Research on the Impact of ESG Performance on Corporate Risk Taking

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Abstract. This paper presents the findings of an empirical investigation into the relationship between improvements in ESG performance and the level of enterprise risk-taking. The analysis is based on a sample of Shanghai and Shenzhen A-share listed companies from 2010 to 2022. The results demonstrate that an enhancement in ESG performance markedly diminishes the extent of corporate risk-taking. The impact mechanism test illustrates that the advancement of ESG performance will curtail the executive's overconfidence, thereby impeding the enterprises risk-taking. In this context, the financing constraint exerts a "masking effect", whereby the inhibition effect of CEO overconfidence outweighs the promotion effect of financing constraints.

Keywords: ESG performance, enterprise risk-taking, financial constraint, CEO overconfidence.

1. Introduction

ESG encompasses three dimensions: the environment, society and corporate governance. It serves as an evaluation criterion for the sustainable development of enterprises. Despite a paucity of recent discourse on ESG in China, the concept itself is not novel. From the business ethics of the 1950s to the present-day concept of sustainable responsible investment, the notion of ESG has evolved in accordance with the advancements of the times. ESG is of benefit to both investors and companies themselves. ESG research is more focused on the link between ESG and financial performance, both domestically and internationally. However, the findings are inconsistent. The relationship between ESG and corporate financial performance is a topic of contention among scholars. Some posit a positive correlation, while others suggest a lack of correlation or even an independence between the two. In the early days of ESG research in China, scholars concentrated on the construction and application of index systems. Recently, however, research has demonstrated that ESG rating can reduce audit costs, enhance the performance of ESG, optimise the financial performance of enterprises and improve investment efficiency. Currently, there is a growing interest in ESG from the capital market, with an increasing number of listed companies proactively disclosing ESG reports. Consequently, ESG is poised to become a pivotal reference point for investment and financing activities. In this context, it is pertinent to inquire whether enhancing ESG performance can facilitate the acquisition of additional resources by enterprises. To what extent will the conduct of business managers be influenced when there is a high level of community concern about ESG performance? In light of the above, this paper adopts an enterprise risk-taking perspective, examining the economic consequences of high ESG performance from two dimensions: financing constraints and CEO overconfidence. This study has the following theoretical and practical implications: Firstly, as a relatively recent investment concept in China, there is a notable absence of academic research on the economic consequences of ESG. This study therefore represents a valuable contribution to the field, offering insights at the micro-level of ESG performance. Secondly, the question remains as to how different angles in capital markets will be affected by ESG. The focus of academic attention is ESG information. This study is based on the level of enterprise risk-taking. It considers the entry point from financing constraints and CEO overconfidence, as well as two dimensions of analysis of enterprises to improve ESG. The economic results of the performance of the capital market can be integrated into the same research framework at the same time, so as to analyse the capital market for enterprises. The third area of investigation is the response of ESG to changes in performance. It is

important to note that management is both the executive of the strategy and a beneficiary of ESG performance. This study can provide empirical evidence for management-related research.

2. Theoretical analysis and research hypothesis

The level of risk-taking represents the strategic choice of the enterprise and indicates the extent to which the enterprise is willing to take greater risks for higher returns. Existing research shows that high-risk companies invest more in research and development and have a higher enterprise value. However, enterprises to improve the level of risk-taking needs the support of many factors, this paper from the enterprise to improve the level of risk-taking financing constraints and CEO overconfidence two perspectives to analyse.

Based on the perspective of financing constraints, financing constraints mainly refers to the inability to obtain financing through the act of financing due to credit problems.

the funds needed to invest in desired projects. Robert et al (1994) in their early studies found that when a firm is faced with a shortage of funds and cannot meet its own investment needs at an acceptable cost of capital, in order to maintain the normal production and operation of the firm and increase the value of the firm, it usually chooses a sound financial strategy to use internal cash flow and funds to maintain production, and is forced to abandon investment projects with positive cash flow. However, according to scholars in later research, under the condition of imperfect capital market, when enterprises face financing constraints, in order to alleviate the financing constraints and realise the value of the enterprise, they usually choose high-risk and radical financial strategies to improve the efficiency of capital use. Enterprises may be more inclined to raise funds through other financing channels, resulting in an increase in the level of enterprise risk taking. Enterprises' risk choices in the investment financing decision-making process have an important impact on the development of enterprises and the growth of the economy, and a higher level of risk-taking means that enterprises make fuller use of investment opportunities and have higher capital expenditures. Improving ESG performance means that enterprises need to invest relevant resources, may not be conducive to mitigating the financing constraints of enterprises, therefore, enterprises to improve ESG performance will strengthen the financing constraints of enterprises, and thus improve the risk-taking level of enterprises.

