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Research on Financial Performance Evaluation of Coal Enterprises Based on Entropy Weight Model

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Abstract: The article takes 25 listed companies in the coal industry as the research object, and selects 12 indicators including profitability, debt-paying ability, development capability and turnover capacity to construct a financial performance evaluation system for the coal industry, and uses the entropy method to list coal companies. Empirical evaluation of business performance. The results show that the financial performance of the 25 coal listed companies is quite different, and based on the conclusions, the countermeasures and suggestions for improving the financial performance of coal enterprises are put forward.
Keywords: Financial Performance Evaluation, Coal Enterprises, Entropy Weight Model.

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1. INTRODUCTION

As the most important energy source for promoting the development of China's national economy, coal has been at the core for a long time in the process of industrialization. China's coal enterprises have made outstanding contributions to social progress and economic improvement while their development has been continuously developed. Their financial performance is also related to the entire industry. Performance. However, in recent years, most of the coal enterprises in China have been affected by state-owned enterprises. The coal market regulation mechanism has partially failed, and the production capacity cannot be voluntarily withdrawn, resulting in a sharp decline in coal production, a drop in coal prices, a sluggish overall coal market, and a continuous operation of coal enterprises. Enterprise assets are insolvent and management is chaotic. To this end, this paper evaluates the financial performance of listed companies in China's coal industry by means of objective weight determination method, and uses the entropy method to evaluate the overall performance of coal listed companies.

2. LITERATURE REVIEW

Financial performance evaluation refers to the application of financial indicator system to scientifically and appropriately evaluate performance. Its connotation involves the selection of financial indicators and the establishment of an indicator system and the evaluation methods used. Research on financial performance evaluation, domestic and foreign scholars have made a lot of research.

Among them, domestic scholar Peng Xiaojie used factor analysis to evaluate the performance of 67 agricultural listed companies in China. The results found that the agricultural listed companies in China have large operating performance gaps, and they have profitability, operational capability, development capability and debt service. The development of the four aspects of capacity is uneven, and some countermeasures and suggestions are proposed based on the analysis results [1]. Chen Lining and others used the Wall score method to evaluate the financial performance of listed companies in China's coal industry. According to the horizontal data of the latest annual report of 26 listed companies in the coal industry, the objective entropy method is used to determine the weight of each indicator in the Wal-Scoring method. Through evaluation, the financial performance of listed companies was compared horizontally to achieve the expected results, and the shortcomings of the method were pointed out [2]. Chen Ling et al. carried out the moving average of the financial data of 27 agricultural listed companies in 2007-2009, and used the factor analysis method to evaluate the performance of the results. It is concluded that the current agricultural listed companies are generally small in scale and their business performance is "two small". , the middle of the big "the olive-type distribution, the development of the sub-industry is not balanced, and put forward some policy recommendations to improve the performance of agricultural listed companies [3]. Zhou Hui uses the power factor method to determine the actual measured value of the index in a dimensionless manner, so that each index is transformed into a fusionable, comprehensive relative quantitative value, and further determined by entropy method. The weight of each indicator in the performance score, and finally weighted to obtain a comprehensive score system of financial performance [4]. Yin Xia Nan constructed a complete financial risk quantitative index evaluation system from the five dimensions of solvency, operational ability, profitability, growth ability and cash flow. On the basis of using the entropy weight method to objectively empower the evaluation indicators, based on the principle of approaching the ideal solution, the financial risk assessment model of TOPSIS method was established, and the financial risk was scientifically calculated and evaluated by biopharmaceutical listed companies. The research results show that the established comprehensive evaluation model can effectively quantitatively evaluate the financial risks of enterprises [5]. Foreign scholar Karimi A collected financial information from 72 companies in four automotive, pharmaceutical, petrochemical and cement industries, selected appropriate financial indicators and measured the standard values. Use the negative data limited adjustment indicators in DEA to assess the financial performance of selected companies and identify high efficiency and inefficient companies. Finally, use the Andersen and Petersen models to rank effective

