

Article

Research on Financial Risk Evaluation of Listed Companies in China's Steel Industry

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Abstract: To effectively identify the financial risk levels in the steel industry, this paper employs factor analysis to study the main financial indicators of 48 listed steel enterprises on the Shanghai and Shenzhen stock exchanges in 2022. After data standardization, five critical factors were extracted: profitability and growth factor, solvency factor, operational efficiency factor, profitability-cash factor, and operational-cash factor. These factors collectively provide a comprehensive assessment of enterprise financial risk. The analysis reveals significant differences in financial risk among enterprises. Companies with strong solvency and effective cash flow management exhibited lower financial risks, while enterprises suffering from poor operational efficiency and inadequate profitability faced higher risks. Consequently, the study concludes that steel enterprises should optimize debt structures, enhance operational management, and accelerate industrial transformation and upgrading to improve financial security and sustainable competitiveness.

Keywords: Listed Steel Enterprises; Factor Analysis; Financial Risk; Operational Efficiency; Sustainable Development

1. Introduction

The steel industry is an important pillar of the national economy, serving as a raw material provider for multiple downstream industries such as infrastructure construction, manufacturing, and real estate. It plays a crucial role in national economic security and industrial system construction. However, the steel industry itself has strong cyclicality and is highly susceptible to shocks from changes in the domestic and international macroeconomic environment. Particularly under the combined effects of fluctuations in raw material prices, increasingly stringent environmental protection policies, and slowing downstream demand, the operational risks of enterprises have significantly increased. In recent years, the complex international trade situation, rising energy costs, and the overlapping impact of the COVID-19 pandemic have posed challenges such as overcapacity, declining efficiency, and increased debt burdens on the steel industry.

The state continues to promote supply-side structural reforms in the steel industry, emphasizing capacity reduction, green development, and high-quality transformation. Policies such as the "Steel Industry Capacity Replacement Implementation Measures" and the "Carbon Peak and Carbon Neutrality Strategic Goals" require steel enterprises to optimize their structures, control

energy consumption, and enhance environmental protection standards. While these policies promote the healthy development of the industry, they also exacerbate the operational and financial pressures on some enterprises, especially small and medium-sized steel enterprises, which face greater survival pressures due to relatively weak financing capabilities, risk resistance, and profitability. Against this backdrop, researching the financial risks of steel industry enterprises is of great practical significance. On one hand, it helps identify key financial factors affecting the stable operation of steel enterprises and enhances their risk prevention and control capabilities. On the other hand, it provides scientific evidence for policymakers and financial institutions, enabling them to more accurately conduct industrial support and risk monitoring.

This paper selects 48 listed steel companies on the Shanghai and Shenzhen stock exchanges in 2022 as research samples. Based on factor analysis, it classifies and models the financial data of enterprises, extracts key factors reflecting corporate financial risks, and constructs a multi-dimensional financial risk evaluation model. Further, through comprehensive scoring and ranking, it analyzes the differences and causes of corporate financial risks and finally proposes practical risk control and management suggestions. It is hoped that this study can provide valuable references for steel enterprises to improve financial management levels and achieve high-quality development.

Domestic scholars have analyzed industry financial risk evaluations from different perspectives. Cheng Zike [1] selected the paper industry as the research object, chose 9 indicators related to profitability, solvency, and operational capacity, and used the AHP model. The study found that solvency accounts for the highest proportion and has the greatest weight in the paper industry. Zhao Yue [2] used the Z-score model to analyze the financial risks of 40 pharmaceutical manufacturing companies from 2017 to 2019. The study found that the overall financial situation of the pharmaceutical manufacturing industry during this period was not optimistic, with unstable and highly volatile financial conditions. Yan Jie [3] applied the MLP neural network method to predict the potential financial risks of 22 listed pharmaceutical manufacturing companies using 149 listed pharmaceutical manufacturing companies as the research sample. The study found that the prediction accuracy of both the training and test samples reached 98%, with extremely high predictive accuracy. Li Yongchen and Yang Zhiyuan [4] used entropy weight method to determine indicator weights and applied the TOPSIS evaluation model to conduct a comprehensive evaluation and analysis of the financial risks of 10 listed new energy industry sample companies, providing reasonable suggestions. Gao Shang and Ma Kun [5] used the entropy weight TOPSIS method, taking BYD, NIO, and other five new energy vehicle enterprises as research objects. By selecting indicators such as financing risk, investment risk, operational risk, and growth risk, and adjusting indicator weights according to entropy values, they evaluated the financial risk levels faced by different enterprises. The study found that Great Wall Motors has relatively low financial risks, while NIO faces greater financial risks. Wu Mei and Zhu Jiaming [6] used the analytic hierarchy process to construct a financial risk evaluation system for the real estate industry from three aspects: solvency, operational capacity, and profitability, and conducted empirical analysis combined with the characteristics of the real estate industry. The results showed that solvency accounts for 0.571 of the weight, ranking first, followed by operational capacity at 0.286, and finally profitability; among the secondary indicators, the quick ratio and current ratio account for the largest proportion. Cong Yuyue and Zhang Yuanyuan [7] used factor analysis and the Logistic model based on factor analysis

