The Impact of Environmental Performance on the Cost of Equity Capital: Evidence from Chinese Listed Companies in Heavy Pollution Industries[†]

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Abstract

This study aims to explore the evaluation level and evaluation model of environmental performance in China, and further investigate the impact of environmental performance, based on stakeholder theory, information asymmetry theory and the cost of equity capital in the principal-agent industry, as well as previous research. The sample was selected from 1,975 listed companies listed on the Shenzhen Stock Exchange and the Shanghai Stock Exchange from 2018 to 2022. The environmental performance data came from the E-value of ESG score in the Wind database. The PEG model is used to calculate the cost of equity capital of enterprises. It can be found that the environmental performance and equity capital cost of China's heavily polluting industries both show a U-shaped trend of first decreasing and then increasing. From the analysis of environmental performance data, it can be concluded that the current level and mode of environmental performance evaluation in China are still in a relatively early stage. The correlation between variables was tested by regression analysis, and the results showed that there was no significant correlation between environmental performance and equity capital cost in heavily polluting industries, and environmental performance had no significant impact on equity capital cost of enterprises. This study explores the relationship between environmental performance and the cost of equity capital, and puts forward some suggestions to improve environmental performance from different perspectives, and also provides some ideas for future scholars who want to conduct research in this field.

Keywords : Environmental performance, Cost of quity capital, Heavily polluting industries in China, Listed companies in China

Introduction

With the non-stop development of the world economy, people are increasingly able to realize the importance of sustainable development. China, as a large industrial country, is an important pillar of global sustainable development. China is committed to peaking its carbon emissions by 2030 and working towards carbon neutrality by 2060 (Sun et al., 2022). With the international community's growing interest in "peak emissions" and "carbon neutrality" ("dual carbon"), there are opportunities for environmental information disclosure and green sustainable development. In January 2015, China's new Environmental Protection Law (EPL), which has been described as the "toughest ever" in the country's history, came into force. For the first time, the law specifies the content and methods of environmental protection for heavily polluting enterprises (Liu et al., 2022). In 2023, the Chinese government introduced a series of policies for green development to promote the effective implementation of green development. Green development is an all-round and revolutionary change in the mode of production, life, way of thinking and values (Information Office of the State Council of the People's Republic of China, 2023). This also places high demands on China's heavy polluting industries and requires great efforts from companies in heavy polluting industries. Economic development and environmental protection represent the shared aspirations of people striving for a better life, and these 2 goals are not inherently contradictory. A noteworthy observation is the negative correlation between environmental performance and the cost of equity capital, indicating that investors exhibit a preference for industries that excel in environmental stewardship. This preference extends to

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industries that actively embrace low-carbon practices in their production and manufacturing processes. As China's heavy pollution industry faces stringent constraints imposed by the new environmental protection law, it becomes imperative to explore how these regulations impact the environmental performance of listed companies within this sector. This study will analyze and provide empirical evidence based on the environmental performance data of listed companies operating in heavily polluting industries in China. This study therefore focuses on 2 main questions,

1) Disclosure trend of environmental performance of Chinese listed companies in heavily polluting industries?

2) Does environmental performance effect cost of equity capital?

Environmental performance

The environmental performance of enterprises is a measure of the fulfilment of environmental responsibility, which is represented by the results of the efforts made by enterprises in the field of environmental governance and protection of the environment (Liang, 2022). At present, there are third-party assessment agencies in China to score enterprises on environmental governance and protection. Therefore, this study regards the results of the third-party assessment of corporate environmental governance as the environmental performance of enterprises.

Cost of equity capital

The cost of equity capital is a central theme in the finance and accounting literature, where the cost of equity equals the necessary rate of return or risk premium required by investors' perceptions of the firm's risk (Liu & Tian, 2022). That is, the cost of equity capital is the price that a firm needs to pay to shareholders when raising and using equity capital, and the rate of return that investors require when investing in a firm's equity.