companies [6]. Chariri A selected the enterprise data listed on the Indonesian stock exchange in 2009-2014 as a research sample to investigate the impact of corporate characteristics on green investment and how green investment affects corporate financial performance. The survey results show the size of the company, foreign ownership, industry profile, the frequency of audit committee meetings and the impact of green investments are significant, while ISO14001 management certification has no impact on financial performance [7]. Ashraf YAY takes Pakistan's cement industry as the research object, constructs relevant evaluation indicators, and selects the data from 2006-2014 to evaluate the financial performance of the company. The results show that ROE\ROA and EPS have the greatest impact on the financial performance of the company, and the organizational performance of EVA and enterprises. There is also a certain connection [8]. Dawd I selected 51 non-financial companies listed in Kuwait to examine the relationship between corporate disclosures and corporate performance of listed companies on the Kuwait Stock Exchange (KSE). Empirical evidence suggests that between collective, mandatory and voluntary disclosures and corporate performance the linear relationship is not significant, and there is sufficient evidence to show that there is a nonlinear relationship between the disclosure type and the firm's performance agent [9]. Gabriela P introduces EVA and its advantages over other performance indicators and attempts to implement it in one of the Romanian banks [10].

Based on the above scholars' research, we can find that the financial performance evaluation methods of enterprises mainly include: AHP method, EVA and balanced scorecard, factor analysis method and so on. However, these methods have certain subjectivity in determining the weight of indicators. Therefore, this paper selects four aspects of profitability, solvency, and ability to fight and turnover to construct the financial performance evaluation index of listed companies in the coal industry. The power law analyzes the financial performance of coal listed companies, which can subjectively determine the defects of weights, and propose improvements to the development of financial performance of coal enterprises.

3. MODEL CONSTRUCTION- ENTROPY WEIGHT MODEL

3.1 Principle of Entropy Weight Method

Entropy was originally a thermodynamic concept. It was first introduced by Shennong in information theory and has been widely used in engineering, social and economic fields. According to the explanation of the basic principles of information theory, information is a measure of the order degree of the system. Entropy is a measure of the degree of disorder of the system. If the information entropy of the indicator is smaller, the amount of information provided by the indicator is larger, which is used in the comprehensive evaluation. The greater the role, the higher the weight should be.

3.2 Steps of the Entropy Method

(1) Standardization of data processing

In the calculation of the entropy weight model, in order to avoid the fact that the indicator data has a negative number and cannot calculate the weight, it is necessary to standardize the original data as follows:

$$r_{ij} = \frac{r_{ij} - \min(r_{ij})}{\max(r_{ij}) - \min(r_{ij})}$$（The indicator which is the Positive indicator）

$$r_{ij} = \frac{\max(r_{ij}) - r_{ij}}{\max(r_{ij}) - \min(r_{ij})}$$（The indicator which is the Negative indicator）

(2) Calculate the weight of each evaluation index in each evaluation object:

$$b_{ij} = \frac{r_{ij}}{\sum_{i=1}^{m} r_{ij}}$$

(3) Using the standardized data of the financial performance of the coal industry, the entropy weight calculation formula is used to calculate the information entropy of each evaluation index:

$$e_{ij} = -k\sum_{j=1}^{m}(b_{ij} \times \ln b_{ij})$$

(4) Calculate information entropy redundancy:

$$d_{ij} = 1 - e_{ij}$$

(5) Calculate indicator weights:

$$w_i = \frac{d_j}{\sum_{j=1}^{n} d_j}$$

(6) Calculate the scores of each indicator evaluation:

$$Z_{ij} = W_i \times r_{ij}$$

In the formula: $k = 1/\ln(m)$, m is the number of samples.

3.3 Construction of Evaluation Index System

The selection of evaluation indicators should follow the principles of comprehensiveness, authenticity, simplicity and operability. This paper uses relevant financial ratio indicators to measure the financial performance of listed companies in the coal industry, and selects profitability, solvency, development capacity, and turnover. Four aspects of capability, multiple indicators to build a financial performance evaluation system for listed companies in the coal industry. The specific indicator names, codes and meanings are shown in Table 1 below:

4. EMPIRICAL TEST AND ANALYSIS

4.1 Sample Selection and Data Sources

According to the classification under the CSRC industry, this paper selects 26 coal listed companies in the coal mining and selection industry as the research object according to the

classification of the CSRC industry, and removes the two coal companies from ST, and finally selects 25 coals. The quarterly data of listed companies in 2018 is used as a research sample. The data of each research sample are all from the annual report of Guotai'an database and listed companies.