to forecast the financial risks of 137 listed real estate companies from 2012 to 2021. The research results showed that among the 137 companies, 60 had general risks, 40 had medium risks, and 21 had severe risks; development capacity, operational capacity, and profitability had a greater impact on the comprehensive financial risk of listed real estate companies. Wang Yaxi [8] conducted a specific analysis of the financial risks of listed real estate companies based on the factor analysis model, exploring four main problems in the real estate industry: poor solvency, insufficient profitability, weak operational capacity, and weak growth capacity, and proposed suggestions for adjusting capital structure, asset structure, and enhancing corporate profitability. Wang Hui and Mai Qiangsheng [9] constructed an indicator system reflecting the financial risks of the real estate industry from four aspects: solvency, operational capacity, profitability, and growth capacity, based on the characteristics of the real estate industry. They combined the matter-element extension model to evaluate the financial risks of the real estate industry from 2020 to 2022. Li Shiyao [10] conducted an empirical analysis of the financial risks of 39 listed logistics companies in China's Shanghai and Shenzhen A-shares from 2016 to 2018 using the Z-model. The study found that the overall financial risks of listed logistics companies in China are relatively low, but there are significant differences between companies. Chen Fan, Jing Yueyang, and Liu Changnan [11] selected relevant financial indicators of cultural media enterprises and used comparative factor analysis to find that the financial risks of the cultural media industry mainly exist in profitability, solvency, and operational capacity, with profitability being easily affected by the environment.

Regarding the steel industry, He Shuangliang and Bai Bing [12] took 36 listed steel companies on the A-share market in 2021 as the research object, selected 13 financial indicators representing solvency, profitability, operational capacity, growth capacity, and cash flow capacity, and constructed a financial risk evaluation system for listed steel companies in the steel industry, proposing suggestions for optimizing capital structure, strengthening inventory control, fund management, and cost control. He Fenli [13] used 45 steel-listed enterprises as the research object and constructed a financial risk evaluation model using the factor analysis method. The study found that low solvency, profitability, and operational capacity are the key factors causing high financial risk levels in steel enterprises. Qu Wenbin and Deng Fei [14] analyzed the impact of the financial leverage of listed steel companies in China on the total return on assets and net asset return on equity, thereby further exploring the impact of financial leverage on earnings and risks in the steel industry, and proposed suggestions for reasonably determining the capital structure, controlling the financial leverage level to match cash flow, and establishing a risk warning mechanism. Zhang Zenglian [15] found through statistical analysis that the financial leverage of the steel industry is relatively high, and the financial risk is large, especially in years affected by the financial crisis, when the number of enterprises where financial leverage plays a positive role decreases rapidly, and unreasonable financing decisions are prominent. Gong Shengli [16] selected listed steel enterprises in China as the research object to analyze the impact of the property rights structure, equity structure, and debt structure in the capital structure on the financial governance efficiency of enterprises. The results showed that the property rights structure, equity structure, and debt structure all significantly affect the financial governance performance of enterprises. The increase in the property rights ratio, equity concentration, equity checks and balances, and the proportion of commercial credit debt can improve the financial governance efficiency of enterprises, while the proportion of management shareholding only reduces the financial governance cost of enterprises and has no

