A test based on mediating and moderating effect models - the effect of corporate environmental performance on idiosyncratic risk

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Abstract. With strong national advocacy and policy guidance, the coordination of economy and environment has become an issue that cannot be ignored nowadays. Proper understanding and handling of the relationship between economic development and environmental protection is conducive to promoting the high-quality development of China's economy and helping enterprises to take environmental benefits into account while pursuing economic benefits. In this context, based on multiple theoretical and empirical studies, this paper selects all A-share listed companies from 2011-2020 as the research object, constructs a multiple regression model with fixed industry and year, and innovatively explores the impact of corporate environmental performance on trait risk and its mechanism of action. The study shows that corporate environmental performance significantly reduces idiosyncratic risk, while corporate information quality mediates the relationship between the two, and media pressure positively moderates the relationship between corporate environmental performance and information disclosure quality. In addition, this paper also replaces the original explanatory variables with Chinese three-factor model regression residuals to estimate corporate idiosyncratic risk, and expands the explanatory variables to ESG to conduct robustness tests on all research hypotheses, which promotes the development of the investigation of the mechanism of ESG's influence on idiosyncratic risk. Based on the results of the above analysis, this paper is able to provide impetus for the improvement of the intrinsic environmental performance of companies and the external environmental concern coverage of media reports, and make marginal contributions to the promotion of high-quality economic development.

Keywords: Corporate governance, Corporate information quality, Idiosyncratic risk, Environmental performance, Three factors for China.

1. Introduction

Over the past 40 years of reform and opening up, China's economy has grown at a rapid pace and has made remarkable achievements. However, the rapid economic growth has also brought about many environmental problems, such as environmental pollution, which has become a serious obstacle to China's sustainable economic and social development. To effectively deal with environmental pollution problems, the Chinese government has taken comprehensive measures to improve environmental issues by starting with specific regulatory systems such as laws and regulations. The rapid growth of China's economy since the reform and opening up is also inseparable from the rapid development of China's capital market. However, enterprise-specific risk, which is often manifested as stock-specific risk, is one of the essential manifestations of the inefficiency of China's capital market. It is an individual risk that is triggered by firm-specific factors and corresponds to systemic risk. It weakens the price discovery and resource allocation function of the capital market, increases the financing cost of companies, and thus is not conducive to the stable development of the capital market.

With strong national advocacy and policy guidance, the coordination of economic development and the environment has become an issue that cannot be ignored nowadays. Proper understanding and handling of the relationship between economic growth and environmental protection is conducive to promoting the high-quality development of China's economy and enabling companies to consider

environmental benefits while pursuing economic benefits. Therefore, in the context of national green development and carbon neutral strategy, in order to make the capital market better serve the real economy, give fuller play to the function of resource allocation and price discovery, and achieve sustainable and high-quality economic development, it is of great practical significance to conduct an in-depth study on the relationship between the environmental performance of enterprises and the impact of trait risk and its mechanism of action.

On this basis, through a series of theoretical bases and empirical studies of related literature, this paper sorts out the possible influence direction and path of environmental performance on idiosyncratic risk and proposes four theoretical hypotheses for further empirical testing.

There are three main levels as to why data from China are selected for analysis in this paper.

First, from the macro status of China, which is the largest developing country today, the second largest economy in the world, and the country with the most complete range of industrial sectors in the world. The environmental performance of Chinese companies is well-documented and highly representative, which has a high reference value and significance for all countries in the world. At the same time, China is ushering in an era of great changes in the environmental protection system, and the environmental performance of enterprises can be said to be changing day by day, so the performance of the data also shows better time-series characteristics, which is also in line with the current background of energy conservation and emission reduction, so the environmental performance of Chinese enterprises is selected to have a higher value for the study of environmental governance issues of the times.

Moreover, from the perspective of China's market environment, compared with developed markets, the system of China's A-share market is not perfect and the investor structure is not mature enough, especially the majority of irrational individual investors in the A-share market [14]; compared with institutional investors, individual investors lack relevant professional knowledge and technology, which to a certain extent makes Chinese stock trait fluctuations more significant and does not lose its role as a trait general property of risk.

Finally, from the perspective of Chinese companies, which are more numerous and representative. There are currently more than 8,000 listed companies in China and, according to the new Fortune 500 list of the world's largest companies, the United States has 124 companies in the top 500, while China has 145 companies on the list this time, topping all countries in the number of large companies, which reflects the high number of Chinese companies and their higher share in the international scale. In addition, it is worth mentioning that China's reform and opening up has entered a deep period, and the reform of the corporate governance system is being carried out in a bold manner, and the governance model of Chinese companies is on par with the international first-class governance model, so the reference significance for countries around the world has been significantly enhanced, which can also be reflected in the data of corporate environmental performance and trait risk, coupled with China's huge economic scale and the number of enterprises This is also reflected in the data on corporate environmental performance and idiosyncratic risk, which, together with China's large economy and number of companies, provides a large sample size and allows for more accurate forecasting and analysis with worldwide reference.