Table 1. Variable name and specific meaning

Target layer	Specific indicators	Indicator Code	Indicator Description
Profitability	Gross Profit Margin	X_1	(Operating incomes- operating cost)/ Operating income
	Operating Profit Ratio	X_2	operating profit/ Operating incomes
	Net Profit Rate	X_3	Net profit/ Operating incomes
debt-paying ability	Current Ratio	X_4	Current Assets/ Current Liabilities
	Quick Ratio	X_5	Quick Assets/ Current Liabilities
	Equity Multiplier	X_6	Total Aaaets/Equities
Development ability	Total Assets Growth Rate	X_7	Asset growth for the current year/total assets at the beginning of the year
	Net Profit Growth Rate	X_8	(net profit for the current year- Net profit for the previous year)/ net profit for the current year
	Revenue Growth Rate	X_9	(Current operating income-Previous operating income)/ Current operating income
Turnover capacity	Receivables Turnover Ratio	X_{10}	Net income from main operations/average balance of accounts receivable
	Inventory Turnover Ratio	X_{11}	Inventory cost/ Average balance of inventory
	Turnover of total capital	X_{12}	Operating incomes/ Average balance of assets

4.2 Calculating Information Entropy and Entropy Redundancy

According to the calculation steps of the entropy weight method above, the information entropy and entropy redundancy of the 12 evaluation indicators are calculated. The calculation results are shown in Table 2 below.

Table 2. Information entropy and entropy redundancy

Evaluation index	e_{ij}	d_{ij}
Gross Profit Margin	0.928524235	0.071475765
Operating Profit Ratio	0.954093545	0.045906455
Net Profit Rate	0.946990879	0.053009121
Current Ratio	0.753993052	0.246006948
Quick Ratio	0.754612648	0.245387352
Equity Multiplier	0.981046585	0.018953415
Total Assets Growth Rate	0.9739626	0.0260374
Net Profit Growth Rate	0.973437575	0.026562425
Revenue Growth Rate	0.960243083	0.039756917
Receivables Turnover Ratio	0.850362614	0.149637386
Inventory Turnover Ratio	0.971640218	0.028359782
Turnover of total capital	0.964679552	0.035320448

4.3 Coal Enterprise Financial Performance Evaluation Results and Analysis

According to the original data above, combined with the entropy weight method, the data is processed by Excel tool, the weights of relevant indicators are calculated, and the index weights are sorted. The specific results are shown in Table 3 below:

Table 3. Related evaluation indicators

	Evaluation Content	Weight	Rank
Profitability	Gross Profit Margin	0.072460252	4
	Operating Profit Ratio	0.046538758	6
	Net Profit Rate	0.053739254	5
debt-paying ability	Current Ratio	0.24939538	1
	Quick Ratio	0.24876725	2
	Equity Multiplier	0.019214474	12
Development ability	Total Assets Growth Rate;	0.026396032	11
	Net Profit Growth Rate	0.026928289	10
	Revenue Growth Rate	0.040304518	7
Turnover capacity	Receivables Turnover Ratio	0.15169845	3
	Inventory Turnover Ratio	0.028750402	9
	Turnover Of Total Capital	0.035806942	8

From the perspective of index weighting, in the financial risk evaluation indicators of coal listed companies, the degree of influence on the financial performance of enterprises is the current ratio, quick ratio, accounts receivable turnover rate, gross profit margin, net profit margin, operating profit. Rate, operating income growth rate, total asset turnover, total asset growth, and equity multiplier. Among them, the biggest impact on the financial performance of listed companies in the coal industry is the current ratio, which is about 0.25, while the current ratio is the ratio of current assets to current liabilities. It is used to measure the liquidity of enterprises before they are short-term debts. The ability to repay debts indicates that the coal industry should pay more attention to the liquidity ratio of enterprises and enable enterprises to have sufficient solvency. At the same time, it is found that the least affected by each evaluation index is the equity multiplier, which is about 0.01, indicating that the coal industry can compare Less attention to the equity multiplier index; the second highest weighting ratio is the quick ratio, which further illustrates that coal companies should pay more attention to solvency; the third highest weight is the receivables turnover capacity, indicating that the coal industry should also pay more attention to Turnaround ability to ensure that it has sufficient funds.