significant impact on the financial governance performance. Liang Ying and Xu Na [17] conducted an empirical analysis of the profitability, solvency, and other five capabilities of Xining Special Steel and Jiugang Hongxing, two major steel listed companies in the northwest region, based on the fuzzy comprehensive evaluation financial analysis model, verifying the practicality and effectiveness of the model. Yao Cuihong [18] first constructed an environmental performance evaluation system with the production department, R&D department, environmental protection department, and finance department as the main bodies, and used the factor analysis method to correct and weight the evaluation indicators to obtain a weighted environmental performance evaluation indicator system; then conducted an empirical analysis based on the data of steel industry listed companies, finding problems in the internal management of environmental performance. Wang Wenmin [19] constructed a financial risk early warning indicator system and model for the steel industry, conducted an empirical analysis of the financial early warning of 40 steel industry listed companies, and found that there are generally problems in the financial management of steel industry listed companies, such as unreasonable capital structure, long capital turnover period, poor adjustment ability, and backward financial management. Through principal component analysis, 17 selected indicators reflecting the financial characteristics of the steel industry were optimized into 8 indicators, and different early warning levels were given. It was concluded that the main influencing factors of the financial crisis of steel industry listed companies come from four aspects of capability: solvency, asset operation capability, profitability, and cash flow capability, which explain approximately 85% of the variation in financial indicators and have a decisive significance for the comprehensive score. Wang Xiaopeng and Zhao Shuangqiang [20] based on the principal component analysis method, used the K-S test, T-test, and Mann-Whitney U test to select 13 variables from 42 important financial indicators and 1 non-financial indicator for principal component analysis, constructed the F-score model, and tested the established financial early warning model using the data of 24 listed steel companies in recent years. The results showed that the model has good reliability. Pan Yalin [21] constructed a financial risk evaluation system for listed steel companies in the steel industry using the principal component analysis method, conducted cluster analysis on the extracted four principal components, and classified the risk levels of listed steel companies. The study found that the overall operating efficiency of listed steel companies in the steel industry is poor, and the financial risk is large, mainly manifested as unreasonable capital structure, poor liquidity of current assets, and low profitability. It proposed that listed steel companies in the steel industry should optimize the capital structure, strengthen inventory management and cost control.

2. Materials and Methods

2.1. Data Selection and Sources

2.1.1. Sample Selection

This paper takes listed steel companies on the Shanghai and Shenzhen stock exchanges as the research object. In accordance with the completeness of financial information, companies with incomplete data, ST, and some abnormal indicators were excluded. A total of 48 steel listed companies were selected as samples. All data used in this study are sourced from Sina Finance and East Money.

2.1.2. Indicator Selection

Based on existing materials of listed steel companies in the steel industry and combined with the characteristics of enterprises in the industry, in accordance with the provisions of the new accounting standards, 18 financial indicators were selected to measure solvency, profitability, operational capacity, growth capacity, and cash flow. The specific indicators are shown in Table 1:

Table 1. List of Financial Indicators.

Type	Symbol	Indicator Name
Solvency	V1	Debt to Capital Ratio
	V2	Current Ratio
	V3	Equity Ratio
	V4	Equity Multiplier
Profitability	V5	Return on Total Assets
	V6	Return on Net Assets
	V7	Gross Profit Margin
	V8	Operating Profit Margin
Growth Capacity	V9	Sales Revenue Growth Rate
	V10	Total Profit Growth Rate
	V11	Operating Profit Growth Rate
	V12	Net Profit Growth Rate
Operational Capacity	V13	Accounts Receivable Turnover Rate
	V14	Inventory Turnover Rate
	V15	Current Asset Turnover Rate
	V16	Total Asset Turnover Rate
Cash Flow	V17	Net Cash Flow from Operating Activities as a Percentage of Net Profit
	V18	Net Cash Flow from Operating Activities as a Percentage of Operating

2.2. Factor Analysis

2.2.1. Preprocessing of Financial Indicators

Since different financial indicators have different meanings and units, to ensure the comparability of indicators, this paper uses the standard score method to standardize the sample data.

2.2.2. Test of Indicator Correlation and Feasibility of Factor Analysis

2.2.2.1. Indicator Correlation

The correlation matrix of the indicators is shown in Table 2.

Table 2. Correlation Matrix.

