical values of 9, 8, 7, 6, 5, 4, 3, 2, and 1, respectively.

Control Variables: Based on relevant literature, the following control variables are selected: firm age (age), firm size (size), ownership concentration (top1), proportion of independent directors (Ind-feep), leverage ratio (lev), cash flow (cfo), capital expenditure (exp), profitability (roa), growth (growth), and ownership structure (SOE). In addition, year and industry effects are also controlled for. All the variables are show in Table 1.

Table.1. Variable Definitions

Type	Name	Symbol	Definitions
Dependent Variable	Corporate Financial Risk	Z-score	See previous section for algorithm
Independent Variable	ESG Information Disclosure	ESG	See previous section for ratings
Control Variables	Company Age	age	Natural logarithm of (current year - establishment year + 1)
	Firm size	size	Natural logarithm of total assets
	Ownership Concentration	top1	Shareholding ratio of the largest shareholder
	Proportion of Independent Directors	Ind-feep	Number of independent directors / Total number of board members
	Leverage Ratio	lev	Debt-to-asset ratio, total liabilities / total assets
	Corporate Cash Flow	cfo	Net cash flow from operating activities / total assets
	Capital Expenditure	exp	Fixed assets / total assets
	Profitability	roa	Return on assets (ROA)
	Growth	growth	Revenue growth rate

3.2. Model Construction

To test the hypotheses of the article, a regression model of ESG disclosure and corporate financial risk is developed:

$$Zscore_{(i,t)} = \alpha_0 + \alpha_1 ESG_{(i,t)} + \alpha_2 \sum Controls_{(i,t)} + \sum Industry + \sum Year + \varepsilon_{(i,t)} \tag{2}$$

In this model, Zscore represents corporate financial risk, ESG represents the company's ESG disclosure rating, and Controls refers to control variables other than year and industry. Σ Year and Σ Industry denote industry fixed effects and year fixed effects, respectively, which account for variations caused by industry differences and time trends, thus eliminating their impact on the company's ESG performance. εis the random error term. The primary focus of this study is the coefficientα_1. Ifα_1 is significantly negative after assigning values to Zscore, the original hypothesis is supported.

3.3. Data

3.3.1 Data sources

Due to the limitations of ESG and corporate patent data, this study selects A-share listed companies on the Shanghai and Shenzhen Stock Exchanges from 2012 to 2022 based on previous study as the research sample. To ensure data accuracy, companies from the financial and insurance industries, "Special Treatment" (ST) firms, as well as industries with limited observations in certain years, have been excluded. ESG disclosure performance data is sourced from the Sino-Securities Index (SSI) ESG ratings, while all other data is obtained from the CSMAR database.

3.3.2 Descriptive statistics

First, as show in Table 2, the mean value of corporate financial risk (Z-score) is 0.658, with a standard deviation of 0.844, indicating significant variation in financial risk across different firms. The mean ESG disclosure score is 4.123, with a standard deviation of 1.084, and the scores range from 1 to 8. This suggests that most firms have a moderate ESG disclosure score, while a few companies either excel or underperform in their ESG disclosure efforts.

Table.2. Descriptive statistics

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
Z-score	29182	0.658	0.844	0	2
ESG	28481	4.123	1.084	1	8
age	29170	2.193	0.783	0.693	3.497
size	29170	22.283	1.38	15.577	28.636
lev	29170	0.425	0.209	0.008	4.026
exp	29170	0.211	0.163	0	0.954
roa	29170	0.032	0.694	-30.688	108.366
growth	29170	-1.389	119.155	-11745.835	8072.186
cfo	29170	0.873	2.028	-5.055	129.31
top1	29170	33.563	14.895	0.29	89.99

4. Result and discussion

4.1. Benchmark results

Firstly, according to Table 3, when considering only ESG and financial risk, the regression coefficient of ESG information disclosure on enterprise financial vulnerability is -0.0322, with a significance level of 1%, indicating a significant negative correlation between good ESG disclosure and lower corporate financial risk. However, the R-squared for this case is only 0.002, showing weak explanatory power, with only a minimal portion of financial risk variability explained by ESG disclosure.

