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ESG Environmental Performance and Corporate Performance Research

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Abstract: Based on China's carbon peaking and carbon neutrality goals and industry characteristics, the data of listed companies in Shanghai and Shenzhen from 2018 to 2021 of chemical raw materials and chemical products enterprises were constructed. The comprehensive performance of ESG is obtained through principal component analysis, and the impact of environmental performance on corporate performance is studied through multiple regression effect model. It is found that good environmental performance can effectively improve the financial performance of enterprises. Further analysis shows that in state-owned enterprises, the positive effect of environmental performance on corporate performance has been enhanced. For the companies audited by the Big Four, the positive effect of environmental performance on corporate performance has increased. The research results provide evidence for the relationship between environmental performance and corporate performance, and have reference value for further strengthening the application and improvement of ESG concept and promoting the construction of corporate environmental performance to promote high-quality economic development.

Keywords: ESG Performance; Principal Component Analysis; Business Performance.

1. Introduction

With the rapid development of global ESG, relevant international institutions, financial institutions and enterprises are increasingly aware of the importance of unified and scientific ESG disclosure standards for ESG development, and are actively carrying out ESG standardization research. as of 2023, the International Organization for Standardization (ISO) has developed and published more than 100 ESG-related international standards. The current dominant ESG standard system reflects the perception and attitude of developed countries on ESG issues, and China's current low-carbon research is in its infancy and faces different environmental pressures than Western societies, so this paper focuses on environmental performance and explores its relationship with corporate performance.

2. Literature Review

2.1. Research Status of Environmental Performance

The origin of ESG-related concepts can be traced back to ESG investment philosophy, which refers to investors who choose sustainable enterprises for ESG investment not only paying attention to the financial performance of the company when judging the value of the company, but also paying attention to the performance of the enterprise in the environment, social responsibility and corporate governance. ESG concept has been closely integrated with investment philosophy since its birth, and ESG evaluation also reflects the recognition of E, S and G by investment institutions.

Among the three indicators E, S and G, environmental performance has received extensive attention. China proposed a two-carbon target in 2020, and enacted a new environmental protection law in 2015, which opened mandatory environmental performance requirements. At present, however, there are no well-established disclosure norms for environmental performance. Enterprises usually disclose environmental information through social responsibility reports, and the quality of disclosure is inconsistent. Moreover, the performance of the existing environment does not have typical industry characteristics, and the huge differences between industries need to be distinguished by new evaluation indicators. Since China does not have complete environmental performance guidelines and requirements, each institution uses the guidance of international institutions such as GRI and ISO to build an exclusive evaluation system, and due to different rating indicators and scoring methods, there are large differences between the ESG scores of the same company in the same year. This paper uses the environmental performance score in wind ESG scoring to explore the relationship between environmental performance and enterprise performance.

2.2. Relationship between Environmental Performance and Firm Performance

Some scholars believe that the improvement of environmental performance has a negative impact on enterprise performance. The business goal of enterprises is to seek benefits for shareholders, so investment in the environment will increase additional expenses of enterprises. It can waste corporate resources, weaken corporate competitiveness, thereby harming shareholders' interests and reducing corporate performance. Clarkson (2013) et al, using heavily polluting industries in the United States, argue that environmental performance does not provide additional information and does not help firm performance.

Some scholars believe that China's environmental performance is based on mandatory disclosure of environmental regulations, which has no significant impact on corporate performance. In addition, some scholars believe that the impact of environmental performance level on firm performance is conditional, such as Chou (2020) and other studies show that in countries with weak market systems, corporate environmental performance has a positive impact on firm performance, so actively carrying out environmental performance activities can overcome market failures caused by institutional gaps; Nolle (2018) et al. argue that there is a

threshold effect on the impact of environmental performance levels on firm performance, which only after the environmental performance level reaches the threshold can it be rewarded.

In the current research on environmental performance and firm performance, scholars use return on equity (ROE) and TobinQ to measure corporate performance when studying corporate performance. But these two indicators have related flaws in their measurement. The calculation caliber of TobinQ value is large, and the selection of which market value disclosed by the enterprise and whether to consider factors such as net intangible assets and net goodwill will make a large difference in the results of TobinQ value. Therefore, there may be a large difference in the correlation measured based on this condition. Return on equity (ROE) cannot be well summarized for the return of total assets, and the overall performance of the enterprise is biased. Through the measurement of financial performance, technical performance and social performance, a comprehensive performance model describing high-tech enterprises is comprehensively constructed.