Zscore	Zscore (X1)	Zscore (X2)	Zscore (X3)	Zscore (X4)	Zscore (X5)	Zscore (X6)	Zscore (X7)	Zscore (X8)	Zscore (X9)
Zscore (X1)	1.00	-0.72	0.78	0.79	-0.54	-0.62	-0.66	-0.70	-0.18
Zscore (X2)	-0.72	1.00	-0.39	-0.41	0.35	0.32	0.65	0.58	-0.05
Zscore (X3)	0.78	-0.39	1.00	0.98	-0.38	-0.66	-0.41	-0.46	-0.23
Zscore (X4)	0.79	-0.41	0.98	1.00	-0.39	-0.64	-0.42	-0.48	-0.23
Zscore (X5)	-0.54	0.35	-0.38	-0.39	1.00	0.90	0.60	0.71	0.70
Zscore (X6)	-0.62	0.32	-0.66	-0.64	0.90	1.00	0.56	0.66	0.66
Zscore (X7)	-0.66	0.65	-0.41	-0.42	0.60	0.56	1.00	0.95	0.11
Zscore (X8)	-0.70	0.58	-0.46	-0.48	0.71	0.66	0.95	1.00	0.21
Zscore (X9)	-0.18	-0.05	-0.23	-0.23	0.70	0.66	0.11	0.21	1.00
Zscore (X10)	-0.54	0.31	-0.49	-0.50	0.85	0.88	0.43	0.54	0.80
Zscore (X11)	-0.39	0.20	-0.36	-0.37	0.54	0.57	0.26	0.33	0.68
Zscore (X12)	-0.56	0.35	-0.50	-0.51	0.85	0.88	0.44	0.55	0.79
Zscore (X13)	0.09	-0.18	-0.02	-0.03	-0.20	-0.19	-0.23	-0.21	-0.14
Zscore (X14)	0.03	-0.04	-0.08	-0.04	-0.09	-0.01	-0.37	-0.27	-0.03
Zscore (X15)	0.26	-0.38	0.12	0.16	-0.20	-0.18	-0.50	-0.44	0.02
Zscore (X16)	0.18	-0.26	0.01	0.04	-0.04	0.01	-0.46	-0.37	0.18
Zscore (X17)	-0.06	-0.10	-0.10	-0.09	-0.05	0.01	-0.13	-0.09	0.01
Zscore (X18)	-0.31	0.17	-0.19	-0.19	0.51	0.45	0.45	0.56	0.22

Table 2. Continued.

Zscore	Zscore (X10)	Zscore (X11)	Zscore (X12)	Zscore (X13)	Zscore (X14)	Zscore (X15)	Zscore (X16)	Zscore (X17)	Zscore (X18)
Zscore (X1)	-0.54	-0.39	-0.56	0.09	0.03	0.26	0.18	-0.06	-0.31
Zscore (X2)	0.31	0.20	0.35	-0.18	-0.04	-0.38	-0.26	-0.10	0.17
Zscore (X3)	-0.49	-0.36	-0.50	-0.02	-0.08	0.12	0.01	-0.10	-0.19
Zscore (X4)	-0.50	-0.37	-0.51	-0.03	-0.04	0.16	0.04	-0.09	-0.19

Zscore (X5)	0.85	0.54	0.85	-0.20	-0.09	-0.20	-0.04	-0.05	0.51
Zscore (X6)	0.88	0.57	0.88	-0.19	-0.01	-0.18	0.01	0.01	0.45
Zscore (X7)	0.43	0.26	0.44	-0.23	-0.37	-0.50	-0.46	-0.13	0.45
Zscore (X8)	0.54	0.33	0.55	-0.21	-0.27	-0.44	-0.37	-0.09	0.56
Zscore (X9)	0.80	0.68	0.79	-0.14	-0.03	0.02	0.18	0.01	0.22
Zscore (X10)	1.00	0.82	1.00	-0.17	-0.05	-0.20	0.01	-0.01	0.35
Zscore (X11)	0.82	1.00	0.80	-0.14	-0.12	-0.18	-0.02	-0.02	0.24
Zscore (X12)	1.00	0.80	1.00	-0.18	-0.04	-0.21	-0.01	-0.01	0.36
Zscore (X13)	-0.17	-0.14	-0.18	1.00	0.40	0.33	0.15	-0.14	-0.12
Zscore (X14)	-0.05	-0.12	-0.04	0.40	1.00	0.72	0.70	0.07	-0.09
Zscore (X15)	-0.20	-0.18	-0.21	0.33	0.72	1.00	0.84	0.24	-0.16
Zscore (X16)	0.01	-0.02	-0.01	0.15	0.70	0.84	1.00	0.13	-0.17
Zscore (X17)	-0.01	-0.02	-0.01	-0.14	0.07	0.24	0.13	1.00	0.10
Zscore (X18)	0.35	0.24	0.36	-0.12	-0.09	-0.16	-0.17	0.10	1.00