Overall, this paper selects all A-share listed companies from 2011-2020 as the research sample, analyzes the impact of corporate environmental performance on idiosyncratic risk, and draws corresponding conclusions. In other words, the better the environmental performance of the company, the lower the trait risk of the company. The quality of information disclosure plays a mediating role between environmental performance and trait risk because environmental performance positively influences the quality of information disclosure, and when the quality of information disclosure is improved, the corporate environment will be more transparent, which will enhance investors' trust in the relevant companies and thus reduce the trait risk of companies. Meanwhile, media pressure plays a positive moderating role between corporate environmental performance and idiosyncratic risk, which enhances the negative relationship between corporate environmental performance and idiosyncratic risk.

As for the innovations of this paper, there are three main aspects.

First, this paper's enriches the research on ESG. However, most of the existing studies are focused on "ESG and corporate financial performance" and "ESG and cost of capital", and the studies are often conducted in one or two of the three ESG dimensions. However, there is still a lack of research on the relationship between ESG performance, "environmental performance" of ESG dimensions and enterprise characteristic risks. Due to the influence of foreign scholars, Chinese scholars' research on ESG is mostly based on foreign research results, and most of the research focuses on how to "build ESG evaluation system" and "improve ESG information disclosure". Meanwhile, a few scholars have studied the impact of corporate environmental performance on corporate environmental information disclosure, but few have fully investigated the effectiveness of "corporate ESG performance" and "corporate environmental performance" in corporate risk and their mechanisms of action. Moreover, there is no consensus on the effect of ESG performance on firm-specific risk, and the existence of the relationship between the two and the mechanism of their influence in China is still important to be further investigated. This paper explores the effects of environmental performance and corporate ESG on corporate trait risk, and enriches the research on ESG and corporate environmental performance.

Second, this paper innovatively selects mediating variables and moderating variables to enrich the study of corporate trait risk. There are many studies on enterprise characteristic risk at home and abroad, and there are many studies on the specific factors and mechanisms affecting enterprise characteristic risk, but there are few studies on the influence of corporate environmental performance on enterprise characteristic risk and the specific effects of corporate environmental performance on enterprise characteristic risk. In this paper, we innovatively use corporate environmental performance as a mediating variable between corporate environmental performance and corporate trait risk, and use media pressure as a moderating variable between corporate environmental performance and corporate information disclosure quality. This paper enriches the research theory of trait risk, deepens the understanding of the specific formation process of trait risk, and improves the understanding of the deep influence mechanism between corporate environmental performance and corporate trait risk.

Finally, this paper contributes theoretical innovation at the level of practical value. In the context of green development and carbon neutral strategies, the relationship between economic growth and environmental protection is an issue that is difficult to ignore, especially for many developing countries. Specifically, the question of whether a company's performance at the environmental level affects its financing costs in the capital market and thus allows for effective development is a pressing issue in the context of quality economic development. However, environmental interests are complex, and companies have not yet developed a clear understanding of whether environmental protection can contribute to their own sustainable development. In this paper, we find that improving the environmental performance of a company can significantly reduce its idiosyncratic risk, and we analyze and test the mechanism of its effect. The empirical findings provide an intrinsic motivation for companies to maintain their environmental performance and help them to reduce their financing costs while actively balancing environmental benefits, thus improving the efficiency of the capital market and promoting the sustainable and high-quality development of China's economy and the new normal development.

2. Literature Review and Research Hypotheses

There are many related studies on the role of environmental performance and trait risk at home and abroad. There have been many studies on the specific factors affecting the environmental performance of enterprises in China, such as environmental policy (Long et al., 2018) [1] , external pressure (Zhao and Cheng, 2019) [2] , corporate environmental information disclosure (Zhou and Liu , 2021) [3] . There are also some studies on the impact of corporate environmental performance on the economy in China, such as financing costs of heavily polluting enterprises (Lv, 2020) [4] , etc.In addition,Zhou (2021) [5] and others studied how bond idiosyncratic risk affects credit spreads, and Lu (2021) [14] and others looked at the effect of firm innovation inputs on idiosyncratic equity

risk, etc., indicating that studying both environmental performance and idiosyncratic risk is of great practical importance.

However, there is a lack of research on the causal relationship and pathways between environmental performance and trait risk at home and abroad, and there is a recent trend to start research on the impact relations between the two. The ESG investment concept system is also often used to refer to ethical investment, responsible investment, green finance and other concepts which are more consistent with the environmental performance dimension. Li (2022) [6] studied the impact of ESG performance on corporate trait risk and found that ESG performance negatively affects corporate trait risk but did not indicate the path of action of both; Ashwin et al. (2016) [7] found that the stock returns of companies incorporating ESG factors were less volatile compared to their competitors in the same industry; some scholars studied the impact of ESG on performance from the external stakeholder perspective on the impact of ESG on performance, Robert et al. (2014) [8] note that because highly sustainable companies value long-term growth, they are more likely to attract long-term investors.

From a theoretical basis perspective, based on an economic theory perspective, voluntary disclosure theory suggests that firms with good environmental performance have more incentives to improve disclosure in order to differentiate themselves from firms with poor environmental performance and that there is a positive relationship between corporate environmental performance and information disclosure. And the improvement of information disclosure quality will help investors to form a consistent opinion by correctly assessing the environmental and sustainability values of the company, and in turn, the corporate environmental performance has a negative impact on idiosyncratic risk through the improvement of information quality.