Most scholars believe that environmental performance has a positive impact on firm performance, which can improve a company's operating performance or market valuation.

Based on this, hypotheses are made

H1: An increased level of environmental performance improves business performance.

H2: Increased levels of environmental performance reduce business performance.

H3: Increased levels of environmental performance do not affect corporate performance.

3. Construction of Enterprise Performance Evaluation Index System

3.1. Principal Component Analysis Index Selection

The financial indicators of the enterprise can clearly reflect the production and operation status of the enterprise, and can play a guiding role in the formulation of the strategic policy for future development. Chemical raw materials and chemical products enterprises complex process, long production cycle, while producing greater pollution, belongs to heavy pollution industry, chemical raw materials and chemical products enterprises environmental performance improvement can effectively reduce environmental pollution, improve environmental quality. Therefore, this paper chooses to analyze the comprehensive performance of chemical raw materials and chemical products enterprises and draw more comprehensive conclusions. Although the four mainstream financial management objectives have their own focus, but always take the profit in the financial indicators as the cornerstone, this paper uses 8 indicators based on four aspects to represent the financial performance of the enterprise when selecting the indicators.

(1) Profitability. Relevant indicators of profitability may affect the development of investment and financing of enterprises. Selecting the return on net assets as a measurement index can better analyze the profitability of the enterprise through the asset income of the enterprise, and the return on total assets as the measurement index can examine the overall profitability of all assets of the enterprise, including net assets and liabilities, so as to evaluate the overall profitability of the enterprise using all assets, and more comprehensively reflect the profitability of the enterprise.

(2) Asset quality status. Enterprises are for profit, and in order to achieve this purpose, it is necessary to invest corresponding assets, which will eventually bring benefits to the enterprise through research and development output or the formation of intangible assets. Total asset turnover is the ratio of the net sales revenue to the average total assets of an enterprise in a certain period, which is an indicator to measure the ratio between asset investment scale and sales level. At the same time, the accounts receivable turnover rate is taken as an indicator to reflect the asset quality status, and the index to measure the turnover speed and management efficiency of the company's accounts receivable, if the accounts receivable can be recovered in time, the company's capital use efficiency can be greatly improved.

(3) Solvency. In the process of production and operation, financing activities are a relatively common phenomenon, choosing equity financing or debt financing or other different financing methods, bringing different financial pressure to enterprises, combined with the operation of the enterprise, timely assessment of the solvency. Chemical raw materials and chemical products are indispensable for R&D activities due to the particularity of related industries, but R&D activities have the characteristics of long cycle, so it is appropriate to choose the asset-liability ratio to measure the long-term solvency of enterprises; When considering the long R&D cycle, it is also necessary to consider whether the funds can ensure the continuous maintenance of R&D activities, so the interest protection multiple is selected to measure the short-term solvency of the enterprise.

Table 1. Summary of enterprise performance indicators

Items	Metrics	Calculation formula
Profitability	Return on equity	Net profit/Average owner's equity
	Return on total assets	EBIT / Average total assets
Asset quality	Total asset turnover	Operating income/Total average assets
	Accounts receivable turnover	Average balance of credit revenue/Accounts receivable
Debt risk	Gearing ratio	Total liabilities/Total assets
	Interest Coverage ratio	EBIT/Finance expense
Operating growth	Sales growth rate	Sales growth/Total sales in the previous year
	Operating profit growth rate	Total operating profit growth/Total operating profit of last year

(4) Ability to operate growth. When measuring the development ability of enterprises, sales analysis can be carried out through the sales growth rate, which is the ratio of the growth of sales revenue in this year to the total sales

revenue of the previous year, which is the basic indicator for analyzing the growth status and development ability of enterprises. In addition, operating profit margins can be used to directly examine corporate profits. The higher the operating profit margin, the more operating profit provided by the company's 100-yuan commodity sales, the stronger the profitability of the enterprise; Conversely, the lower this ratio, the weaker the profitability of the business.

3.2. Analysis of Principal Components of Enterprise Performance

Feasibility analysis uses principal component analysis for information concentration studies, provided that the study data needs to be analyzed for principal component analysis, usually using KMO and Bartlett sphericity tests for feasibility analysis.