Thus, after introducing control variables such as firm size, leverage ratio, capital expenditure, and profitability, the coefficient for ESG disclosure slightly decreases to -0.0224 but remains significant at the 1% level. The R-squared of Model 2 increases to 0.182, indicating that the model's explanatory power for financial risk substantially improves with the inclusion of control variables.

Finally, after adding industry and year fixed effects, the coefficient for ESG disclosure is -0.035, still significantly negatively correlated at the 1% level. This further confirms the significant negative relationship between ESG disclosure and financial risk. The R-squared of Model 3 rises to 0.234, suggesting that the model's explanatory power is further enhanced after controlling for industry and year effects. At this point, firm size (size), capital expenditure (exp), and profitability (roa) remain significantly correlated with financial risk, with directions consistent with the previous two models.

In conclusion, the benchmark regression results indicate that the influence of sustainability-related disclosures can significantly reduce enterprise financial vulnerability, supporting Hypothesis H1.

Table.3. Benchmark results

VARIABLES	(1)	(2)	(3)
	Z-score	Z-score	Z-score
ESG	-0.0322***	-0.0224***	-0.035***
	(0.006)	(0.005)	(0.005)
age		-0.0203**	-0.019**
		(0.01)	(0.01)
size		0.266***	0.329***
		(0.012)	(0.016)
lev		0.0103	0.017
		(0.029)	(0.028)
exp		0.455***	0.438***
		(0.077)	(0.074)
roa		-2.321***	-2.315***
		(0.144)	(0.148)
growth		2.95e-05	-3.72e-05
		(2.30e-05)	(2.93e-05)
cfo		-0.00496*	-0.009***
		(0.003)	(0.004)
top1		0.00509***	0.003***
		(0.0001)	(0.001)
Constant	0.807***	-5.319***	-5.914***
	(0.024)	(0.288)	(0.542)
Ind-fe	NO	NO	Yes
Year-fe	NO	NO	Yes
Observations	28,473	28,473	28,473
R-squared	0.002	0.182	0.234
Standard errors are in parentheses			
*** p<.01, ** p<.05, * p<.1			

4.2. Robustness checks

4.2.1 Replacing the dependent variable

Drawing on existing research, the Merton Distance-to-Default (DD) metric is selected as a proxy variable for corporate financial risk to conduct a robustness test. A higher Merton DD value indicates lower corporate financial risk. Following the approach of Bharath, the Merton DD is simplified and calculated [12].

The regression results, shown in Table 4, reveal that the coefficient for ESG information disclosure is 0.265, which is significant at the 1% level. This indicates that ESG disclosure has a significant positive impact on the Merton DD metric, further demonstrating that good implications of non-financial disclosures can significantly reduce corporate enterprise financial vulnerability. This result is consistent with the earlier findings using the Z-score as a measure of financial risk, further supporting Hypothesis H1, which posits that ESG disclosure can reduce corporate financial risk.

4.2.2 Using an alternative estimation method

By changing the measurement method for ESG, a three-tier scoring system is adopted, where ratings of AAA, AA, and A are assigned a value of 3, ratings of BBB, BB, and B are assigned a value of 2, and ratings of CCC, CC, and C are assigned a value of 1. ESG and financial risk (Z-score) are then re-examined through regression analysis, with the results presented in Column (2) of Table 4. The results show that the effect of ESG-related transparency on the Z-score remains significantly negative. This further confirms that the influence of sustainability-related disclosures can significantly reduce corporate financial risk, and this conclusion holds robust even when the ESG measurement method is altered.

In summary, the robustness test results are consistent with the benchmark regression, providing additional evidence that ESG disclosure has a significant effect in reducing corporate financial risk.