From the perspective of CEO overconfidence, even if the firm has sufficient resources and high risk-taking ability, managers may still have risk-averse motivation due to consideration of their own career, maintenance of their own reputation, or due to personal personality traits, i.e. to protect their personal reputation and show low risk-taking willingness. Existing research shows that CEO overconfidence reduces the level of strategic risk-taking. As a result, higher ESG performance may mitigate CEO overconfidence and thus reduce the firms risk-taking.

In summary, if the facilitating effect of financing constraints is greater than the inhibiting effect of CEO overconfidence, then a firm's improved ESG performance will increase the level of corporate risk-taking; if the inhibiting effect of CEO overconfidence is greater than the facilitating effect of financing constraints, then a firm's improved ESG performance will reduce the level of corporate risk-taking. Therefore, this paper proposes the following competing hypotheses:

H1a: Improved ESG performance increases firm risk-taking.

H1b: Improved ESG performance reduces the level of corporate risk-taking.

H2: Firms improve ESG performance by increasing financing constraints to increase corporate risk-taking.

H3: Firms improve ESG performance by reducing CEO overconfidence to reduce firm risk taking.

3. Study design

3.1. Sample selection and data sources

This paper takes A-share listed companies from 1 January 2010 to 31 December 2022 as the research sample and processes them as follows: (1) financial enterprises are significantly different from general enterprises in terms of asset composition and risk characteristics, so they are eliminated; (2) ST and *ST enterprises are eliminated; (3) sample companies with missing data for the main variables are eliminated. To eliminate the impact of extreme values, the 1% quantile of the main continuous variables was trimmed.

The ESG rating data in this article come from the Wind Huazheng ESG database, and the indicators related to the level of corporate risk-taking and other financial data come from the CSMAR database.

3.2. Model construction and variable selection

This paper constructs the following model to test the relationship between ESG performance and the level of corporate risk-taking:

$$RiskTaking_{i,t} = \beta_0 + \beta_1 esg\_score_{i,t} + \beta_2 Controls_{i,t} + \varepsilon_{i,t}$$

3.2.1. Explained variable

Existing literature often uses performance measures such as earnings volatility and stock return volatility, while some scholars also use risk-taking behaviour in financial decisions such as capital expenditure, research and development expenditure and the frequency of mergers and acquisitions. Since the higher the risk-taking level, the more significant the fluctuation in corporate performance, and compared to decision-making behaviour, using the performance fluctuation index to measure the risk-taking level of a company is more comprehensive and objective, and the relevant data is also easier to obtain, and in addition, stock returns are susceptible to the influence of many factors in the capital market, therefore, drawing on the research of John and others, this paper uses the standard deviation of the company's return on total assets over the past three years to measure. To avoid the influence of industry factors, this paper first adjusts the ROA using the industry average to obtain AdjRoa. In the formula, X is the number of enterprises in the industry where the sample enterprise is located. The specific formula is as follows:

$$AdjRoa = \frac{EBIT}{Asset} - \frac{1}{X}\sum \frac{EBIT}{Asset}$$

$$RiskTaking = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(AdjRoa_{it} - \frac{1}{T}\sum_{t=1}^{T} AdjRoa_{it}\right)^2} \ (T = 3)$$