Table 2. KMO and Bartlett sphericity tests

KMO sample appropriateness measure		0.612
Bartlett sphericity test	Approximate chi-square	619.007
	Degree of freedom	21
	significance	0.000

As can be seen from Table 2, KMO is 0.612, which is greater than 0.6, which means that the data can be used for principal component analysis. In addition, the relevant data also passed the Bartlett sphericity test ($p<0.05$), which also indicates that the study data is suitable for principal component analysis. As can be seen from the ANOVA table (Table 3), the characteristic root of the factor F1 before rotation is 2.070, which is greater than that of other factors, although the general default feature root is greater than 1 as the standard, in order to fully explain the financial situation, the five factors accounting for the largest proportion are selected. And the cumulative variance contribution rate of the five principal components is 29.577%, 16.768%, 14.544%, 13.651% and 13.309%, which means that these five principal components basically cover the selected seven index information, so these principal components can be used as representative indicators for the comprehensive performance of manufacturing chemical raw materials and chemical products. These five principal components are F1, F2, F3, F4, and F5. Among them, F1 represents profitability, F2 represents solvency, F3 represents development ability, F4 represents operating ability, and F5 represents asset capacity. According to the contribution weight of each component to the cumulative variance, the comprehensive performance expression is:

$W = 0.239*F1+0.237*F2+0.232*F3+0.168*F4+0.069*F5$

Finally, bringing the data of each enterprise into the above expression can yield the overall performance.

Table 3. The ANOVA tables

ingredient	Initial eigenvalue			Extract the sum of squared loads		
	total	Percent variance	accumulate %	total	Percent variance	accumulate %
1	2.070	29.577	29.577	2.070	29.577	29.577
2	1.174	16.768	46.345	1.174	16.768	46.345
3	1.018	14.544	60.890	1.018	14.544	60.890
4	0.956	13.651	74.540	0.956	13.651	74.540
5	0.932	13.309	87.850	0.932	13.309	87.850
6	0.587	8.387	96.236			
7	0.263	3.764	100.000			

4. Model Construction and Variable Setting

4.1. Data Sources

In 2018, the China Securities Regulatory Commission revised the "Governance Guidelines for Listed Companies", which established the basic framework of ESG information disclosure for the first time, marking that China's supervision of environmental protection disclosure is stricter than before, resulting in enterprises under pressure to strengthen the research on carbon environmental performance, so this paper selects A-share manufacturing raw materials and chemical listed companies from 2018 to 2021 as research samples, and treats: (1) exclude financial, ST and * ST companies; (2) Companies with abnormal and incomplete data were eliminated, and 1080 valid observations were finally obtained. The environmental performance described in this article is from the Wind environmental performance score, and other data are from the Guotaian database. To eliminate the influence of extreme values, all variables were tailed at the 1% and 99% levels.

4.2. Variable Settings

(1) Explained variables: the comprehensive performance of enterprises (CP). Combined with the existing relevant research, this paper constructs enterprise performance evaluation indicators based on industry characteristics, assigns new weights to 7 financial indicators in 4 aspects through principal component analysis, and calculates the comprehensive financial performance of sample enterprises.

(2) Explanatory variables: environmental performance

(EP). In 2014, the Ministry of Environmental Protection issued the Measures for the Disclosure of Environmental Information of Enterprises and Institutions, which mandates heavily polluting enterprises to disclose environmental information such as pollutant discharge and the operation of pollution prevention and control facilities. Since the current disclosure in China is disclosed by enterprises independently, the quality of disclosure is uneven, so the environmental score in the windESG score is used.

(3) Control variables: Referring to previous research Zhu Naiping (2014), the proportion of independent directors (top), the proportion of liquid cash (cf), enterprise size (size) and other characteristic variables were selected as control variables.

4.3. Model Settings

Referring to the relevant research and models of Wang Bo, Yang Maojia (2022) and others, this paper constructs a model (1) to discuss the relationship between environmental performance and enterprise performance.

$$CP_i = \beta_0 + \beta_{1t} EP_{it} + \beta_{2t} controls_{it} + \mu_{it} \quad (1)$$

5. Results and Analysis

5.1. Descriptive Statistics

Table 4 shows the descriptive statistical results for the main variables. The mean environmental disclosure score was 1.95, the standard deviation was 1.61, the minimum value was 0, and the maximum value was 10; The maximum, minimum and standard deviations of the comprehensive enterprise performance of the explanatory variables were 1226.635, 0.182 and 46.10, respectively, indicating that the comprehensive performance of the sample enterprises was quite different, of which the mean value was 7.22, which was significantly greater than the median, indicating that the overall enterprise performance of chemical raw materials and chemical manufacturing enterprises was high and the economic performance was better, in addition, the standard deviation of the control variables was large, indicating that there were also large differences in the observed values between the sample companies, which in turn may affect the performance of enterprises.