Heavy pollution industry

According to the classification of "Guidelines for Disclosure of Environmental Information of Listed Companies" published by the Chinese Ministry of Environmental Protection on September 14, 2010, there are 16 industries classified as heavy polluting industries, namely metallurgy, iron and steel, coal, building materials, cement, chemical, electrolytic aluminum, paper, petrochemical, pharmaceutical, brewing, fermentation, thermal power, textile, tanning, and mineral mining (Wang et al., 2023).

Research theory
Stakeholder theory

In 1984, Freeman expanded this concept to include the idea that the overall interests of all stakeholders are interrelated with the development of the firm. The company cannot be limited by specific stakeholders and classifies them as shareholders, employees, market consumers, suppliers, society and government, who can influence the achievement of the company's organizational goals and who are also affected by the actions of the company in the process of achieving them (Freeman, 1984).

Information asymmetry theory

Information mismatch arises when sellers possess more insights about a product than buyers. This information asymmetry allows the knowledgeable party to exploit the market by imparting reliable data to the less-informed counterpart. Within a market-driven economy, disparities in information availability lead to advantageous positions for those well-informed, while leaving the less-informed at a disadvantage. Nevertheless, the market does provide signals that alleviate this imbalance to some extent. Muslim and Setiawan (2021) by studying how information asymmetry and equity structure affect the cost of equity capital, found that through Price asynchrony and trading volume induced by The information asymmetry induced by Price asynchrony and volume of transactions affects the cost of equity capital.

Principal-agent theory

Jensen and Meckling (1976) provided a clear definition of principal-agent theory and a clear delineation of agency costs. Principal-agent theory posits that principal-agent relationships emerged alongside significant leaps in productivity and large-scale mass production. This occurrence stems from 2 factors. Firstly, enhanced productivity led to a more intricate division of labor. Consequently, rights holders couldn't effectively wield all rights due to limitations in knowledge, skills, and energy. Secondly, the specialized division of labor yielded numerous proficient agents armed with specialized knowledge, energy, and ability to effectively exercise delegated rights on behalf of the principals.

Prior research and hypothesis development

Research on the topic of the impact of the environmental performance of enterprises on the cost of equity capital has been studied by many scholars. Li et al. (2018) studied the relationship between the quality of environmental information disclosure and the cost of equity capital in China's chemical industry from 2014 to 2017, collected the social responsibility reports of the enterprises, designed the relevant evaluation criteria for the evaluation of the enterprise's environmental performance, and concluded that the heavy polluting industries should pass the appropriate environmental information disclosure system to show the outside world the fulfilment of corporate social responsibility, and taking the initiative to make environmental information disclosure is a way to cope with the situation, which can reduce the cost of equity capital of the enterprise and make it easier to finance.

Yan et al. (2022) found that in China's new development stage of pursuing a balance between economic growth and environmental protection, re-examining the link between environmental performance and the cost of equity capital, established through the establishment of a mechanism for evaluating the quality of corporate environmental information disclosure, it can be found that there is no significant link between environmental performance and the firm's cost of equity capital, which suggests that institutional investors, although appreciating the environmental performance of heavily polluting firms, do not care much about it, whereas there is a significant link when the intensity of government regulation is introduced as a moderator, thus it can be shown that the environmental performance of the firms is contributing to the reduction of the cost of equity capital of the firms.

Sun et al. (2022) argue that high corporate environmental performance reduces the cost of financing, while good environmental performance promotes sustainable corporate development. The empirical study proves that corporate environmental performance is negatively related to financing costs. Taking sustainable development as a moderating variable, it is negatively related to financing cost, which attenuates the inhibitory effect of corporate environmental performance on financing cost.

Since creditors cannot directly participate in the business activities of enterprises, based on the principal-agent theory, the managers of enterprises are required to make positive behaviors to improve the quality of environmental information disclosure and thus obtain a higher environmental performance score. This information is transformed into a green image and reputation signal of the enterprise and transmitted to creditors, thus reducing the information asymmetry between creditors and enterprises. Based on the stakeholder theory, the overall interests of stakeholders will be affected by the relevant behaviors of the company. A positive corporate reputation means that the environmental risks faced by the company are low, and the accuracy of creditors in estimating the solvency of the company will also be improved, and the cost of debt capital of the company will be reduced to a certain extent. For enterprises with poor reputation, creditors tend to think that they face higher environmental risks. In order to ensure the safety of investment funds and recover the principal and interest in full at maturity, creditors will appropriately raise the borrowing interest rate, thus increasing the debt capital cost of enterprises. In this process, the government will also strengthen guidance and supervision. Guide enterprises to invest in enterprises with good environmental performance, so as to maximize the overall interests of stakeholders.

