

Financial Risk Assessment of Environmental Protection Enterprises under the Background of Carbon Peak and Carbon Neutrality

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Abstract: With the proposal of China's carbon peak and carbon neutral strategic goals, the environmental protection industry is facing significant development opportunities and challenges. As a crucial support to achieve the goal of carbon peak and carbon neutral, environmental protection industry unavoidable has financial risks in the process of transformation and upgrading. The purpose of this study is to build A set of financial risk evaluation system suitable for environmental listed companies under the background of dual-carbon, and use factor analysis method to quantitatively assess the financial risk of 93 A-share environmental protection enterprises. It is found that the financial risk level of environmental protection listed companies is different, among which profitability and solvency are the most important factors affecting the financial risk of enterprises. Therefore, this paper also throws out some suggestions for environmental protection enterprises based on the data analysis results to promote the risk control and sustainable development of the environmental protection industry.

Keywords: Carbon peaking and carbon neutrality, Environmental protection listed companies, Factor analysis method, Financial risk assessment

1. Introduction

With the increasingly severe global climate change, low-carbon economy and sustainable development have become the common goal of the international community. In September 2020, at the 75th session of the United Nations General Assembly, China proposed the goal of reaching carbon peak by 2030 and carbon neutrality by 2060. The implementation of this strategic goal makes a new request for the development of environmental protection industry, and also becomes an important guidance for the green development of enterprises^[1]. As an important force to promote environmental protection, energy conservation and emission reduction, the financial status and risk control ability of environmental protection listed companies have a direct impact on the sustainable development of the company and the realization of dual-carbon goals. In the context of dual-carbon, environmental protection listed companies need to face multiple pressures such as increased investment in technology research and development, difficulty in financing, and intensifying competition in the market environment, all of which may lead to an increase in the company's financial risk^[2]. Therefore, it is of great significance to study the financial risk and control mechanism of listed environmental protection companies under the background of carbon peaking and carbon neutrality for ensuring the steady operation of companies and promoting the healthy development of environmental protection industry.

Through reading the existing literature, I found that many scholars have done relevant research on the financial aspects of environmental protection industry. Li Shu believes that China's environmental protection industry still has problems such as insufficient total investment, single financing sources and investment subjects, and low investment efficiency. In view of the above problems, he puts forward measures to strengthen fiscal and tax collection policies^[3]. Xu Wenhua and Zhuang Huudi used factor analysis to analyze and evaluate the environmental protection industries in four regions of China, and found that the main factors affecting the development of environmental protection industry were environmental protection investment and government support^[4]. However, at present, systematic studies on the financial risk and control of environmental listed companies under the background of dual-carbon are still few and lack timeliness.

Therefore, based on the perspective of financial risk evaluation and control, this study selected 93 A-share environmental protection listed companies as research objects and selected 18 financial indicators to build A financial risk evaluation system. In addition, through factor analysis, public factors were extracted and named as debt paying ability factor, development ability factor, cash flow factor and operation ability factor. In addition, SPSS software was used to calculate the score of each public factor. The higher the score, the lower the financial risk. Finally, the results of factor analysis are further analyzed and summarized. The research significance of this study has two aspects, one is to help environmental protection enterprises to better identify, evaluate and control financial risks, so as to improve the risk management ability of environmental protection enterprises. On the other hand, policymakers can obtain information about financial risks from environmentally friendly companies, which is conducive to them to formulate policies more reasonably and scientifically, so as to promote the sustainable development of environmental protection industry.

2. The development status of environmental protection industry

In 1973, China conducted the first national environmental protection conference, and it indicated the environmental protection industry began to take off, which was later than that of developed countries. After years of development, nowadays, China's environmental protection industry is in a stage of rapid development [5]. With the improvement of the state's attention to environmental protection and the deepening of the battle against pollution prevention and control, the market capacity of the environmental protection industry is constantly expanding, and its strategic position in the national economy is increasingly prominent. As mentioned in the "14th Five-Year Plan" for Industrial Green Development, the output value of green environmental protection industry is expected to reach 11 trillion yuan by 2025 [6].