Table 4. Descriptive statistics

variable	Observed quantity	Mean	SD	Median	Min	Max
CP	1079	7.22	46.10	1.430	0.182	1226.635
EP	1079	1.95	1.61	1.930	0.000	10.000
size	1079	21.95	1.29	21.832	0.485	25.972
top	1079	31.22	14.79	29.080	0.000	95.500
lev	1079	0.36	0.18	0.349	0.019	0.979
cf	1079	0.07	0.07	0.065	-0.463	0.479
fixed	1079	0.27	0.15	0.249	0.000	0.787

5.2. Correlation Analysis

In this paper, the correlation analysis of the above variables is carried out to determine whether there is a relationship between the variables, and to avoid the influence of multicollinearity in the research results. The correlation between corporate performance and environmental performance is 0.434 and is significant at the 1% level, suggesting in part that enhanced environmental disclosure may improve corporate performance. Due to the significant correlation coefficient between some variables, the possible multicollinearity problem between the variables was further detected, and the tolerance (Tolerance) and variance inflation factor (VIF) of the explanatory and control variables in the model were tested, and the results showed that the Tolerance values were greater than 0. 4. The VIF values of the variables in the model (1) are less than 3, and the model does not have serious multicollinearity problems.

Table 5. Correlation analysis

	CP	EP	size	top	lev	cf	fixed
CP	1						
EP	0.434***	1					
size	-0.3800	0.189***	1				
top	-0.268**	-0.00700	0.084***	1			
lev	-0.351*	0.069**	0.330***	-0.141***	1		
cf	0.078**	0.122***	0.095***	0.061**	-0.156***	1	
fixed	0.112***	0.170***	0.243***	-0.0280	0.281***	0.154***	1

5.3. Regression Analysis

Considering that there may be individual random effects and individual fixed effects in the model, the results of F-test, Breusch-Pagan, LM test and Hausman test of the model in advance show that the F-test is significant at the 1% level, indicating that there is an individual fixed effect in the model. The Breusch-PaganL M test for mixed OLS models and random-effects models showed a P value of 0.00, which was significant at the 1% level, indicating that there were individual random effects in the model; The Hausman test for random-effects and fixed-effect models showed a P value of 0.08, significant at the 10% level, indicating that a fixed-effect model was more appropriate for estimation.

Table 6. Regression analysis

variable	CP	
	model1	model2
EP	3.4169*	3.2108***
	(1.3354)	(0.9304)
size	1.7708	-0.1226
	(1.7153)	(1.2352)
top	-0.0108	-0.1958
	(0.3074)	(0.1106)
lev	-17.1357	-22.8287*
	(18.6745)	(9.4702)
cf	-5.5143	10.4412
	(22.2386)	(19.3843)
fixed	77.3770***	40.6923***
	(21.5219)	(11.1849)
N	1079	1079
r2	0.5180	0.2551
F	3.5537	2.3087

Through robust standard false regression, it is found that the VIF value (1.29) of the multicollinearity test is less than 10, indicating that there is no serious multicollinearity problem. In order to mitigate the interference of heteroscedasticity on the study conclusions, a robust standard error was used for multiple regression analysis, and table 6 reported the multiple regression results of the fixed-effect model and the random-effects model. The fixed-effect regression coefficient of environmental performance level on firm performance was 3.4169 and 3.2108, which was significant at the level of 1%. This shows that environmental performance can improve firm performance to some extent, validating the hypothesis H1 in this paper.

5.4. Robustness Test

In order to ensure the reliability of the research results, the robustness test is carried out on the comprehensive performance of enterprises lagging the first and two periods, and the directional causal relationship between the environmental performance of enterprises and enterprise performance is considered, that is, enterprises improve environmental performance first, and the market reflects well, so as to improve comprehensive performance. This paper uses the method of one period and two periods of lag in the comprehensive performance of enterprises to verify the hypothesis. The regression results are shown in columns (1) and (2) of Table 7, and it can be seen from the results that the regression coefficient is still significantly positive after the comprehensive performance lag for one period. After two periods of lag, the regression coefficient was still significantly positive, and the results were basically consistent with the benchmark regression results, which confirmed the robustness of the previous research results.