3.2.2. Explanatory variable

This article uses the environmental, social and governance ratings of the China Securities Index to measure the ESG performance of companies. The calculation of the China Securities ESG rating index is quantitative and evidence-based. Based on the development experience of foreign mainstream ESG systems and combined with the characteristics of the domestic market, a three-level indicator evaluation system has been constructed, which can integrate both traditional and alternative data, and comprehensively covers publicly disclosed data of listed banks, social responsibility reports, sustainable development reports, data from regulatory websites and news media reports. In terms of data updates, the China Securities ESG Indicators use a combination of regular quarterly evaluations and dynamic tracking to adjust data, which is highly timely. From a methodological perspective, environmental indicators are based on key factors such as banks' environmental management systems, environmentally certified products and environmental violations and incidents; social indicators are based on key factors such as poverty alleviation, quality of social responsibility reports and negative business incidents; and corporate governance indicators include key variables such as related party transactions, board independence, overall financial credibility and quality of information disclosure.

3.2.3. Mediating variable

First, this paper uses Whited and Wu (2006) constructed WW index model to calculate corporate financing constraints.

$$WW = -\frac{0.091CF_{it}}{A_{it}} - 0.062DIVPOS_{it} + 0.021LEV_{it} - 0.044SIZE_{it} + 0.1021IGROWTH_{it} - 0.035GROWTH_{it}$$

In the formula, CF is the operating cash flow, A is the total assets of the enterprise, DIVPOS is a dummy variable that takes the value 1 if the enterprise pays cash and 0 otherwise, LEV is the debt ratio of the enterprise, SIZE is the size of the enterprise measured by the logarithm of the total assets of the enterprise, IGROWTH is the average growth rate of operating income in the industry in which the enterprise is located, and GROWTH is the growth rate of operating income of the enterprise. The higher the WW index, the stronger the financing constraints of the firm.

Second, this paper draws on the research of KIM, SCHRAND and YU Minggui to infer the degree of overconfidence of CEOs from their investment and financing styles and personal characteristics. The specific measurement process is divided into two steps:

Step 1: Measuring the scores of the following five sub-dimensions:

① Overinvestment (Inv). Overconfident CEOs are more likely to overinvest, pay excessive fees and engage in mergers and acquisitions of projects with negative returns. If the company's inefficient investment level is in the top quartile of the industry, Inv is set to 1, otherwise it is set to 0.

② Equity ratio (Cq). Overconfident CEOs tend to prefer debt financing to equity financing and are more likely to use risky debt that is long term and does not require the payment of dividends. If the equity ratio is in the top quartile of the industry for the year, Cq is set to 1, otherwise it is set to 0.

③ Age (Age). As older CEOs have more knowledge and experience, they are better able to understand themselves and avoid risks. Therefore, younger CEOs are more likely to be overconfident. If the CEO is in the bottom quartile of the industry for the year, Age is set to 1, otherwise it is set to 0.

④ Education (Edu): In general, people with more education are more confident in their abilities and judgements and are more likely to be overconfident. Therefore, if the CEO has a bachelor's degree or higher, Edu is set to 1, otherwise it is set to 0.

⑤ Dual role (Dua): In general, if the CEO is also the chairman of the board, he will be more confident in his abilities and more likely to show overconfidence. Therefore, if the CEO is also the chairman of the board, Dua is set to 1, otherwise it is set to 0.

Step 2: Sum the scores of the above five sub-dimensions. If the total score is 3 or higher, the CEO is considered overconfident and the value is 1, otherwise the value is 0. The specific measurement formula is:

$$OC = \begin{cases} 1, & if\,(Inv + Cq + Age + Edu + Dua) \geq 3 \\ 0, & if\,(Inv + Cq + Age + Edu + Dua) < 3 \end{cases}$$

Among them, OC refers to the CEO's overconfidence.

3.2.4. Control variable

In order to gain a deeper understanding of the factors influencing the return on total assets (ROA), cash holding level (Cash), company size (Size), liquidity (Liq), tangible asset ratio (Tang), financing costs (Cost), executive compensation incentives (Salary), and board size (Board), existing research was consulted. Based on this research, these variables were selected as control variables. Furthermore, this paper controls for the fixed effects of year (Year) and industry (Ind).