Table.4. Robustness test results

VARIABLES	(1)	(2)
	Merton DD	Z-score
ESG	0.265***	-0.389***
	(0.029)	(0.018)
Controls	Yes	Yes
Ind-fe	Yes	Yes
Year-fe	Yes	Yes
Constant	46.73***	-4.845***
	(1.018)	(0.552)
Observations	28,473	28,473
R-squared	0.099	0.182
Standard errors are in parentheses		
*** p<.01, ** p<.05, * p<.1		

5. Mechanisms and Heterogeneity Analyses

5.1. Mediating effect analyses

To examine whether ESG performance can reduce financial risk by alleviating financing constraints, this paper follows the two-step method proposed by [13] and constructs a mediation effect model based on the original model.

$$Zscore_{(i,t)} = \alpha_0 + \alpha_1 ESG_{(i,t)} + \sum \alpha_m controls_{(i,t)} + \varepsilon_{(i,t)} \tag{3}$$

$$Zscore_{(i,t)} = \beta_0 + \beta_1 ESG_{(i,t)} + \beta_1 Median_{(i,t)} + \sum \beta_m controls_{(i,t)} + \varepsilon_{(i,t)} \tag{4}$$

In this model, Median represents the mediator variable. The mediator variable selected is "financing constraints," measured by the KZ Index (Kaplan-Zingales index), where a higher value indicates a higher degree of financing constraints.

According to the results in Table 5, when the KZ Index is incorporated into the model, the coefficient of ESG disclosure on financial risk is -0.0224, remaining significant at the 1% level. Additionally, this coefficient is slightly reduced compared to the base model, indicating that financing constraints play a partial mediating role between ESG disclosure and financial risk.

Furthermore, the model's R-squared decreases from 0.207 to 0.182, suggesting that the explanatory power of the model changes after accounting for the influence of financing constraints. The introduction of financing constraints weakens the direct effect of ESG disclosure on financial risk, providing further evidence that financing constraints act as a mediating variable. This supports Hypothesis 2, which posits that ESG disclosure can indirectly reduce corporate financial risk by alleviating financing constraints.

In conclusion, through mediation effect analysis, this study confirms that ESG disclosure can indirectly reduce corporate financial risk by mitigating financing constraints, thus validating Hypothesis 2.

Table.5. Mediating test results

VARIABLES	(1)
	Z-score
ESG	-0.0224***
	(0.004)
Controls	Yes
Ind-fe	Yes
Year-fe	Yes
Constant	-5.319***
	(0.141)
Observations	28,473
R-squared	0.182
Standard errors are in parentheses	
*** p<.01, ** p<.05, * p<.1	

5.2. Moderating effect analyses

This study uses text analysis combined with word frequency statistics to Evaluate the level of digital transformation within the company [14]. Since listed companies' annual reports elaborate on their annual strategic layout, business philosophy, and organizational structure, they provide a good reflection of the progress in digital transformation. Thus, measuring the degree of digital transformation through word frequency statistics and conducting long-term trend analysis is feasible. To prevent the right-skewed nature of keyword frequency from biasing the regression results, the word frequency count is incremented by one and then the natural logarithm is taken, resulting in the corporate digital transformation variable (DT).

According to Table 6, the coefficient of the interaction term (ESG_DT) is -0.00804, significant at the 1% level, indicating that digital transformation has a significant moderating effect on the relationship between ESG information disclosure and financial risk. Specifically, as the degree of corporate digital transformation increases, the effect of ESG-related transparency in reducing enterprise financial vulnerability is further strengthened. Additionally, digital transformation itself also has a significant negative impact on financial risk, suggesting that digital transformation directly reduces corporate financial risk.

In summary, the results of the moderating effect analysis indicate that as the degree of corporate digital transformation increases, the negative impact of ESG disclosure on financial risk becomes more pronounced. This supports Hypothesis H3, confirming that digital transformation plays a significant positive moderating role in the relationship between ESG disclosure and financial risk.