Based on the above theories and related literature, this paper proposes the hypothesis that the higher the firm's environmental performance, the lower the cost of equity capital under equal conditions.

H1: There is an effect of heavy polluting industries on environmental performance and cost of equity capital of Chinese listed companies.
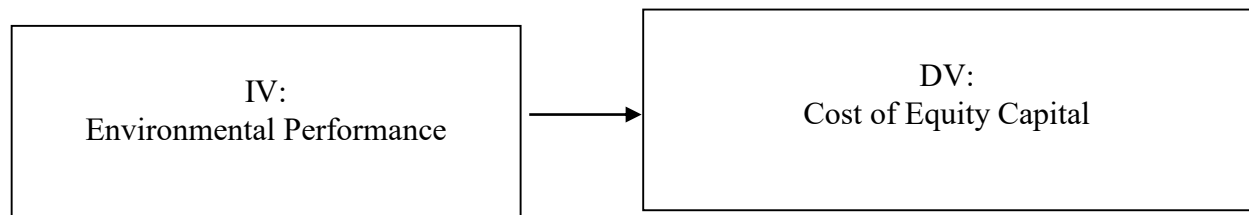
Conceptual framework

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┌─────────────────────────────┐              ┌─────────────────────────────┐
│             IV:             │─────────────▶│             DV:             │
│  Environmental Performance  │              │   Cost of Equity Capital    │
└─────────────────────────────┘              └─────────────────────────────┘
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Figure 1 Conceptual framework.

Methodology

Population and sampling

The population is A-share listed companies in heavily polluting industries in China, that is, companies in heavily polluting industries listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange at the same time. A-share is the stock market with the largest number of listed companies in China's stock market, and the information disclosure mechanism and supervision mechanism are unified, while the other stock markets have different disclosure mechanisms and settlement currencies. Therefore, only A-share listed companies are selected in this study. China's Ministry of Environmental Protection (MEP) defines 16 categories of industries as heavy polluting industries, including thermal power, iron and steel, cement, electrolytic aluminum, coal, metallurgy, chemical, petrochemical, building materials, paper, papermaking, fermentation, textile, tanning and mining. The total number of listed companies in Chin's heavy pollution industries initially screened from 2018 to 2022 is 2,970. Selected listed companies in related industries through CSMAR database, and then matched with Wind database ESG rating environmental dimension score (E value) data. To exclude Special Treatment (ST) companies marked by the stock market because of abnormal financial status or other conditions of the company, as well as *St companies and listed companies with incomplete relevant data, the calculation of such samples will lead to large deviations in the data. Finally, the number of samples that meet the conditions is selected. This study uses purposeful sampling technique as sample selection. The sample size of qualified listed companies finally collected in this study is 1975.

Independent variable: Environmental performance

The independent variable chosen for this study is the environmental performance of listed companies, which lacks the relative objectivity and standardisation of the individual ratings of the collected corporate environmental disclosures due to the large sample size and the long period of selection. With the increasing improvement of China's social responsibility disclosure information system, the credibility of corporate social responsibility disclosure information is becoming more and more reliable, and third-party organisations are becoming more and more reliable in evaluating environmental performance. Zhao and Huang (2022) analyzed the current situation of the development of Chinese A-share listed companies in relation to several ESG rating agencies in China, and mention that the Wind database ESG rating is based on listed companies' independent disclosure, government and regulatory authorities, and the ESG rating of listed companies. Li et al. (2023) found that the ESG rating of listed companies in China is more likely to affect the stock returns of non-manufacturing companies, non-state-owned enterprises and non-provincial city companies by using the data of Wind database.