4. Empirical results

4.1. Baseline regression results

Table 1. Benchmark model regression results

	(1)	(2)
VARIABLES	RiskTaking	RiskTaking
ESG	-0.0514***	-0.0424***
	(0.00737)	(0.00728)
ROA		-0.0696***
		(0.0182)
Cash		0.0112**
		(0.00488)
Size		-0.00292***
		(0.000795)
Liq		0.000227
		(0.000427)
Tang		-0.00452
		(0.00842)
Cost		-0.000868
		(0.000836)
Salary		0.00185**
		(0.000792)
Board		0.0113
		(0.00771)
Constant		0.276***
		(0.0348)
Industry FE	YES	YES
Year FE	YES	YES
Observations	11,640	11,640
Number of firms	900	900
R-square	0.3357	0.3357

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1 presents the regression results pertaining to the relationship between the level of corporate risk-taking and ESG performance. Column (1) does not include control variables, while column (2) includes control variables. The empirical results demonstrate that there is a negative correlation between ESG performance and the level of corporate risk-taking, and that this relationship is statistically significant at the 1% level, which supports Hypothesis H1b. The above regression indicates that there is a suppressive effect of improving ESG performance on the level of corporate risk-taking.

4.2. Based on ESG three sub-dimensions

Table 2. ESG 3 sub-dimension regression results

	(1)	(2)	(3)
VARIABLES	RiskTaking	RiskTaking	RiskTaking
E_score	-1.82e-05		
	(6.06e-05)		
S_score		-6.34e-05*	
		(3.58e-05)	
G_score			-0.000582***
			(8.69e-05)
ROA	-0.0741***	-0.0734***	-0.0675***
	(0.0184)	(0.0184)	(0.0180)
Cash	0.00983**	0.00987**	0.0133***
	(0.00488)	(0.00488)	(0.00493)
Size	-0.00362***	-0.00356***	-0.00310***
	(0.000835)	(0.000793)	(0.000775)
Liq	0.000145	0.000142	0.000333
	(0.000433)	(0.000432)	(0.000422)
Tang	-0.00465	-0.00503	-0.00364
	(0.00850)	(0.00848)	(0.00844)
Cost	-0.000863	-0.000859	-0.00108
	(0.000834)	(0.000833)	(0.000833)
Salary	0.00170**	0.00175**	0.00167**
	(0.000799)	(0.000794)	(0.000779)
Board	0.00747	0.00743	0.0163**
	(0.00766)	(0.00765)	(0.00789)
Constant	0.116***	0.117***	0.149***
	(0.0222)	(0.0223)	(0.0228)
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	11,640	11,640	11,640
Number of firms	900	900	900
R_square	0.3345	0.3341	0.3402

In order to examine the impact of the three different sub-dimensions of ESG on the level of corporate risk-taking, this paper replaces the core explanatory variables in the baseline model with the environmental score (E_score), the social responsibility score (S_score), and the corporate governance score (G_score), respectively. According to the regression results in Table 2, all three sub-dimensions have a negative effect on the level of corporate risk-taking, but the results of environmental and social responsibility scores are not significant, while the corporate governance score is negatively correlated with the level of corporate risk-taking at the 1% significance level. Thus, the overall dampening effect of ESG performance on the level of corporate risk-taking is mainly driven by corporate governance.

5. Mechanism testing

5.1. Financing constraints

Table 3. Regression results of the mediating effect of financing constraints

	(1)	(2)
VARIABLES	WW	RiskTaking
WW		0.0173***
		(0.00216)
ESG	0.0393***	-0.0414***
	(0.0137)	(0.00709)
ROA	-0.401***	-0.0647***
	(0.0339)	(0.0172)
Cash	-0.0238	0.0113**
	(0.0152)	(0.00495)
Size	-0.0503***	-0.00187***
	(0.00124)	(0.000637)
Liq	-0.000530	0.000261
	(0.00100)	(0.000416)
Tang	0.0143	-0.000741
	(0.0113)	(0.00751)
Cost	-0.00284	-9.51e-05
	(0.00206)	(0.000760)
Salary	-0.00221	0.00159**
	(0.00148)	(0.000731)
Board	0.0207	0.00783
	(0.0187)	(0.00728)
Constant	0.00317	0.266***
	(0.0562)	(0.0329)
Industry FE	YES	YES
Year FE	YES	YES
Observations	11640	11640
Number of firms	900	900