Table.6. Moderating test results

	(1)
VARIABLES	Z-score
ESG	-0.0229***
	(0.00378)
ESG_DT	-0.00804***
	(0.000759)
DT	-0.0279***
	(0.00363)
Controls	Yes
Ind-fe	Yes
Year-fe	Yes
Constant	-5.431***
	(0.142)
Observations	28,319
R-squared	0.184
Standard errors are in parentheses	
*** p<.01, ** p<.05, * p<.1	

5.3. Further heterogeneity analyses

5.3.1 Heterogeneity analyses of regional factors

This study divides companies based on their location into eastern and central-western regions to analyze whether the influence of sustainability-related disclosures on corporate enterprise financial vulnerability differs across regions.

According to Table 7, the effect of non-financial disclosures on enterprise financial vulnerability shows significant differences between the eastern and central-western regions. For companies in the eastern region, the regression coefficient of ESG disclosure is -0.0440, but it does not reach statistical significance. In contrast, for companies in the central-western region, the regression coefficient of ESG disclosure is -0.0236, and it is significant at the 1% level. This indicates that ESG disclosure does not significantly reduce financial risk for companies in the eastern region. This may be because the eastern region has a higher degree of marketization, better corporate governance, and more informed investors, resulting in less information asymmetry and thus weaker marginal effects of ESG disclosure.

On the other hand, ESG disclosure significantly reduces financial risk for companies in the central-western region. This could be due to the relatively underdeveloped market environment in these areas, where companies face higher operational risks and more severe information asymmetry. In such contexts, ESG disclosure can effectively enhance corporate transparency, boost market confidence, and thereby mitigate financial risk.

5.3.2 Heterogeneity analyses across industries

Companies are grouped based on whether they are in highly polluting industries to analyze the differences in the effects of ESG disclosure across firms with varying levels of pollution [15].

The results indicate that for companies in highly polluting industries, the regression coefficient of ESG disclosure is -0.013, which is not statistically significant. In contrast, for companies in non-highly polluting industries, ESG disclosure has a significantly negative effect on financial risk, with a regression coefficient of -0.032, significant at the 1% level. This may be because highly polluting companies typically face stringent environmental regulations, compliance requirements, and high environmental risks, all of which have a more direct impact on their financial risk. Consequently, the role of ESG disclosure in reducing financial risk is limited for these firms.

On the other hand, non-highly polluting companies face lower environmental risks and less regulatory pressure, allowing ESG disclosure to enhance market confidence, reduce information asymmetry, and consequently lower financing costs and financial risk.

Table.7. Heterogeneity analyses: regional and industry factors

VARIABLES	(1)	(2)	(3)	(4)
	Eastern Region	Central and Western Region	Polluting Firms	Non-Polluting Firms
	Z-score	Z-score	Z-score	Z-score
ESG	-0.044	-0.0236***	-0.013	-0.032***
	(-0.0268)	(-0.00456)	(-0.007)	-0.004
Controls	Yes	Yes	Yes	Yes
Ind-fe	Yes	Yes	Yes	Yes
Year-fe	Yes	Yes	Yes	Yes
Constant	-7.994***	-5.054***	-1.97***	-3.44***
	(-0.499)	(-0.173)	(-0.321)	(-0.171)
Observations	2,416	19,920	6,278	20,583
R-squared	0.248	0.176	0.48	0.421

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

5.3.3 Heterogeneity analyses based on the corporate life cycle

In the heterogeneity analysis of the corporate life cycle, since all the selected companies are publicly listed, this study combines the introduction and growth stages into the growth stage, and the decline and recession stages into the recession stage. Thus, the life cycle is divided into three phases: growth, maturity, and recession [16]. The study analyzes the role of ESG communication on company financial exposure across companies at different life cycle stages.

As shown in Table 8, for companies in the growth stage, the regression coefficient of ESG disclosure is -0.0244, and it is significant at the 1% level. For companies in the maturity stage, the coefficient is -0.0116, with a significance level of 10%. For companies in the recession stage, the ESG disclosure coefficient is -0.0212, also significant at the 1% level.