However, under the background of continuous favorable policy environment and broad market prospects, there are also many problems in the development of environmental protection industry. For example, PPP model (the cooperation model between the government and private enterprises or individuals) brings financing risks [7]. In addition, at present, the environmental protection industry has problems such as lack of standardized market supervision mechanism, imperfect business operation model, insufficient technology and service level, and disorderly expansion. Therefore, the development of environmental protection industry still needs to face a lot of challenges.

3. Environmental protection listed companies financial risk assessment

3.1 Selection of financial risk evaluation indicators for environmental listed companies

Table 1. Evaluation index system

Evaluation content	Evaluating indicator	Sign
Debt paying ability	Current ratio	X1
	Quick ratio	X2
	Cash ratio	X3
	Asset-liability ratio	X4
Development ability	Return on equity growth rate	X5
	Net profit growth rate	X6
	Operating profit growth rate	X7
Profitability	Return on assets	X8
	Net profit rate on total assets	X9
	Return on equity	X10
	Return on invested capital	X11
	Net operating margin	X12
Cash flow capacity	Cash content of operating income	X13
	Total cash recovery	X14
	Operating index	X15
Operation capacity	Accounts payable turnover ratio	X16
	Turnover of current assets	X17
	Turnover of total assets	X18

Compared with other industries, the environmental protection industry has some unique features. On the one hand, environmental protection projects are usually capital-intensive and have a long payback period [8]. Therefore, a stable cash flow is essential for the sustainable operation of the project research. On the other hand, the environmental protection industry is highly policy-driven, and many projects are closely related to government finance and tax policies [9]. Therefore, environmental

protection companies are required to pay close attention to the inflow and outflow of cash. Therefore, when constructing the financial risk evaluation system, this paper includes the cash flow ability, and selects 18 financial indicators from five financial analysis aspects to constitute the financial risk evaluation system of environmental listed companies. (Table 1)

3.2 Selection and preprocessing of sample data

This paper refers to the classification standard of Shenyin and Wanguo Industry Classification 2021 Revision edition, and selects 137 listed environmental protection companies as the initial research objects. However, after removing the ST, * ST plate and the companies with incomplete data disclosure, 94 environmental protection listed companies were finally selected as the research objects. All financial indicators data are from the National Taian database (CSMAR).

In order to reduce the variation differences among indicators, we carried out positive and standardized processing on the original data before factor analysis. Generally speaking, in the financial risk evaluation system, the asset-liability ratio is usually regarded as a negative indicator, so we take the reciprocal treatment of the asset-liability ratio. At the same time, SPSS software was used to conduct Z-score standardized processing of the data.

3.3 KMO-Barlett spherical test

This study takes the financial indicators data of environmental listed companies in 2023 as samples, and adopts SPSS software to conduct KMO-Barlett sphericity test on the data. In general, factor analysis can be performed when the KMO value is greater than 0.6. As shown in Table 2, the KMO value is 0.722, greater than 0.6. And the significance value of Bartlett sphericity test is less than 0.5, indicating that the data selected in this paper is suitable for factor analysis.

Table 2. KMO-Barlett spherical test

Number of KMO sampling suitability quantities.		0.722
Bartlett sphericity test	Approximate chi-square	2328.031
	DOF	153
	Significance	0.000

3.4 Common factor variance

All evaluation indexes extracted a common variance greater than 0.6, and most of the common variance greater than 0.7. In addition, the five common factors were extracted from the 18 indicators, and the cumulative contribution rate of the variance of these five public factors reached 87.178%. Therefore, it can be shown that the common factor can better reflect most of the information of the original indicators. (Table 3 and Table 4)