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The empirical results of the mechanism test from the perspective of financing constraints are shown in Table 5.1. In column (1) of Table 3, the regression coefficient of ESG is 0.0393, which is significant at the 1% level, indicating that the improvement of ESG performance of enterprises will enhance the financing constraints, and the mediating variable WW index is added in column (2), which is also significant at the 1% level, and the mediating effect is established. Meanwhile, analyzing the results of the benchmark regression, we find that the sign of the mediating effect is opposite to that of the main effect, so that the financing constraints play a "masking effect" in the process of this influence, and the hypothesis H2 is proved.

5.2. CEO overconfidence

Table 4. CEO overconfidence mediation effect regression results

	(1)	(2)
VARIABLES	OC	RiskTaking
OC		0.00294***
		(0.00113)
ESG	-0.226***	-0.0327***
	(0.0722)	(0.00552)
ROA	-0.346***	-0.0239
	(0.0986)	(0.0153)
Cash	-0.0256	0.0138***
	(0.0452)	(0.00456)
Size	0.00846	-0.00198***
	(0.00699)	(0.000465)
Liq	-0.0110***	0.000542
	(0.00267)	(0.000365)
Tang	-0.0335	-0.00636
	(0.0800)	(0.00646)
Cost	-0.000796	4.22e-05
	(0.0144)	(0.000753)
Salary	0.0158*	4.77e-05
	(0.00822)	(0.000582)
Board	-0.0852	0.00921
	(0.0800)	(0.00662)
Constant	0.813**	0.220***
	(0.336)	(0.0227)
Industry FE	YES	YES
Year FE	YES	YES
Observations	11640	11640
Number of firms	900	900

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The empirical results of the mechanism test from the perspective of CEO overconfidence are shown in Table 4. In column (1) of Table 5.2, the regression coefficient of ESG is -0.226, which is significant at 1% level, indicating that improving ESG performance of firms significantly reduces CEO overconfidence, and the mediating variable OC is added to column (2), which is significant at 1% level, so the mediating effect is established, and the hypothesis H3 is proved.

6. Robustness test

6.1. Missing variable

To address potential endogeneity issues arising from omitted variables, we further control for firm fixed effects in addition to the baseline regression controlling for industry and year fixed effects. The results are shown in Table 5. After controlling for firm fixed effects, ESG performance is negatively associated with the level of corporate risk-taking at the 1% significance level. The regression results after controlling for firm fixed effects are consistent with the baseline regression results.

Table 5. Control the fixed effects regression results of the enterprise

	(1)
VARIABLES	RiskTaking
ESG	-0.0418***
	(0.00873)
ROA	-0.0785***
	(0.0209)
Cash	0.0142**
	(0.00555)
Size	-0.00184
	(0.00344)
Liq	-0.000247
	(0.000541)
Tang	0.0126
	(0.0166)
Cost	-0.00163
	(0.00167)
Salary	0.00172
	(0.00117)
Board	0.0138
	(0.0106)
Constant	0.199**
	(0.0925)
Firm FE	YES
Year FE	YES
Observations	11,640
Number of firms	900
R-square	0.3564

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6.2. Propensity Score Matching

This paper uses the PSM (propensity score matching) method to control for endogeneity problems caused by sample selection bias. Firms with ESG scores in the top third of the sample each year serve as the experimental group, while the other firms belong to the control group. According to the logit regression results, firms with higher return on assets, larger size and higher proportion of tangible assets are more likely to have better ESG performance. All the control variables are significant at 1% statistical level and the direction of the coefficients is consistent with the expectation, which indicates that the selection of control variables for matching is reasonable.