2.2.2.2. KMO and Bartlett's Test

The KMO and Bartlett's test are shown in Table 3.

Table 3. KMO and Bartlett's Test.

KMO and Bartlett's Tests	KMO and Bartlett's Tests	KMO and Bartlett's Tests
KMO Sampling Adequacy	KMO Sampling Adequacy	0.718
	Approx. Chi-Square	1114.639
Bartlett's Test of Sphericity	Degrees of Freedom	153
	Significance	0.000

2.2.2.3. Conclusion on the Feasibility of Factor Analysis

Combining the indicator correlation matrix, it is evident that there is a correlation between the indicators. The KMO value is 0.718, which is between 0.5 and 1, and the observed value of Bartlett's sphericity test (approximately chi-square) is 1114.639, with a corresponding significance level of 0.000, less than 5%. This indicates that there is a moderate correlation between the sample variables, making it suitable for factor analysis.

2.2.3. Extraction of Principal Factors

2.2.3.1. Scree Plot

The scree plot indicates that after the sixth factor, each factor shows a flat trend, so five principal factors should be extracted.

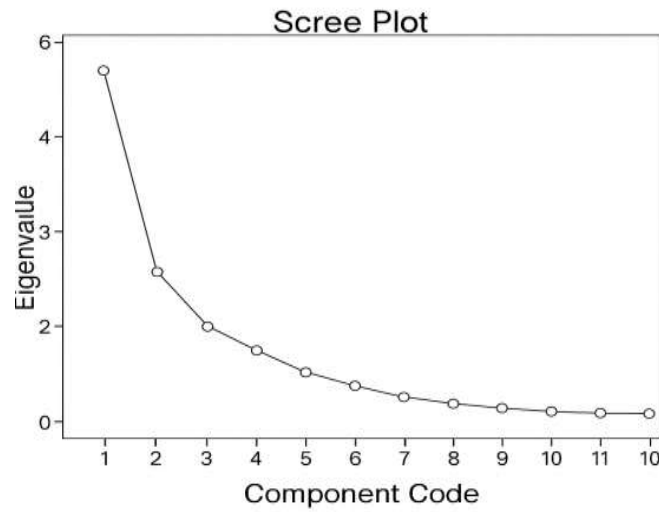


Figure 1. Scree plot.

2.2.3.2. Total Variance Explained

The total variance explained by the factors is shown in Table 4.

Table 4. Total Explained Variance.

Component	Initial Eigenvalues			Rotated Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.59	42.168	42.168	4.688	26.044	26.044
2	3.062	17.009	59.177	3.503	19.460	45.504
3	2.043	11.347	70.524	2.935	16.306	61.810
4	1.181	6.561	77.085	2.712	15.065	76.875
5	1.16	6.445	83.530	1.198	6.655	83.530
6	0.86	4.779	88.309			
7	0.601	3.341	91.650			
8	0.455	2.53	94.180			
9	0.345	1.918	96.098			
10	0.221	1.226	97.324			
11	0.145	0.805	98.129			
12	0.125	0.694	98.823			
13	0.09	0.502	99.325			
14	0.058	0.324	99.648			
15	0.033	0.185	99.834			
16	0.021	0.115	99.949			
17	0.008	0.043	99.992			
18	0.001	0.008	100.000			

Factor analysis shows that five principal factors can be extracted, with the cumulative contribution rate of the rotated square sum of loadings reaching 83.53%. Among them, f1 contributes 26.044%, f2 contributes 19.460%, f3 contributes 16.306%, f4 contributes 15.065%, and f5 contributes 6.655%.