Dependent variable: Cost of equity capital

The PEG model is one of the most commonly used methods of combining value and growth, and it can be used to identify stocks with low P/E ratios relative to earnings growth rates. It is usually expressed in a simplified way as the P/E ratio divided by the expected investment earnings growth rate. Easton (2004) proposed the PEG model based on the residual valuation model, which estimates the cost of equity capital

of a firm based on financial analysts' earnings forecasts and stock prices for the latter 2 periods. The formula of the model is expressed as follows:

$$R_{PEG} = \sqrt{\frac{EPS_2 - EPS_1}{P_0}}$$

R_{PEG} is the final calculated cost of equity capital, EPS1 and EPS2 are the average of financial analysts' forecasts of the company's earnings per share after 1 year and after 2 years; P0 is the stock price at the end of the year.

Control variables

He and Qu (2011) mentioned that China's securities market is not fully mature, most investors' investment behavior is irrational, and there is a small-cap effect in China's securities market. Small-cap effect refers to the fact that the return of investing in the stocks of large companies is lower than that of investing in the stocks of small companies, resulting in the stock price of large companies being undervalued by the market, resulting in a relatively low cost of equity capital for small companies. Peng and Qiao (2021) pointed out that financial risk has a positive impact on the cost of equity capital of enterprises, and verified that the empirical model of environmental performance affecting the cost of equity capital took financial risk into account. Li (2015) also shows that profitability is positively correlated with the cost of equity capital. Gebhardt et al. (2001) pointed out that due to the uncertainty of the company's future operation in the growth stage, investors face greater risks, so higher investment returns are needed to compensate for operational risks. Li (2011) studied the reliability of cost of equity capital estimation method based on Chinese capital market data and proved that total asset turnover was positively correlated with cost of equity capital.

Table 1 Variable measurements.

Variable	Explanatory note	Measure
Equity capital costs	R_{PEG}	Calculated from the PEG model
Environmental performance	EPI	An E value from the Wind Database ESG rating report on a scale of 0 to 10
Size of business	SIZE	Natural logarithm of the enterprise's total assets at the end of the period
Financial risks	LEV	Corporate gearing ratio
Profitability	ROA	Total net asset margin of the business
Growth capacity	GR	Growth rate of total assets of the enterprise
Operational capabilities	TURN	Total asset turnover of the business

Research model

Based on the above theoretical analyses and the research hypotheses proposed in this study, the computational model constructed in this study for the impact of environmental performance on the cost of equity capital in China's heavy pollution industries is as follows:

$$R_{PEG} = \alpha + \beta_1 EPI + \beta_2 SIZE + \beta_3 LEV + \beta_4 ROA + \beta_5 GR + \beta_6 TURN + \varepsilon$$

In the above equation, Re is the cost of equity capital, α is the constant term, β is the calculated regression coefficient, ε is the error term.

Results and discussion

Descriptive analysis

Table 2 presents a yearly overview of the main variables. In terms of sample size, the number of listed companies in the heavy pollution industry shows a gradual increase from 2018 to 2022. The environmental performance score shows a decreasing trend during these 5 years. The score ranges from a low of 0.02 to a high of 9.07 with a standard deviation of 1.979. These statistics show that there are significant differences in the environmental performance of different companies under the same conditions. The decline in the overall score of the heavy pollution industry is also due to the fact that China's concept of ESG started late and the number of companies has been increasing year by year, and many companies do not yet have a clear understanding of ESG performance, which has led to a lack of attention to ESG performance, resulting in a low level of overall ESG. In addition, China's economy has been affected by the 3-year epidemic, which also makes many enterprises have no more energy to pay attention to their own environmental performance, thus leading to a downward trend in the level of environmental performance.

In addition, the cost of equity capital of the company represented by the value of "Rpeg" shows a U-shaped trend in 5 years, but the overall level of the data fluctuates less, with a minimum value of 0.024 and a maximum value of 0.285. this shows that there is a large difference in the cost of equity capital between listed companies, and the fluctuation of the cost of equity capital appeared to be from the 20 years to start to turn from the impacts of the epidemic need to be companies to spend more on the cost of equity capital to attract investors to invest.