However, from the perspective of empirical studies, the findings are divergent. The following empirical findings appear contradictory: there is a negative relationship between environmental performance and environmental information disclosure (Cho and Patten, 2007) [9], a positive relationship (Clarkson et al., 2008) [10], no relationship (Wiseman, 1982) [11] and a U-shaped relationship (Shen et al., 2014) [12], one reason being that the existing literature adopted different environmental information disclosure index systems. While Zhu (2019) [13] et al. studied the impact of corporate environmental performance on disclosure quality by distinguishing between substantive and selective environmental aspects of the disclosure and designed an indicator system for environmental disclosure quality by means of content analysis method and scoring and concluded that there is a positive relationship between the two, while environmental regulation, which is the main source of external pressure, strengthens the environmental performance and environmental disclosure The relationship between environmental performance and environmental information disclosure quality was strengthened by environmental regulation as the main source of external pressure. Lu et al. (2021) [14] studied the impact of firm innovation inputs on idiosyncratic stock risk, which also showed that the information mediation role of analysts could reduce the positive impact of innovation inputs on investors' heterogeneous beliefs and thus negatively regulate the positive relationship between innovation inputs and stock idiosyncratic risk. Based on the above theoretical basis and empirical evidence, hypotheses H1, H2,H3 are proposed.

H1: The better the firm's environmental performance, the lower the firm's idiosyncratic risk.

H2: Corporate environmental performance positively affects the quality of information disclosure.

H3: Corporate disclosure quality plays a mediating role between environmental performance and trait risk.

As for the explanation of media pressure, Dyck A et al. (2008) [15]believe that media attention has a positive effect on the supervision and regulation of corporate business behavior. This is because media reports on the social management behavior of enterprises will increase people's attention to enterprises. Therefore, based on multiple factors such as reputation management and legitimacy principle, enterprises have full motivation to respond positively to media attention. Liu and Wu (2021)[16] took the impact of analysts' attention on enterprise idiosyncratic risk as the starting point. They believe that the improvement of analyst attention can improve the information transparency of

enterprises, and the improvement of information transparency will reduce the company's idiosyncratic risk, which also indicates that the information transparency plays a moderating role between the analyst attention and the company's idiosyncratic risk. Ying et al. (2018) [17]. proposed that media reports on corporate environmental performance would deepen investors' understanding of corporate environmental performance and enhance investors' rational understanding of the enterprise, thus affecting the idiosynagic risks of the enterprise. Therefore, it is concluded that media pressure plays an important moderating effect on the relationship between corporate environmental performance score and corporate idiosyncratic risk. Based on the above theoretical basis and empirical research results, hypothesis H4 is put forward:

H4: Media pressure strengthens the negative relationship between corporate environmental performance and idiosyncratic risk.

3. Research Design

3.1. Theoretical model

As shown in Figure 1, in exploring the influence of corporate environmental performance on trait risk, combining a series of theoretical foundations, environmental performance is taken as the explanatory variable; trait risk is taken as the explanatory variable, corporate disclosure quality is taken as the mediating variable between environmental performance and trait risk, and media coverage pressure faced by the company is taken as the moderating variable to positively adjust the relationship between corporate environmental performance and trait risk through the mediating variable of information disclosure quality. The relationship between environmental performance and idiosyncratic risk is positively changed by the mediating variable of disclosure quality.

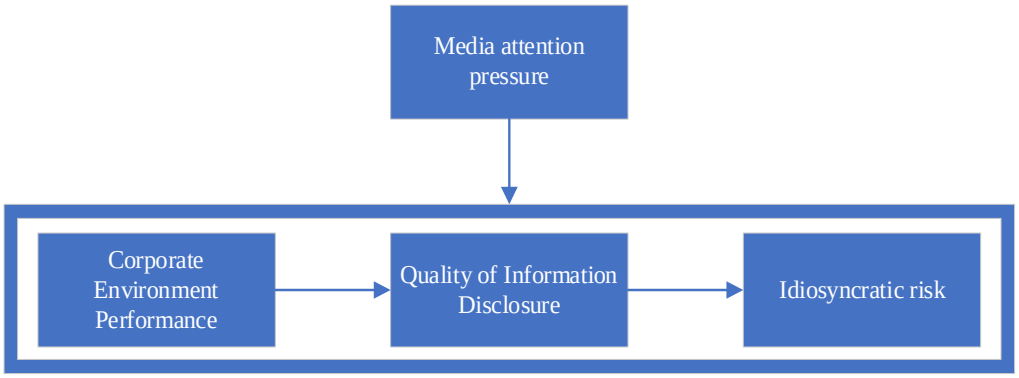

Figure 1. Theoretical model of firm innovation inputs and stock idiosyncratic risk

3.2. Variable definition and data source

In this paper, all A-share listed companies from 2011-2020 are selected as research objects, and the data are processed as follows: firstly, financial companies are excluded; secondly, the samples of companies whose stock codes are identified as ST and PT are excluded; thirdly, to reduce the influence of outliers, all micro-level continuous variables are subject to 1% and 99% tailoring in this paper. The raw data are obtained from the Cathay Capital database (CSMAR) and Bloomberg database, among others. For each variable, the selection is specified as follows, and the variables are defined as shown in Table 1.