This may be because companies in the growth stage are typically in a phase of rapid expansion and face significant external financing needs. ESG disclosure enhances corporate transparency and credibility, thereby reducing financing costs and alleviating financial risk. In contrast, companies in the maturity stage usually have established stable market positions and governance structures, with more stable financial conditions. While ESG disclosure helps improve corporate image, its marginal effect on reducing financial risk is relatively weaker. For companies in the recession stage, facing high uncertainty and market trust crises, ESG disclosure helps improve their reputation and transparency, attracting external investors' attention, thereby easing financial pressure.

5.3.4 Heterogeneity analysis based on firm size

This study classifies companies with annual revenues exceeding 400 million yuan as large-scale enterprises, according to the "Standards for the Classification of Large, Medium, Small, and Micro Enterprises" issued by the National Bureau of Statistics. It analyzes the moderating effect of firm size on the relationship between ESG disclosure and financial risk.

For large-scale enterprises, the regression coefficient of ESG disclosure is 0.0177, but it is not statistically significant. In contrast, for small-scale enterprises, the regression coefficient of ESG disclosure is -0.0237, and it is significant at the 1% level.

This may be because large-scale enterprises typically have strong financial stability and well-established risk management systems. External investors are also more familiar with their operational status, so the effect of ESG-related transparency on reducing enterprise financial vulnerability is relatively weak. Small-scale enterprises, on the other hand, often face greater information asymmetry and higher financing constraints. ESG disclosure can enhance their transparency, boost market confidence, reduce financing costs, and effectively mitigate financial risk.

Table.8. Heterogeneity analyses: corporate life cycle and firm size

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Growth Stage	Maturity Stage	Decline Stage	Large Scale	Small Scale
	Z-score	Zs-core	Z-score	Z-score	Z-score
ESG	-0.0244***	-0.0116*	-0.0212***	0.0177	-0.0237***
	(-0.00468)	(-0.00695)	(-0.000632)	(-0.0118)	(-0.00415)
Controls	Yes	Yes	Yes	Yes	Yes
Ind-fe	Yes	Yes	Yes	Yes	Yes
Year-fe	Yes	Yes	Yes	Yes	Yes
Constant	-5.255***	-5.244***	-5.063***	-6.569***	-5.296***
	(-0.174)	(-0.243)	(-0.254)	(-0.599)	(-0.162)
Observations	20,223	12,201	10,460	2,675	24,552
R-squared	0.181	0.172	0.187	0.17	0.191

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

6. Conclusions and recommendations

In the context of global sustainable development, companies are increasingly required to balance economic benefits with environmental and social responsibilities. ESG disclosures have emerged as a critical measure for assessing corporate sustainability and financial risk in capital markets. This study, based on A-share listed companies from China's Shanghai and Shenzhen stock exchanges between 2012 and 2022, finds that ESG disclosure significantly reduces corporate financial risk, particularly by alleviating financing constraints and promoting digital transformation. Enhanced ESG transparency helps companies optimize capital structures and improve market transparency, leading to lower financial risks. Furthermore, digital transformation amplifies the effect of ESG disclosure in reducing financial risk, improving management efficiency and long-term sustainability.

In conclusion, ESG disclosure not only strengthens corporate image but serves as an effective financial risk management tool. Companies should tailor their transparency efforts to their characteristics, while policymakers should incentivize broader ESG adoption to promote coordinated economic, social, and environmental development.

(1) Improve the ESG Disclosure Mechanism and Enhance Corporate Transparency

Firstly, ESG information disclosure reduces financial risk by mitigating information asymmetry, boosting market confidence, and lowering corporate financing costs. Therefore, companies should actively enhance the quality and transparency of their ESG disclosures, particularly in the areas of environmental performance, social responsibility, and corporate governance. This will not only increase investor confidence in the company's future prospects but also improve the company's performance in capital markets, reducing financing pressures and financial risk.