After the descriptive statistics for the main variables, the next step was to perform descriptive statistics for each control variable, see **Table 3** for detailed data.

Table 2 Description of the Environmental performance score and Rpeg.

EPI	Sample size	Mean	Standard Deviation	Maximum	Minimum
2018	298	2.996	1.778	8.650	0.180
2019	342	2.860	1.540	7.890	0.120
2020	383	2.873	1.624	7.880	0.330
2021	484	2.806	1.611	7.830	0.240
2022	468	2.502	1.979	9.070	0.020
Average		2.807	1.706	8.264	0.178
Rpeg	**Sample size**	**Mean**	**Standard Deviation**	**Maximum**	**Minimum**
2018	298	0.124	0.043	0.285	0.029
2019	342	0.109	0.039	0.228	0.024
2020	383	0.106	0.356	0.234	0.033
2021	484	0.111	0.037	0.228	0.029
2022	468	0.129	0.041	0.245	0.015
Average		0.116	0.103	0.244	0.026

Table 3 Descriptive statistics for control variables.

Variable name	Sample Size	Mean	Standard Deviation	Maximum	Minimum
SIZE	1975	23.129	1.410	28.636	20.181
LEV	1975	0.410	0.180	0.907	0.030
ROA	1975	0.068	0.066	0.644	−0.429
GR	1975	0.208	0.576	18.025	−0.429
TURN	1975	0.671	0.420	4.014	0.022
Average		4.897	0.530	10.446	3.875

Table 3 presents the descriptive statistics for the control variables. The variable "SIZE" which represents the natural logarithm of the total assets of the firm and is used as a measure of firm size, has a mean value of 23.129 and a standard deviation of 1.410. This indicates a significant variation in firm size within the selected sample.

The variable "LEV," representing the financial risk of the enterprises, has a mean value of 41 %. This suggests that the total liabilities of most companies in the sample did not exceed half of their total assets, indicating a relatively low overall financial risk.

Regarding profitability (ROA), the comparison companies have a mean value of 6.8 %. The maximum value observed is 64.4 %, while some companies show negative values. This indicates a substantial disparity in profitability among the sample companies.

The growth capability (GR) of the comparison companies has a mean value of 20.8 %. The maximum value observed is 18.025, and some companies show negative values. This indicates that the sample companies generally possess good growth capability, with many experiencing a period of rapid growth.

Lastly, the operational capability (TURN) of the sample companies has a mean value of 0.671 and a standard deviation of 0.420. This suggests a significant variation in operational capability among the companies.

Overall, the listed companies in heavily polluting industries demonstrate relatively favorable performance in the control variables.

Correlation analysis

In order to enhance the accuracy of the study's findings, this paper conducts correlation tests on the variables of interest before conducting the multiple regression analysis. The results of these tests are presented in **Table 4**.

Table 4 The correlation coefficients for variables of interest.

	Rpeg	EPI	SIZE	LEV	ROA	GR	TURN
Rpeg	1						
EPI	−0.04	1					
SIZE	−0.068**	0.227**	1				
LEV	0.127**	0.071**	0.536**	1			
ROA	−0.024	−0.036	−0.167**	−0.452**	1		
GR	0.01	−0.03	−0.045*	−0.018	0.177**	1	
TURN	−0.078**	0.056*	0.052*	0.118**	0.093**	−0.023	1

** Significant correlation at 0.01 level (two-tailed).

* Significant correlation at 0.05 level (two-tailed).

Table 4 shows the correlation matrix used to test for multicollinearity between 7 variables used in this study, including one dependent variable, 1 independent variable and 5 control variables. The correlation between a pair of variables should not exceed 0.7, with the highest Pearson correlation score of 0.536 between SIZE and LEV. In the sample of this study, Pearson correlation coefficient between EPI and Rpeg was calculated. The results show that the correlation coefficient between EPI and Rpeg is −0.04, and general E may be negatively correlated with Rpeg, but the results of the data test are in line with the expectations of the study, and this study found no significant correlation between EPI and Rpeg. The results of the Pearson correlation analysis show that the correlation between environmental performance (EPI) and the cost of equity capital (Rpeg) is not significant. This implies that the linear relationship between environmental performance (EPI) and cost of equity capital (Rpeg) in the sample is weak or non-existent. These results may indicate that there are other non-linear relationships between environmental performance

and the cost of equity capital, or that they are influenced by other factors. In addition, there may be other variables not considered or sample-specific factors that affect the relationship.