(1) Explanatory variables

Firm-specific risk (Idiosyn_risk), also known as unsystematic risk, is distinguished from systematic risk, which is a risk that is closely related to the firm's financial position, governance structure, and other internal and external factors, such as industrial development and social dynamics. Referring to Bernie et al. (2018) [18] approach, the annual standard deviation of daily individual stock returns is used as the firm's total risk-taking (Total_risk), and the coefficient obtained from the market model regression of daily individual stock returns on the composite daily market returns is the firm's systemic

risk-taking (System_risk), and the residual standard deviation of the regression model yields the idiosyncrasy of the firm. The above three risk indicators are annualized by multiplying the results by 250 and then taking the logarithm of the results, referring to the practice of Bernie et. The specific calculation formula is as follows:

$$\text{Total\_risk}_{i,t} = \ln(250 * \sqrt{\text{var}(R_{i,d})} \quad (1)$$

Market regression model, the daily return of individual stocks on the market return regression:

$$R_{i,d} = \propto_i + \beta_i R_{m,d} + \varepsilon_{i,t} \quad (2)$$

Systematic risk-taking and idiosyncratic risk-taking are then obtained from the market regression results.

$$\text{System\_risk}_{i,t} = \ln(250 * \beta_i) \quad (3)$$

$$\text{Idiosyn\_risk}_{i,t} = \ln(250 * \sqrt{\text{var}(\epsilon_{i,t})} \quad (4)$$

Among them, $R_{i,d}$ is the daily stock return rate of stock i on the d day of t year considering cash dividend reinvestment, and $R_{m,d}$ is the comprehensive daily market return rate calculated on the d day of t year by using the weighted average method of circulating market value considering cash dividend reinvestment.

(2) Explanatory variables

In this paper, we use the environmental score (ENVIRON_SCORE) in the ESG performance sub-score to measure the environmental performance of companies. Environmental performance includes climate change, natural resources, pollution and consumption, and environmental governance opportunities. The higher the ENVIRON_SCORE score, the better the environmental performance of the company.

(3) Mediating variables

In this paper, KV robustness is used as a mediating variable. The KV index reflects market information, which is equivalent to an objective evaluation of investors about information asymmetry. The basic principle of the KV metric is that if the quality of information disclosure of listed companies is high, the stock return of investors is less dependent on their stock trading volume [23]. While the KV robustness index can be used for robustness testing, there are different criteria for the expansion multiples of the KV index in the calculation method. A higher KV robustness represents a lower disclosure quality.

(4) Moderating variables

In this paper, the total number of news about the company whose content appears is used to measure the external pressure of the company to bear the media, which is noted as Media_Force. Regarding the explanation of media pressure: According to Huang [19], media attention helps to monitor and regulate the company's business behavior. This is because the media reports on the behavior of the company's social operations, thus increasing the attention of the company. Therefore, based on multiple considerations such as legitimacy and reputation management, companies have a strong incentive to respond positively to media attention. The total number of news items in which the company appears in the content (N_News) is logarithmically processed as a measure of media pressure. The specific calculation formula is as follows:

$$\text{Media\_Force} = \ln(\text{N\_News} + 1) \quad (5)$$

(5) Control variables

To ensure the accuracy of the research results, the control variables selected in this paper include: size (Size), age of listing (ListAge), return on total assets (ROA), total asset turnover (ATO), fixed asset investment ratio (FIXED), Tobin's Q (TobinQ), shareholding of the first largest shareholder (Top1), equity checks and balances (Balence1), FirmAge, Occupy, and Dual.

Table 1. Definition of variables

Type	Name	Variable Symbol	Description
Dependent variable	Idiosyncratic Risk	Idiosyn_risk	The method was calculated using daily data with reference to Bernile et al.
Independent variable	Environmental Performance	ENVIRON_SCORE	Sub-indicators of E in ESG.
Intermediate variables	Quality of Information Disclosure	KV_Rob	Reflects market information and corresponds to an objective evaluation by investors regarding the degree of information asymmetry.
Adjustment variables	Media Pressure	Media_Force	The natural logarithm of the total number of news items in which the company appears in the content.
Control variables	Size	Size	The natural logarithm of the total assets for the year.
	Age of listing	ListAge	The natural logarithm of the number of years on the market.
	Return on Total Assets	ROA	Net profit / average balance of total assets.
	Total assets turnover ratio	ATO	Operating income / average total assets.
	Year of company establishment	FirmAge	The natural logarithm of the number of years of establishment.
	Percentage of fixed asset investment	FIXED	The ratio of net fixed assets to total assets.
	Tobin's Q value	TobinQ	The ratio of the market value of capital to its replacement cost.
	Percentage of shareholding of the largest shareholder	Top1	Number of shares held by the first largest shareholder / total number of shares.
	Degree of shareholding checks and balances	Balence1	The sum of the second to fifth largest shareholders relative to the shareholding of the first largest shareholder.
	Percentage of capital of major shareholders	Occupy	Other receivables divided by total assets.
	The integration of two positions	Dual	Whether the president and general manager are one person.