Table 3. Factorial variance

Evaluating indicator	Initial	Extract
Current ratio	1.000	0.975
Quick ratio	1.000	0.965
Cash ratio	1.000	0.843
Asset-liability ratio	1.000	0.924
Return on equity growth rate	1.000	0.863
Net profit growth rate	1.000	0.938
Operating profit growth rate	1.000	0.909
Return on assets	1.000	0.956
Net profit rate on total assets	1.000	0.955
Return on equity	1.000	0.929
Return on invested capital	1.000	0.952
Net operating margin	1.000	0.906
Cash content of operating income	1.000	0.761
Total cash recovery	1.000	0.878
Operating index	1.000	0.743
Accounts payable turnover ratio	1.000	0.738
Turnover of current assets	1.000	0.659
Turnover of total assets	1.000	0.798

Extraction method: principal component analysis method.

Table 4. Total variance interpretation

Constituent	Initial eigenvalue			Sum of the rotating load squares		
	Total	Variance	Cumulation %	Total	Variance	Cumulation %
1	6.261	34.784	34.784	4.938	27.431	27.431
2	4.144	23.023	57.807	4.138	22.987	50.419
3	2.443	13.570	71.377	2.403	13.350	63.768
4	1.844	10.244	81.621	2.301	12.783	76.551
5	1.000	5.557	87.178	1.913	10.627	87.178

3.5 Extraction and naming of common factors

Factor names are based on the factor load values of the variables in the rotated component matrix (Table 5). In the F1 factor, the factor load value of the return on assets, net profit rate on total assets, return on equity and net operating rate reflecting the company's profitability is the highest, so F1 is named as the profit factor.

In terms of F2 factor, the current ratio, quick ratio, cash ratio and asset-liability ratio, which reflect the company's debt paying ability, have the highest factor load value, so F2 is named as the debt paying factor.

In the F3 factor, the factor load value of the growth rate of return on equity, net profit growth rate and return on assets, which reflect the company's development ability, have the highest factor load value, so F3 is named as the development factor.

In the F4 factor, the factor load value of operating income cash content, total cash recovery rate and operating index, which reflect the company's cash flow, have the highest factor load value, so F4 is named as the cash flow factor.

In the F5 factor, the factor load value of accounts payable turnover, current assets turnover and total assets turnover, which reflect the company's operating capacity, have the highest factor load value, so F5 is named as the operating capacity factor.

Table 5. Factor load value after rotation

Evaluating indicator	F1	F2	F3	F4	F5
Current ratio	0.016	0.986	-0.005	-0.013	0.042
Quick ratio	0.032	0.982	-0.016	-0.006	-0.010
Cash ratio	0.081	0.913	0.009	0.034	-0.044
Asset-liability ratio	-0.020	0.958	-0.031	0.059	0.034
Return on equity growth rate	0.540	0.008	0.756	0.002	0.008
Net profit growth rate	0.375	-0.027	0.888	0.010	-0.084
Operating profit growth rate	0.438	-0.019	0.843	-0.035	-0.076
Return on assets	0.930	-0.036	0.270	0.038	0.124
Net profit rate on total assets	0.914	0.086	0.297	0.036	0.147
Return on equity	0.933	-0.030	0.210	-0.003	0.118
Return on invested capital	0.918	-0.075	0.296	0.071	0.104
Net operating margin	0.897	0.163	0.159	-0.004	-0.221
Cash content of operating income	-0.143	0.181	-0.025	0.814	0.213
Total cash recovery	0.186	-0.028	-0.016	0.915	-0.072
Operating index	0.028	-0.085	0.024	0.857	-0.016
Accounts payable turnover ratio	0.052	0.353	-0.098	0.031	0.775
Turnover of current assets	0.157	-0.479	-0.039	0.227	0.593
Turnover of total assets	0.053	-0.113	-0.004	-0.031	0.884