It is important to note that the lack of correlation does not mean that there is no relationship between the 2 variables, but rather that the linear relationship between them is not significant.

Regression analysis

In order to explore in depth, the correlation between the environmental performance of the firms and the cost of equity capital, this study conducted a regression analysis of the data using SPSS software. In the regression analysis, the cost of equity capital, which is calculated by the PEG model, also known as the Rpeg value of the firm, was used as the dependent variable. Also, the environmental performance of the company, also known as EPI value, was used as the independent variable. The company size, financial risk, profitability, growth capacity and operational capacity are introduced as control variables to conduct multiple regression analyses on the environmental performance and cost of equity capital of listed companies in China's heavy pollution industry, and the test results are shown in **Table 5** as follows:

Table 5 Results of multiple regression analysis.

Variable	Model A β coefficient	T(sig)	Model B β coefficient	T(sig)	Tolerances	VIF
α	0.118	69.924 (0.000)		13.226** (<0.001)		
EPI	−0.001	−1.78 (0.075)	−0.016	−0.689 (0.491)	0.941	1.063
SIZE			−0.191	−7.075** (<0.001)	0.667	1.5
LEV			0.246	8.317** (<0.001)	0.553	1.809
ROA			0.05	1.936 (0.053)	0.734	1.362
GR			−0.002	−0.107 (0.915)	0.957	1.045
TURN			0.055	2.447* (0.014)	0.952	1.05
R Square	0.002		0.048			
Adj. R Square	0.001		0.045			
F-value (sig)	3.167 (0.075)		16.482 (<0.001)			

** Significant correlation at 0.01 level (two-tailed).
* Significant correlation at 0.05 level (two-tailed).

Table 5 shows the results of the multiple regression analysis testing the effect of environmental performance on the cost of equity capital of the sample firms. As can be seen from **Table 5**, the maximum value of the variance inflation factor (VIF) of the regression model is 1.809, which is much less than 10, proving that there is no problem of multicollinearity between the variables. The paper continues to investigate the relationship between the explanatory variables and other variables, the environmental performance of the sample firms and the cost of equity capital is negative, but did not pass the test of significance. The model A is a regression equation analysis of the cost of equity capital of the firms using only EPI. The equation B is the regression equation analysis using the computational model designed in the

previous section taking into account all the control variables, and the data results show that the environmental performance of the sample firms has a certain effect on the cost of equity capital, and the better the environmental performance of the firms, the lower the cost of equity capital under certain conditions, but it cannot have a significant effect. This is not enough to support the hypothesis. Among the control variables, the coefficient of firm size is negative and significantly correlated, indicating that the larger the firm size, the lower the firm's cost of equity capital. The financial risk of the enterprise and the company's cost of equity capital show a positive correlation, indicating that when the company's financial risk is smaller, the company's cost of equity capital is lower, which also proves that investors are more willing to invest in companies with good financial condition. The correlation between the profitability and growth ability of the company and the cost of equity capital did not pass the significance test, indicating that the net interest rate on total assets and the growth rate of total assets do not make a significant difference to the cost of equity capital of the company. Whereas, the total asset turnover of the firm shows a significant positive correlation of 1 % with the cost of equity capital of the firm. In conclusion, the multiple regression results in **Table 5** do not support the validity of the hypotheses of this research.

Conclusions

This study analyses the relevant literature on the cost of equity capital, takes the listed companies in China's heavy pollution industry from 2018 - 2022 as the research sample, and empirically analyses the impact of corporate environmental performance on the cost of equity capital using SPSS software. The following conclusions have been drawn.