3.3. Model setting

This paper uses an econometric model that regresses corporate environmental performance on current corporate stock idiosyncratic risk and controls for both time fixed effects and industry fixed effects to test a total of four hypotheses, which can be divided into three steps as follows.

In the first step, hypothesis 1 is tested and the model is constructed as follows:

$$\text{Idiosyn\_risk}_{i,t} = \alpha_1 + \beta_1 \text{ENVIRON\_SCORE}_{i,t} + \sum \text{Controls} + \text{Industry}_i + \text{Year}_t + \varepsilon_{i,t} \quad (6)$$

Among them, $\text{Idiosyn\_risk}_{i,t}$ and $\text{ENVIRON\_SCORE}_{i,t}$ respectively represent the idiosyncratic risk and environmental performance of company i in year t, Controls is each control variable, Industry and Year denote the time-invariant industry fixed effects and the time-invariant firm fixed effects, respectively, and $\varepsilon_{i,t}$ is the error term. If β_1 is significantly positive, it indicates that environmental indicators are negatively correlated with stock idiosyncratic risk, and hypothesis 1 is verified.

In the second step, hypothesis 2 and hypothesis 3 are tested, and the model is constructed as follows:

$$\text{KV\_Rob}_{i,t} = \alpha_2 + \beta_2 \text{ENVIRON\_SCORE}_{i,t} + \sum \text{Controls} + \text{Industry}_i + \text{Year}_t + \varepsilon_{i,t} \quad (7)$$

In this paper, we draw on the one-step method of Shi (2021) [20] to test for mediating effects. In which, the explanatory variable, that is, the quality of information disclosure, is measured by KV robustness (KV_Rob) and the explanatory variable is corporate environmental performance (ENVIRON_SCORE). If β_2 is significant and negative, it shows that enterprise environmental performance negatively affects KV robustness, that is, enterprise environmental performance positively affects the quality of information disclosure, then hypothesis 2 and 3 can be verified.

In the third step, hypothesis test 4, the model is constructed as follows:

$$\text{Idiosyn\_risk}_{i,t} = \alpha_3 + \beta_3 \text{ENVIRON\_SCORE}_{i,t} + \beta_4 \text{Media\_Force}_{i,t} + \beta_5 \text{Interact}_{i,t} + \sum \text{Controls} + \text{Industry}_i + \text{Year}_t + \varepsilon_{i,t} \quad (8)$$

The interaction term Interact is $\text{Media\_Force} * \text{ENVIRON\_SCORE}$. Provided that β_3 is significant and negative, if β_5 is significant and positive or insignificant, the hypothesis can be verified as not valid. If β_5 is significant and negative, it indicates that media pressure enhances the correlation between corporate environmental performance and the idiosyncratic risk of corporate stocks, then hypothesis 4 is verified to be valid.

4. Empirical Results and Analysis

4.1. Descriptive statistics

Firstly, this paper makes a descriptive statistical analysis of 76400 sample data, and the results are shown in table 2.

The maximum value of idiosyn risk in the sample companies is 6.461, and the minimum value is 0.285. The listed companies with higher idiosyn risk and lower idiosyn risk are included. The sample is selected as the research object for discussion, and the results are representative. The maximum value of ENVIRON_SCORE is 65.625, the minimum value is 0.775, and the average value is 11.047, indicating that the environmental performance of A-share listed companies is quite different, and the overall environmental performance is not particularly good ; thus, corporate environmental performance needs to be further improved.

Table 2. Descriptive statistics by variable

Variable	Sample size	Mean standard	Minimum	Maximum	Value
Idiosyn risk	76400	1.625	0.349	0.285	6.461
ENVIRON_SCORE	65412	11.047	8.069	0.775	65.625
Size	76400	23.119	1.29	19.552	26.398
ROA	76400	0.045	0.062	-0.398	0.244
ATO	76400	0.669	0.464	0.053	2.902
FIXED	76400	0.23	0.179	0.002	0.725
Dual	76400	0.199	0.399	0	1
Top1	76400	0.369	0.159	0.083	0.758
Balance1	76392	0.333	0.286	0.006	1
TobinQ	75160	1.892	1.287	0.802	17.729
ListAge	76400	2.501	0.596	0.693	3.332
FirmAge	76400	2.905	0.336	1.386	3.555
Occupy	76384	0.016	0.024	0	0.202

4.2. Analysis of regression results

Table 3 shows the regression results of model (6). It can be seen that the regression coefficient of environmental performance (ENVIRON_SCORE) to stock Idiosyn_risk is -0.005, which indicates that environmental performance is negatively correlated with stock Idiosyn _ risk, and is significant at the 1% level, indicating that the environmental performance index significantly negatively affects the Idiosyn_risk of stocks.