(2) Alleviate Financing Constraints through ESG Disclosure

Secondly, ESG disclosure can indirectly reduce corporate financial risk by alleviating financing constraints. By disclosing ESG information, companies can demonstrate their strong social responsibility and governance capabilities, which helps optimize their capital structure and attract more long-term investment. Policymakers should encourage companies to improve the standardization and transparency of ESG disclosures and offer policy incentives to companies facing financing constraints. This will help them secure greater capital support through enhanced ESG practices.

(3) Accelerate Digital Transformation and Optimize Financial Risk Management

In addition, digital transformation plays a significant moderating role in the relationship between the influence of sustainability-related disclosures and enterprise financial vulnerability. As companies deepen their digital transformation efforts, the effect of ESG disclosure on reducing financial risk becomes more pronounced. Therefore, companies should accelerate their digital development, leveraging technological tools to enhance transparency and management capabilities. Governments should also implement supportive policies to assist companies in their digital transformation, further amplifying the role of ESG information in reducing financial risk.

References

[1] Li Z, Shao Y, Li Z. ESG Information Disclosure, Media Supervision, and Corporate Financing Constraints. [J]. Science Decision Making, 2022(7):1-26.

[2] Zhang Z, Jin X, Li G. Empirical Study of the Interactive and Cross-Period Influence between Corporate Social Responsibility and Financial Performance. [J]. Accounting Research, 2013(8):32-39.

[3] Feng S, Zhao S, Wu H. The Impact of FinTech on Corporate Financial Risk and Its Internal Mechanism—The Threshold Effect of Financial Regulation. [J]. Reform, 2021(10):84-100.

[4] Wang X, Cao F. Research on the Mediating Effect of Pledged Shares on Corporate Financial Risk Based on Structural Equation Modeling. [J]. Commercial Research, 2021(5):85-93.

[5] Xu G, Zhuo Y, Zhang Y. Does ESG Information Disclosure Increase Corporate Value? [J]. Finance & Accounting Communication, 2022(4):33-37.

[6] Tan J, Huang R, Zhang J. ESG Performance and Corporate Risk—An Explanation from the Perspective of Resource Acquisition. [J]. Management Science, 2022, 35(5):3-18.

[7] Dhaliwal D S, Li O Z, Tsang A, et. al. Voluntary Non-Financial Disclosure and the Cost of Equity Capital: The Case of Corporate Social Responsibility Reporting. [J]. Accounting Review, 2011, 86(1):59-100.

[8] Qiu M, Yin. Corporate ESG Performance and Financing Costs in the Context of Ecological Civilization Construction. [J]. Quantitative & Technical Economics, 2019, 36(3):108-123.

[9] Hang H, Xu S. Exploration of Corporate Financial Risk Identification and Control Under Digital Transformation. [J]. Finance and Accounting Communication, 2022, 2022(24):131-134.

[10] Liu L, Yang G. The Impact of Digital Construction on Corporate Investment Efficiency: Empirical Evidence from Listed Manufacturing Companies in China. [J]. Friends of Accounting, 2022(23):123-130.

[11] Altman E I. Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy[J]. Journal of Finance, 1968, 23(4):589-609.

[12] Bharath S T, Tyler S. Forecasting Default with the Merton Distance to Default Model. [J]. The Review of Financial Studies, 2008, 3(3).

[13]] Jiang T. Mediation and Moderation Effects in Empirical Research on Causal Inference. [J]. China Industrial Economics, 2022(5):100-120.

[14] Wu F, Hu H, Lin H. Corporate Digital Transformation and Capital Market Performance—Empirical Evidence from Stock Liquidity. [J]. Management World, 2021, 37(7):130-144.

[15] Xiao H, Z, Li. Institutional Pressure, Executive Characteristics, and Corporate Environmental Information Disclosure. [J]. Economic Management, 2016, 38(3):168-180.

[16] Li Y, Li Z. Managerial Agency Behavior, Corporate Over investment, and Corporate Governance—An Empirical Study from the Perspective of Corporate Life Cycle. [J]. Management Review, 2012, 24(7):117-131.