It is found that the environmental performance of enterprises has a negative but statistically insignificant impact on the cost of equity capital. This suggests that improvements in environmental performance may not significantly reduce a company's cost of equity capital. This study focuses on listed companies in heavily polluting industries, where environmental performance varies widely. From the point of view of principal-agent theory, it shows that managers pay different attention to environmental protection, which leads to the difference of environmental performance. Although some companies show poor environmental performance due to high production and related pollution, from the perspective of information asymmetry theory, the more comprehensive information investors have, the more conducive it is to make favorable decisions, such as mastering information such as enterprise management effectiveness and social impact, reducing information asymmetry, and thus investing in some enterprises with poor environmental performance. From the perspective of stakeholder theory, the current green development advocated by the Chinese government will influence heavily polluting industries to move towards low-carbon development for a period of time and lead investors to be more inclined to invest in environmental protection. Stakeholders can influence the realization of corporate organizational goals, thus enabling enterprises to take the initiative to improve environmental performance. Investors will also remain interested in companies with better environmental performance, but the specific investment situation will depend on the information available to investors and the performance of the company.

The reasons for the non-significant effect of environmental performance on the cost of equity capital can be derived from the conclusions drawn with reference to the following scholars. Atan et al. (2018) have previously conducted a study on the cost of capital of the company using the ESG score of the company as well as a single factor of the ESG, and the results of the study have found that the composite score of the ESG will have a significant impact, but individual factors of ESG do not significantly impact the firm's cost of capital. Marselita et al. (2021), in their study on the effect of environmental performance on the cost of equity capital of listed companies in Indonesia, also confirmed that the environmental performance of listed companies does not have a significant effect on their cost of equity capital. The reasons for the non-significance of environmental performance on the cost of equity capital may also be due to other aspects. By reviewing the previous references, it can be found that Yan et al. (2022) initially explored the relationship between environmental performance and corporate equity in Chinese enterprises and found that there was no significant relationship between the two. However, when regulatory quality was introduced as a moderating variable, environmental performance could effectively reduce the cost of equity capital. Therefore, there is no significant correlation between environmental performance and equity capital

cost in this study, and some effective conditional variables may be missing. In addition, during the 3 years from 2018 to 2022, the novel coronavirus epidemic occurred and China's economy was affected, which also made it difficult for companies to operate, and investors would consider their investment more carefully and comprehensively. Under the influence of Chin's political environment, investors will pay more attention to environmental performance in the future, and this hypothesis may show a significant relationship after the economic environment improves. These 2 factors may be the reason why environmental performance and cost of equity capital are not significantly affected in this study.

Practical implication and recommendations

Firstly, from the government's point of view, it is necessary to guide enterprises and the capital market to raise their awareness of environmental protection and advocate the development of a green economy. In the face of enterprises, the government can learn from the experience of developed countries, combined with the status quo of China's capital market, improve the relevant supervision regulations and legal provisions to establish a scientific and effective supervision system, to give enterprises the corresponding constraints and pressures, and then standardize corporate environmental performance systems. thereby improving the overall environmental performance level of the industry. In addition, most of the environmental performance in the current capital market relies on the disclosure of enterprises themselves and the assessment of third-party assessment agencies, the government can authorise the relevant auditing institutions to develop a unified assessment standards for the assessment of the environmental information disclosed by enterprises, thereby improving the credibility of environmental performance.

In the face of the capital market, the government should establish the concept of green investment in the whole market, advocate investors to make green investment, should be to investors to invest in high environmental performance of enterprises, promote the green development of the capital market, so as to promote the sustainable development of the economy.