Table 6. Logit regression results

ESG	coefficient	Std.err.	z	p> | z |
ROA	4.6342	0.4775	9.71	0.000
Cash	1.3797	0.1966	7.02	0.000
Size	0.3719	0.0193	19.22	0.000
Tang	0.9025	0.2802	3.22	0.001
Cost	0.2307	0.0590	3.91	0.000
Salary	0.3402	0.0305	11.15	0.000
Board	3.5117	0.3781	9.29	0.000
_con	-16.9414	0.5671	-29.87	0.000

Table 7. Average treatment effect result

Sample	Treated	Controls	Difference	S.E.	T-stat
Unmatched	0.02265	0.02763	-0.00498	0.00059	-8.51
ATT	0.02264	0.02628	-0.00364	0.00083	-4.38

Table 7 shows the results of the average treatment effect estimated using the nearest neighbour matching method. The empirical results show that companies with higher ESG performance suppress their risk taking. To ensure the reliability of the results, this paper also conducts a balance test on the variables matched by the nearest neighbour matching method. The high ESG performance group and the low ESG performance group had large standardised deviations before matching, but after matching, the standardised deviations of all control variables were significantly reduced. This shows that the propensity score matching method passed the balance test and that it effectively overcame the endogenous estimation bias by reducing the differences between the high ESG performance group and the low ESG performance group, which further validates the regression results of the benchmark model.

6.3. Substitution of explained variables

To further test the robustness of the empirical results, we replace the measure of the explained variable, the level of corporate risk-taking. We use cash flow volatility (RiskT2) to measure the level of corporate risk-taking. The standard deviation of the ratio of a company's net operating cash flow to total assets over the past three years (from year t-2 to year t) is used to represent cash flow volatility. The empirical results are shown in Table 8.

Table 8. Regression results after replacing the explained variable

	(1)
VARIABLES	RiskT2
ESG	-0.0169***
	(0.00643)
ROA	0.0419***
	(0.0115)
Cash	0.0110*
	(0.00657)
Size	-0.00378***
	(0.000741)
Liq	-0.000520
	(0.000505)
Tang	0.0123*
	(0.00698)
Cost	-0.000564
	(0.00143)
Salary	0.000586
	(0.000914)
Board	0.0246**
	(0.00988)
Constant	0.187***
	(0.0327)
Firm FE	YES
Year FE	YES
Observations	11,640
Number of firms	900
R-square	0.2579

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The empirical results show that ESG performance is negatively related to the level of corporate risk-taking at the 1% significance level. Therefore, the regression results of replacing the explanatory variables are consistent with the regression results of our benchmark model.

7. Summary

The principal findings of this study are as follows: firstly, enhancing an enterprise's ESG performance markedly diminishes its propensity to assume risk; secondly, the mechanism test indicates that improving an enterprise's ESG performance curtails its risk-taking behaviour by eroding the CEO's overconfidence, and that financing constraints exert a 'masking effect' in this process, whereby the CEO's overconfidence is more constrained than encouraged by financing constraints.

In light of the aforementioned findings, this paper puts forth the following recommendations: Firstly, it is recommended that enterprises implement sustainable development strategies proactively, integrating social sustainable development with their own sustainable operations. Furthermore, it is advised that they take the initiative to implement energy conservation initiatives, participate in environmental governance, prioritise the protection of consumer rights and interests, engage in charitable activities, and safeguard the rights and interests of employees. Secondly, enterprises should endeavour to cultivate robust relationships with a diverse array of stakeholders through the implementation of ESG strategies. This will facilitate the establishment of a favourable reputation and image, which in turn will lead to the enhancement of operational and managerial practices. This, in turn, will result in a reduction of financing costs and an improvement in resource utilisation efficiency. Thirdly, companies should implement improvements to their performance-based remuneration systems. On the one hand, ESG performance should be incorporated into the performance appraisal indicators for management, and the implementation of ESG strategies should be supervised. On the other hand, the risk strategy choices of management should be examined, and management should be reminded that they should not abandon development strategies with investment value in order to protect their personal reputation. Fourthly, third-party monitoring and evaluation agencies, such as the media, should employ scientific methodology to determine the relative weight of ESG performance in different evaluation systems related to the enterprise. It is imperative that ESG performance has a significant bearing on the overall evaluation of the enterprise, yet it should not be the sole determining factor. Fifth, the pertinent government departments must progressively implement a mandatory ESG information disclosure system, establish unified and scientific evaluation standards, and encourage disparate third-party rating agencies to issue ESG rating reports with their distinctive characteristics, thereby offering a spectrum of options for information consumers in the capital market.

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