3.6 Calculation of the factor score

According to the factor score coefficients in Table 6, the calculation formula of common factors can be obtained, that is:

$$F1 = -0.012X1 + 0.002X2 + 0.015X3 - 0.017X4 - 0.065X5 - 0.163X6 - 0.124X7 + 0.236X8 + 0.217X9 + 0.260X10 + 0.224X11 + 0.290X12 - 0.088X13 + 0.054X14 - 0.020X15 - 0.020X16 + 0.021X17 + 0.053X18 \quad (1)$$

$$F2 = 0.240X1 + 0.237X2 + 0.220X3 + 0.237X4 + 0.012X5 + 0.008X6 + 0.008X7 - 0.015X8 + 0.015X9 - 0.016X10 - 0.024X11 + 0.026X12 + 0.047X13 - 0.013X14 - 0.023X15 + 0.094X16 - 0.111X17 - 0.015X18 \quad (2)$$

$$F3 = 0.020X1 + 0.000X2 - 0.003X3 + 0.013X4 + 0.378X5 + 0.523X6 + 0.467X7 - 0.107X8 - 0.076X9 - 0.155X10 - 0.086X11 - 0.214X12 + 0.080X13 - 0.063X14 + 0.025X15 + 0.007X16 - 0.022X17 + 0.076X18 \quad (3)$$

$$F4 = -0.010X1 - 0.005X2 + 0.013X3 + 0.022X4 + 0.004X5 + 0.020X6 - 0.003X7 - 0.009X8 - 0.010X9 - 0.029X10 + 0.007X11 - 0.012X12 + 0.353X13 + 0.403X14 + 0.380X15 - 0.029X16 + 0.066X17 - 0.059X18 \quad (4)$$

$$F5 = 0.037X1 + 0.005X2 - 0.018X3 + 0.029X4 + 0.021X5 + 0.018X6 + 0.017X7 + 0.036X8 + 0.008X9 + 0.007X10 - 0.179X11 - 0.179X12 + 0.089X13 - 0.104X14 - 0.053X15 + 0.417X16 + 0.292X17 + 0.484X18 \quad (5)$$

Then, according to the contribution rate of common factors in Table 4, the contribution rate is taken as the coefficient to calculate the synthesis score, that is:

$$F = 0.27431F1 + 0.22987F2 + 0.13350F3 + 0.12783F4 + 0.10627F5 \quad (6)$$

Table 6. Factor score coefficient

Evaluating indicator	F1	F2	F3	4	5
Current ratio	-0.012	0.240	0.020	-0.010	0.037
Quick ratio	0.002	0.237	0.000	-0.005	0.005
Cash ratio	0.015	0.220	-0.003	0.013	-0.018
Asset-liability ratio	-0.017	0.233	0.013	0.022	0.029
Return on equity growth rate	-0.065	0.012	0.378	0.004	0.044
Net profit growth rate	-0.163	0.008	0.523	0.020	0.021
Operating profit growth rate	-0.124	0.008	0.467	-0.003	0.018
Return on assets	0.236	-0.015	-0.107	-0.009	0.017
Net profit rate on total assets	0.217	0.015	-0.076	-0.010	0.036
Return on equity	0.260	-0.016	-0.155	-0.029	0.008
Return on invested capital	0.224	-0.024	-0.086	0.007	0.007
Net operating margin	0.290	0.026	-0.214	-0.012	-0.179
Cash content of operating income	-0.088	0.047	0.080	0.353	0.089
Total cash recovery	0.054	-0.013	-0.063	0.403	-0.104
Operating index	-0.020	-0.023	0.025	0.380	-0.053
Accounts payable turnover ratio	-0.020	0.094	0.007	-0.029	0.417
Turnover of current assets	0.021	-0.111	-0.022	0.066	0.292
Turnover of total assets	0.053	-0.015	0.076	-0.059	0.484

3.7 Results analysis

According to the above formula (6), the synthesis score of each listed environmental protection company can be calculated and the ranking can be calculated according to the synthesis score. The higher the synthesis score, the less financial risk and the higher the ranking. Overall, half of the enterprises in the environmental protection industry have a financial risk score of less than 0, which indicates that the financial risk of the environmental protection industry is greater. Among them, the synthesis score of 93 environmental protection companies is the maximum value of 1.43, the minimum value of -1.46, a difference of 2.89, indicating that the development of environmental protection industry is unbalanced, and the financial risk between enterprises is quite different.