Secondly, an analysis of the received data reveals that the average overall environmental performance score for listed companies in China's heavy pollution industry is 2.807, significantly lower than the maximum average score of 8.264. This indicates a lack of sufficient attention to environmental performance among these companies, resulting in subpar environmental performance overall. To address this issue, it is imperative for enterprises to regularly update their environmental information and enhance their focus on environmental performance. By doing so, not only can they contribute to the improvement of the overall ecological environment, but they can also enhance their social image, making them more appealing to investors. Therefore, enterprises should prioritize the disclosure of their environmental information and gradually establish a standardized disclosure system to improve their environmental performance. Currently, most listed companies in China disclose their environmental information through financial statements and social responsibility reports. However, only a few companies publish separate environmental reports, and there is a lack of clear regulations regarding the content and details of such disclosures. In practice, enterprises can also provide supplementary reports to complement the disclosure of environmental information. This approach proves to be effective and aids investors in making more comprehensive assessments of the environmental risks faced by the enterprise, enabling them to make informed investment decisions.

Finally, from an investor's perspective. Investors, as creditors of the enterprise, need to pay more attention to all aspects of the enterprise's performance, as well as to its environmental performance, for the benefit of all stakeholders. The performance assessed by the third party has a certain objectivity, which can help investors identify the risks faced by the enterprise more efficiently, thus allowing investors to make more reasonable decisions, not only to protect the safety of the funds, but also to obtain a certain amount of income, but also to safeguard the interests of the stakeholders of the light. Investors should also focus on enterprises with better environmental performance and exclude enterprises with poorer environmental performance when choosing investment targets. Other stakeholders should also raise the level of attention to the environmental performance of enterprises, objectively evaluate the environmental performance of enterprises, promote environmental protection knowledge to the public through a variety of channels, raise the overall environmental awareness of society, and actively fulfil their responsibility to protect the

environment.

Limitations of the study and suggestions for future research

This study conducted empirical research and analyzed relevant data from 2018 to 2022 in China's heavy pollution industry 2022, but due to my limited level of knowledge and the impact of relevant objective factors, this study has many shortcomings that need to be improved in the future research, as summarized below:

1) Sample selection, as this study selects listed companies in China's heavy pollution industry, most of the samples do not show a more satisfactory performance in terms of environmental performance, so the selection of the industry is relatively one-sided, which has a certain impact on the results of the study. If other scholars carry out this research, they can try to use a variety of industry samples to make a comprehensive comparison, so that the results may be more significant.

2) The choice of indicators for environmental performance, the E-value in the wind ESG evaluation chosen in this study to measure the environmental performance of the firm, although this is a relatively objective result evaluated by a third party, the individual factors of the firm's ESG performance are not very suitable for the measurement of the cost of equity capital. The reason for the results of the empirical analysis and the hypotheses are not valid is also due to the fact that the selected variable is the single factor in the ESG score of the company is not applicable to the analysis of the impact of the cost of equity capital.

3) Selection of control variables. The control variables selected in this study have relatively poor correlation with the dependent variable cost of equity capital, and there may be control variables that are more compatible with the model, so the selection of control variables between the correlation between environmental performance and cost of equity capital may be more complicated. In this study the 3 variables of enterprise size, financial risk, and operational capacity have a significant effect on the enterprise. Enterprise size is selected from the natural logarithm of total assets at the end of the financial statement period of the enterprise, when the higher the total assets of the enterprise, the lower the cost of equity capital of the enterprise, the size of the enterprise presents a significant negative correlation effect on the enterprise equity capital. Financial risk is selected from the enterprise's gearing ratio, the higher the enterprise's gearing ratio, the higher the risk of investing in the enterprise, so investors will be more cautious, the enterprise will also increase the cost of equity capital, financial risk has a significant positive correlation effect on equity capital, the higher the financial risk, the higher the cost of equity capital. The running ability of the enterprise is taken from the total asset turnover rate of the enterprise, the total asset turnover rate of the enterprise presents a positive correlation effect on the cost of equity capital to a certain extent, the higher the total asset turnover rate of the enterprise indicates that the enterprise's profitability is better, which also needs to give more dividends to the shareholders, which also raises the cost of equity capital of the enterprise, so the running ability of the enterprise plays a significant positive correlation effect on the cost of equity capital. On the basis of determining the correlation of variables, introducing control variables with higher correlation and significance, a more accurate model can be established for in-depth analysis and research.

4) The research model designed in this study is relatively simple, and the research on the impact of environmental performance on the cost of equity capital of enterprises needs to be further deepened.

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