The regression results of control variables show that for stocks with lower ENVIRON_SCORE, smaller size (SIZE), lower return on total assets (ROA), younger listing age (ListAge), higher return on total assets (ROA), higher Tobin's Q value (TobinQ), and higher dual value, the risk of idiosyncratic volatility is higher.

4.3. Mediation effect test

Table 3 also shows the regression results of model (7). The regression results of table 3 show that the regression coefficient of enterprise environmental performance (ENVIRON_SCORE) to KV robustness is -0.001, and it is significant at the 5% level, indicating that enterprise environmental performance negatively affects KV robustness, that is, enterprise environmental performance positively affects the quality of enterprise information disclosure, and it is significant,which verifies hypothesis 2 and hypothesis 3 of this paper.

4.4. Test of moderating effect

Through the regression results of table 3, it can be seen that β_3 is significant and negative, which indicates that there is a negative correlation between ENVIRON_SCORE and Idiosyn_risk. The coefficient β_5 of the interaction term is significant and negative, which indicates that media pressure enhances the negative correlation between corporate environmental performance ENVIRON_SCORE and corporate trait risk Idiosyn_risk, thus verifying hypothesis 4.

Table 3. Empirical testing

VARIABLES	(1) Idiosyn_risk	(2) KV_Rob	(3) Idiosyn_risk
ENVIRON_SCORE	-0.013***	-0.001**	-0.018***
	(-10.390)	(-2.430)	(-13.751)
Media_Rob			0.097***
			(38.033)
Interact			-0.008***
			(-9.277)
Size	-0.060***	-0.023***	-0.102***
	(-58.558)	(-63.580)	(-86.694)
ROA	-0.487***	0.249***	-0.525***
	(-27.282)	(39.760)	(-30.262)
ATO	0.043***	0.003***	0.036***
	(17.454)	(3.701)	(14.970)
FIXED	-0.011	-0.050***	-0.010
	(-1.597)	(-20.730)	(-1.525)
Dual	0.027***	-0.001	0.017***
	(10.715)	(-1.085)	(7.084)
Top1	0.028***	0.161***	0.066***
	(3.217)	(52.829)	(7.768)
Balance1	0.056***	0.053***	0.052***
	(12.263)	(33.451)	(11.889)
TobinQ	0.045***	-0.001	0.028***
	(47.073)	(-1.510)	(29.763)
ListAge	-0.037***	-0.040***	-0.031***
	(-15.706)	(-47.765)	(-13.431)
FirmAge	0.030***	0.035***	0.027***
	(7.047)	(23.822)	(6.605)
Occupy	0.463***	-0.085***	0.312***
	(10.469)	(-5.487)	(7.255)
Constant	2.826***	0.512***	3.240***
	(110.056)	(56.920)	(110.550)
Observations	75,136	75,136	75,136
R-squared	0.432	0.269	0.465
Year FE	YES	YES	YES
Industry FE	YES	YES	YES

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Robustness test

5.1. Measuring idiosyncratic risk with the Chinese three-factor model

In addition to using the residual standard deviation of the regression model to obtain the idiosyncratic risk calculation method used by the enterprise's idiosyncratic risk-taking, this paper also uses the Chinese three-factor model proposed by Liu et al. (2019) [21] to estimate the idiosyncratic risk more effectively and innovatively.

Liu believes that the IPO supervision mechanism in China's A-share market has caused the asset pricing effect of the Fama-French three-factor model to be destroyed. As Liu said, the three-factor model can explain the cross-sectional anomalies of most of the returns in China's A-share market. The standard deviation of the residuals of the Chinese three-factor model regression is used as an indicator of idiosyncratic risk, denoted as Irisk, and the explained variable is replaced for re-estimation. From the first column of Table 4, it can be found that the coefficient of determination decreases after the explained variable is replaced. The reason may be that the Chinese three-factor regression model itself already contains the effect of environmental performance on idiosyncratic risk in most of the original regression residuals, so the explanatory part of the environmental performance regression model in the residual part will be reduced. However, from the perspective of significance, corporate environmental performance still significantly negatively affects trait risk, and the conclusion is still robust.

5.2. Adding missing variables to supplement five control variables

BM effect refers to the book-to-market effect (2014) [22]. It means that the average monthly return of companies with higher BM values is higher than that of companies with lower BM values, so there may be a problem with missing variables. The monthly average excess turnover rate Return, audit opinion, whether it is a state-owned enterprise SOE, the proportion of independent directors Indep is the same. In order to alleviate this problem, this paper adds five control variables to the original regression model and re-estimates them. The second column of Table 4 shows the significant situation after the addition. After alleviating the problem of missing variables, environmental performance still significantly negatively affects the idiosyncratic risk of enterprises, supporting the robustness of the conclusion.

5.3. Expanding the range of explanatory variables from E to ESG and retesting all hypotheses

ESG is a proper noun for responsible investment. It is the abbreviation of the first letter of three English words, namely, Environment, Social and Governance. ESG is an important criterion to measure whether listed companies have sufficient social responsibility. It is an important performance indicator in the era of global economic pursuit of high-quality growth and sustainable development. It can affect the investment decision-making process of enterprise management and investors from the perspective of the environment, society and corporate governance. It is the same as the impact mechanism of environmental performance and can reflect the high quality and sustainable development of enterprises from a broader perspective.