In the financial risk evaluation system of this paper, the profit factor has the greatest impact on the synthesis score, accounting for 27.431% of the total weight. The average profit factor score of 93 environmental protection enterprises is less than 0, which reflects the weak profitability of the entire industry. The debt paying factor has the second impact on the synthesis score, accounting for 22.987% of the total weight. Among 93 environmental protection enterprises, 64 of them have lower debt paying factor scores than the average, which reflects that most environmental protection listed companies are not strong in debt paying ability. The remaining development factors, cash flow factors and operating factors have little impact on the synthesis score, and most of them have good development ability and potential. However, the cash flow of most companies is not robust. As the blood of enterprise operation, cash flow will threaten the survival and development of enterprises once there is a problem.

4. Suggestion

Firstly, seize the policy opportunity and achieve sustainable development. Environmental protection as a policy-oriented industry, its development is largely affected by policies. In recent years, government policies have facilitated the development of the environmental protection industry. Through the implementation of fiscal, financial, policy guidance and other measures, the government has provide a good external environment for the development of environmental protection industries. In this context, enterprises should do the following two points. On the one hand, enterprises should make good use of the benefits brought by existing policies, actively adjust the business structure and development priorities according to the policy orientation, and actively declare the government's

environmental protection projects and financial support. On the other hand, enterprises should remain flexible and innovative to adapt to the changing policy environment, better grasp policy opportunities, and achieve sustainable development.

Secondly, enhance profitability and consolidate the foundation of enterprise survival and development. Only in the case of maintaining profitability, enterprises can maintain normal production and business activities. Profitability is also the most important factor affecting the financial risk evaluation of enterprises, and enterprises with strong profitability have better risk defense ability. On the one hand, enterprises can expand the scope of services and enter new market areas, such as Marine protection, agricultural environmental protection and other emerging markets. On the other hand, enterprises can use Internet technology to achieve delicacy management and reduce production costs and management costs.

Thirdly, adjust the structure of assets and liabilities, and enhance cash flow capacity. From the above financial risk evaluation results, most of the environmental protection listed companies are insufficient in debt paying ability and cash flow ability. Enterprises should optimize the asset structure and increase the proportion of highly liquid assets to improve the liquidity of assets. In addition, enterprises should establish an effective cash flow forecasting and monitoring system, and establish an emergency fund reserve to cope with sudden capital needs.

Fourthly, establish and improve the risk control mechanism of environmental protection enterprises to effectively prevent all kinds of risks. Environmental protection enterprises are faced with many risks from policy, market, technology, operation, etc. Therefore, it is indispensable to establish a synthesis risk control mechanism. Therefore, companies need to set up a risk control team composed of senior leaders, auditors, professional lawyers, and other relevant functional departments. In addition, employees are encouraged to take part in the risk control process and recognition problems through their observations and timely feedback.

5. Conclusion

Based on the financial index data of 93 A-share environmental protection listed companies in 2023, this paper selects 18 indicators combined with the particularity of the environmental protection industry to build a financial risk evaluation index system. Through a factor analysis, we extract the common factors and calculate the synthesis score of the financial risk of each company. The results show that about half of the environmental protection listed companies have a high level of financial risk. Although environmental protection listed companies have great potential for development, there are currently problems such as insufficient profitability, weak solvency and poor cash flow management. Therefore, for the above problems, this paper puts forward some suggestions to provide reference for the financial risk control of the environmental protection industry.

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