Table 7. Robustness test

	CP	
	One-phase lag	Tow-phase lag
EP	3.0169*	2.2108***
	(1.3549)	(0.7704)
size	1.5428	0.0719
	(1.7353)	(1.2352)
top	0.0430	-0.00061
	(0.3441)	(0.2986)
lev	21.1347*	19.8207*
	(12.699)	(4.4798)
cf	16.5143**	12.7622
	(22.2386)	(19.3843)
fixed	77.3770***	40.6923***
	(21.5219)	(11.1849)
N	1079	1079
r2	0.5180	0.2551
F	3.5537	2.3087

6. Heterogeneity Testing

6.1. Nature of Property Rights

Heterogeneity in the nature of property rights. According to the nature of property rights, the sample is divided into two categories: state-owned enterprises and non-state-owned enterprises. Multiple regression analysis was performed with those two categories. Results show that the coefficient of environmental performance on enterprise performance is 0.444 when the enterprise type is state-owned, which is significant at the 1% level, and the significance is higher than that of non-state-owned enterprises with a coefficient of 0.147 at the 5% level. So, it is concluded that compared with non-

state-owned enterprises, the promotion effect of environmental performance on enterprise performance is stronger in state-owned enterprises. State-owned enterprises respond to the needs and demands of stakeholders in order to convey the signal of actively fulfilling their social responsibilities to the outside world, and more proactive disclosure of environmental performance.

Possible explanations are: from the perspective of environmental regulation, the government accounts for a certain proportion of the cooperative units of state-owned enterprises, chemical raw materials and chemical products enterprises belong to the heavy polluting industries in the manufacturing industry, driven by the pressure of environmental regulation, state-owned enterprises to improve environmental performance is more in line with the current policy orientation, which is conducive to improving enterprise performance.

6.2. External Governance

This paper further considers the impact of corporate governance factors on the environmental performance and corporate performance of listed companies from the perspective of external corporate governance. Using whether the enterprise is the international four major audits for measurement, the enterprise auditor from the international "big four", take 1, otherwise take 0. This paper uses the grouped regression method consistent with the previous article to briefly verify the relationship between champion performance and company performance, when the enterprise is the four major audits, the coefficient of environmental performance on enterprise performance is 0.33, which is significant at the 5% level, and the significance is higher than that of non-state-owned enterprises with a coefficient of 0.106 at the 5% level. The four major enterprises pay more attention to the examination of corporate social responsibility, and actively fulfilling environmental social responsibility can effectively improve corporate performance.

7. Research Conclusion and Discussion

This paper uses the data of chemical raw materials and chemical products enterprises in the manufacturing industry of A-share listed companies from 2018 to 2021 as a research sample, constructs enterprise performance evaluation indicators from the perspective of environment, and conducts empirical analysis through comprehensive performance to examine the impact of listed companies' environmental performance level on corporate performance. The experimental results show that the level of corporate environmental performance has a significant positive impact on corporate performance, which means that enterprises that attach importance to environmental performance have deeper potential and stronger motivation for improving corporate performance. As General Secretary Xi Jinping said: "Gold and silver mountains are not as good as green water and green mountains", which will also be the direction for listed enterprises, investors and regulatory authorities to practice and continue to develop in the future.

The empirical results of this paper provide the following insights:

The government should provide institutional oversight and policy incentives for the development of environmental disclosure. On the one hand, improve China's environmental performance system. On the other hand, give play to the incentive and punishment role of policies, provide policy support such as tax incentives and environmental subsidies for enterprises with good environmental performance, and impose substantive sanctions and large-scale penalties on enterprises with poor environmental performance or even falsification of environmental information, increasing the cost of non-compliance.

At the enterprise level, enterprises should pay attention to sustainable development, continue to improve their ESG performance, and in view of the national conditions of China's "dual carbon" goal and the industry characteristics of chemical raw materials and chemical products enterprises, short-term excellent financial performance is important, but while pursuing performance, do not forget the development quality of enterprises. Improve environmental performance to meet the expectations of various stakeholders, maintain friendly and mutually beneficial relationships with stakeholders, thereby reducing costs, establishing competitive advantages, improving business performance and maintaining long-term development.

In summary, the above research results provide important references and guidance for governments and enterprises to better formulate policies and manage enterprises. At the same time, the research of this paper has certain limitations: first, the construction of enterprise performance evaluation indicators refers to a large number of literature, due to the author's ability to limit the understanding of chemical raw materials and chemical products enterprises mainly obtained from the literature, the selection of enterprise performance indicators lacks certain innovation; Secondly, only chemical raw materials and chemical products enterprises are analyzed, and the performance of enterprises in special financial industries and other industries needs to be studied.

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