After replacing the explanatory variables, all the hypotheses of the model were retested. Table 4 shows the estimation results of the model test using the enterprise ESG score as the explanatory variable. The results show that after replacing the explanatory variable, the regression model, the mediating effect and the moderating effect are tested in turn, and the performance is still significant. The conclusion is still robust, and it is proved that the impact of ESG on trait risk has the same path.

Table 4. Robustness test

VARIABLES	(1) Irisk	(2) Idiosyn_risk	(3) Idiosyn_risk	(4) KV_Rob	(5) Idiosyn_risk
ENVIRON_SCORE	-0.001***	-0.014***			
	(-4.273)	(-11.383)			
ESG_SCORE			-0.011***	-0.001***	-0.014***
			(-9.575)	(-2.729)	(-12.686)
Interact11					-0.007***
					(-9.553)
Media_Force					0.097***
					(38.184)
Size	0.001***	-0.036***	-0.060***	-0.023***	-0.103***
	(2.816)	(-32.111)	(-59.122)	(-63.723)	(-87.127)
ROA	-0.060***	-0.607***	-0.487***	0.249***	-0.525***
	(-13.631)	(-34.365)	(-27.298)	(39.758)	(-30.289)
ATO	0.003***	0.039***	0.043***	0.003***	0.036***
	(4.809)	(16.955)	(17.396)	(3.712)	(14.900)
FIXED	0.013***	0.011	-0.011	-0.050***	-0.010
	(7.284)	(1.635)	(-1.608)	(-20.721)	(-1.530)
Dual	0.006***	0.017***	0.027***	-0.001	0.017***
	(9.246)	(7.355)	(10.753)	(-1.097)	(7.138)
Top1	0.017***	0.053***	0.027***	0.161***	0.065***
	(7.808)	(6.433)	(3.138)	(52.857)	(7.660)
Balance1	0.011***	0.054***	0.055***	0.053***	0.052***
	(10.151)	(12.598)	(12.162)	(33.482)	(11.766)
TobinQ	0.009***	0.037***	0.045***	-0.001	0.028***
	(39.746)	(40.856)	(47.040)	(-1.507)	(29.755)
ListAge	-0.002***	-0.072***	-0.037***	-0.040***	-0.031***
	(-3.239)	(-30.887)	(-15.747)	(-47.773)	(-13.497)
FirmAge	0.000	0.059***	0.030***	0.035***	0.027***
	(0.120)	(14.903)	(7.020)	(23.839)	(6.564)
Occupy	0.051***	0.570***	0.465***	-0.085***	0.316***
	(4.644)	(13.615)	(10.527)	(-5.497)	(7.341)
Dturn		0.272***			
		(78.123)			
BM		-0.041***			
		(-44.069)			
Indep		0.034**			
		(2.048)			
SOE		-0.021***			
		(-9.300)			
Opinion		-0.065***			
		(-9.758)			
Constant	0.038***	2.454***	2.821***	0.510***	3.228***
	(5.928)	(87.258)	(108.199)	(55.849)	(109.474)
Observations	75,136	75,112	75,136	75,136	75,136
R-squared	0.122	0.497	0.432	0.270	0.465
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	2.821***	0.510***	3.228***

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. Conclusions and recommendations:

This paper used all A-share listed companies from 2011-2020 as a research sample to analyze the impact of corporate environmental performance on idiosyncratic risk and analyzed the impact mechanism of corporate environmental performance on idiosyncratic risk from the perspective of corporate environmental information disclosure and the external pressure of media attention. In terms of the path of action, the corporate environmental performance has a negative impact on idiosyncratic risk through the mediating effect of information quality improvement and the positive moderating effect of media pressure on corporate disclosure quality.

In the context of increasingly serious environmental problems such as environmental pollution and the national strategy to advocate green development and carbon peaking and carbon neutrality, this paper makes the following recommendations.

For companies, they should change the previous view that protecting the environment is a waste of company money, promote business transformation and upgrading, actively improve their environmental or ESG performance, and disclose more relevant information so as to reduce their own idiosyncratic risks. For investors, they should actively focus on companies with better environmental or ESG performance, which have lower idiosyncratic risk and sustainability, and investing in these companies generally helps investors to manage risk in the long term. For the media, they should pay more attention to the environmental performance of companies and actively report on it to increase the credibility of the media and create the right ideological guidance for the public. For the government, it can set up reward and punishment mechanisms based on the environmental or ESG performance of enterprises and accelerate the construction of environmental performance or ESG evaluation systems to improve the efficiency of the capital market and achieve high-quality economic development.

Finally, this paper only explores the impact of corporate environmental performance on its idiosyncratic risk from the mediation of corporate disclosure quality and the regulation of media pressure, and the investigation of the mechanism of the impact between the two is still not comprehensive. In addition, although a firm's environmental performance positively and significantly affects its disclosure quality, it should also be expressed through the dimension of environmental information quality. And Zhu et al. (2019) proposed that there are substantive disclosure and selective disclosure of corporate environmental information [13], i.e., both qualitative and quantitative disclosures, which brings additional room for further exploration of the quality of corporate disclosure and further refinement of the mechanism of action in this paper to be added and improved.