According to the value of each evaluation index weight determined by the entropy weight method, the financial performance evaluation scores of 25 listed companies in the coal industry were calculated by the comprehensive evaluation method. The results are shown in Table 4 below:

5. CONCLUSIONS AND RECOMMENDATIONS

In this paper, from the four aspects of profitability, solvency, development ability and turnover capacity, 12 specific indicators were selected to construct the financial performance evaluation system of listed companies in the coal industry, and 25 coal listed companies were used as research objects for empirical analysis. The research shows that the financial performance of the 25 selected coal listed companies is quite different. Only a few companies have higher financial performance scores, while most of them have low-level financial performance levels. Based on this, the following suggestions are made:

Table 4. Comprehensive evaluation score and ranking

Stock Code	composite score	Rank
000552	0.25916539	11
000780	0.28126215	10
000937	0.17719154	20
000983	0.18724171	18
002128	0.34484876	2
600121	0.16703740	22
600123	0.31597127	3
600157	0.12099289	24
600188	0.25086622	12
600348	0.17028404	21
600395	0.23037413	13
600403	0.22763319	14
600508	0.30142787	6
600714	0.67963609	1
600758	0.11586470	25
600971	0.29666545	8
601001	0.29735177	7
601088	0.28616128	9
601101	0.31382490	5
601225	0.31459619	4
601666	0.14164329	23
601699	0.17852493	19
601898	0.21321501	17
601918	0.22249405	16
900948	0.22652112	15

From the above table, we can see the rankings of 25 listed companies in the coal industry. The top 5 companies in terms of financial performance are Jinrui Mining, Open-pit Coal, Lanhua Kechuang, Shaanxi Coal and Yanhua Energy, indicating that these five companies are listed. The company has a good operating effect and a low probability of financial risk. Among them, Jinrui Mining ranks first, indicating that the company is in a leading position in the company's comprehensive capabilities, solvency, profitability and growth capabilities, but is operating. There is room for improvement in terms of ability. The top five companies in the financial performance rankings are Yangquan Coal, Zhengzhou Coal, Pingmei, Yongtai Energy and Hongyang Energy, indicating that these companies have poor financial performance and that enterprises are prone to financial risks and should be given more attention.

(1) Optimizing the capital structure of coal listed companies. The capital of enterprises mainly comes from equity financing and debt financing. Interests in equity financing are high and the risks are small, but they will disperse power, interest on debt financing is low, and financial risks are high. Therefore, coal listed companies should optimize the capital structure according to the specific conditions of coal listed companies, rationally arrange the proportion of reasonable equity financing and liabilities, and optimize the allocation of funds.

(2) Strengthening cash flow management from the development, processing and sales of coal resources, the cash flow should be controlled within a reasonable range at each link. The cash flow of an enterprise is the blood of its production and operation, and the appropriate cash flow is the guarantee for the effective operation of the enterprise. The cash flow of the enterprise

includes cash flow from financing activities, cash flow from investment activities and cash flow from operating activities. In particular, it should strengthen the management of operating cash flow, improve the efficiency of capital use, and ensure the safe use of funds, thereby improving the quality of capital use and promoting business development. At the same time, it is necessary to enhance the efficiency of capital recovery.

(3) Establish risk awareness and strive for stability. Coal resources belong to the country's mineral resources. Coal listed companies range from coal mining to processing and sales. They have large projects and heavy tasks. They have huge demand for funds. A large proportion of the sources of funds are liabilities. Therefore, coal listed companies should improve their Financial risk and the importance of operational risks such as coal mining risks and processing risks. When exploring and developing mining projects, the impact of the use of funds should be fully considered, and the scope of the capital chain should not be exceeded. As a result, the capital chain should be broken and should be developed steadily and gradually.

(4) Strengthen the internal management of enterprises. The stable operation of coal enterprises requires strong financial strength and operational strength. Coal enterprises should put the strengthening of internal control mechanism construction, standardize operations, prevent and resolve financial risks in the first place of all work, establish financial early warning and supervision mechanisms, and comprehensively improve the internal company. Control the system to avoid blind expansion. It is also necessary to adhere to the principle of sound adherence, formulate a reasonable development plan, and plan a scientific business development strategy.

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