References

[1] Long Wenbin, Li Sihai, Ding Rong. Environmental policy and environmental performance of SMEs: administrative enforcement or economic incentives [J]. Nankai Economic Research, 2018 (03): 20-39.DOI: 10.14116/j. nkes.2018.03.002.

[2] Zhao Fang, Cheng Songsong. External Pressure, Technological Innovation, and Corporate Environmental Performance - A Mediated Moderation Model [J]. Learning & Exploring, 2019 (06): 144-150.

[3] Zhou Yihong, Liu Yuanzhe. Research on the impact of corporate environmental information disclosure on environmental performance [J]. Journal of Jilin Business University, 2021, 37 (05): 36-41. DOI: 10.19520/j.cnki. issn1674-3288.2021.05.006.

[4] Lv Wenxi. Research on the impact of environmental performance on the financing cost of heavy polluting enterprises [D]. Wuhan University of Technology, 2020.DOI: 10.27381/d.cnki.gwlgu.2020.000432.

[5] Zhou C, Zhang Zongxin. Information mining or noise trading: How does bond idiosyncratic risk affect credit spreads? [J]. Statistical Research, 2021, 38(06): 86-101.

[6] Li BJ. Research on the impact of ESG performance on corporate trait risk [D]. Harbin Institute of Technology, 2021. doi: 10.27061/d.cnki.ghgdu.2021.002689.

[7] N. C. Ashwin Kumar, Camille Smith, Leïla Badis, Nan Wang, Paz Ambrosy, Rodrigo Tavares. ESG factors and risk-adjusted performance: a new quantitative model [J]. Journal of Sustainable Finance & Investment, 2016, 6(4).

[8] Robert G. Eccles, Ioannis Ioannou, George Serafeim. The impact of corporate sustainability on organizational processes and performance [J]. Management Science, 2014, 60(11).

[9] Wiseman, J.. 1982.An Evaluation of Environmental Disclosures Made in Corporate Annual Reports. Accounting Organizations & Society, 7 (1): 53 ~ 63

[10] Patten, D.M.. 2002.The Relation between Environmental Performance and Environmental Disclosure: A Research Note Accounting, Organizations and Society, 27(8): 763 ~ 773

[11] Cho, C.H, D.M. Patten. 2007.The Role of Environmental Disclosures as to Tools of Legitimacy: a Research Note. Accounting, Organizations and Society, 32 (7-8): 639 ~ 647

[12] Shen, Hongtao, Huang, Zhen, Guo, Fatru. Confessing or justifying--a study on the relationship between corporate environmental performance and environmental information disclosure [J]. Nankai Management Review, 2014, 17(02): 56-63+73.

[13] Zhu Wei, Sun Yuxing, Tang Qian. Substantive disclosure or selective disclosure: The impact of corporate environmental performance on the quality of environmental information disclosure [J]. Accounting Research, 2019(03): 10-17

[14] Lu J, Qiu Yuhang, Qin Dachao. The impact of firm innovation input on stock idiosyncratic risk--a test with mediating moderating effect [J]. Securities Market Herald, 2021(12): 42-53.

[15] Dyck A, Volchkova N, Zingales L. The corporate governance role of the media: Evidence from Russia [J]. The Journal of Finance, 2008, 63(3): 1093 -1135.

[16] Liu, Vicky, Wu, Hanzhang. Do analysts improve the market information environment? --Evidence from firm-specific risks [J]. Journal of Central University of Finance and Economics, 2021(01): 43-53. DOI: 10.19681/j.cnki.jcufe.2021.01.005.

[17] Ying Qianwei, Lopsided Haojing, Deng Kebin. The market pressure effect of media attention and its transmission mechanism [J]. Journal of Management Science, 2017, 20(04): 32-49.

[18] Gennaro Bernile, Vineet Bhagwat, Scott Yonker. board diversity, firm risk, and corporate policies [J]. Journal of Financial Economics, 2018, 127(3).

[19] Huang, Ching-Ying. A study on the impact of media attention and internal control on corporate risk-taking[D]. Fujian Agriculture and Forestry University, 2020.DOI: 10.27018/d.cnki.gfjnu.2020.000441

[20] Shi YD, Song MY, Li FY, Zhen HL. Controlling shareholders' equity pledges and corporate creditors' interest protection-evidence from the Chinese bond market [J]. Economic Research,2021,56(08):109-126.

[21] Jianan Liu, Robert F. Stambaugh, Yu Yuan. size and value in China [J]. Journal of Financial Economics, 2019, 134(1)

[22] Yin H. R&D investment, book-to-market ratio effect and stock return--a study of data from GEM listed companies in China [J]. Nanjing Normal University Journal (Social Science Edition), 2014(05): 41-50.

[23] Xu Shoufu, Xu Longbing. Information disclosure quality and capital market valuation bias[J]. Accounting Research, 2015(01): 40-47+96.