2.2.4. Establishment of Factor Loading Matrix

The rotated factor matrix is shown in Table 5.

Table 5. Rotation Component Matrix.

Zscore	Component				
	1	2	3	4	5
Zscore (X1)	-0.231	-0.825	0.094	-0.380	-0.009
Zscore (X2)	-0.006	0.576	-0.224	0.448	-0.165
Zscore (X3)	-0.281	-0.910	-0.051	-0.042	-0.082
Zscore (X4)	-0.280	-0.913	-0.015	-0.044	-0.067
Zscore (X5)	0.741	0.172	-0.031	0.569	-0.019
Zscore (X6)	0.742	0.423	0.019	0.397	0.053
Zscore (X7)	0.152	0.409	-0.403	0.722	-0.116
Zscore (X8)	0.259	0.410	-0.293	0.768	-0.070
Zscore (X9)	0.932	-0.057	0.074	0.021	0.059
Zscore (X10)	0.912	0.284	-0.041	0.229	-0.006
Zscore (X11)	0.823	0.197	-0.124	-0.018	-0.010
Zscore (X12)	0.894	0.305	-0.044	0.248	-0.004
Zscore (X13)	-0.182	0.105	0.457	-0.16	-0.523
Zscore (X14)	-0.067	0.101	0.895	-0.019	-0.121
Zscore (X15)	-0.078	-0.163	0.905	-0.142	0.135
Zscore (X16)	0.131	-0.094	0.861	-0.163	0.109
Zscore (X17)	-0.065	0.114	0.173	-0.020	0.883
Zscore (X18)	0.216	-0.011	-0.007	0.763	0.191

From the analysis of Table 5, it can be seen that in factor f1, X9, X10, X11, X12, X5, and X6 have larger loadings, hence named 'Development Profit Factor'; in factor f2, X1, X2, X3, and X4 have larger loadings, hence named 'Debt Repayment Factor'; in factor f3, X14, X15, and X16 have larger loadings, hence named 'Operational Capability'; in factor f4, X7, X8, and X18 have larger loadings, hence named 'Profit Cash Factor'; in factor f5, X13 and X17 have larger loadings, hence named 'Operational Cash Factor'.

2.2.5. Model Construction and Evaluation

The factor score coefficient matrix is shown in Table 6.

Table 6. Component Scoring Coefficient Matrix.

Zscore	Component				
	1	2	3	4	5
Zscore (X1)	0.068	-0.261	-0.018	-0.030	-0.019

Zscore (X2)	-0.114	0.160	-0.007	0.138	-0.117
Zscore (X3)	0.018	-0.363	-0.012	0.192	-0.072
Zscore (X4)	0.017	-0.364	0.001	0.197	-0.062
Zscore (X5)	0.129	-0.118	0.065	0.224	-0.040
Zscore (X6)	0.124	0.028	0.051	0.068	0.023
Zscore (X7)	-0.086	0.015	-0.036	0.298	-0.077
Zscore (X8)	-0.065	-0.004	0.011	0.332	-0.046
Zscore (X9)	0.287	-0.125	0.002	-0.101	0.007
Zscore (X10)	0.221	-0.016	-0.005	-0.051	-0.035
Zscore (X11)	0.242	0.005	-0.079	-0.198	-0.035
Zscore (X12)	0.211	-0.009	-0.003	-0.040	-0.032
Zscore (X13)	-0.036	0.086	0.180	-0.022	-0.451
Zscore (X14)	-0.051	0.049	0.362	0.134	-0.133
Zscore (X15)	-0.020	-0.036	0.335	0.112	0.078
Zscore (X16)	0.043	-0.023	0.308	0.045	0.050
Zscore (X17)	-0.072	0.076	0.033	0.009	0.744
Zscore (X18)	-0.054	-0.180	0.118	0.474	0.157

The factor fractional expression is:

$$f1 = 0.068X1 - 0.114X2 + 0.018X3 + 0.017X4 + 0.129X5 + 0.124X6 - 0.086X7 - 0.065X8 + 0.287X9 + 0.221X10 + 0.242X11 + 0.211X12 - 0.036X13 - 0.051X14 - 0.020X15 + 0.043X16 - 0.072X17 - 0.054X18$$

$$f2 = -0.261X1 + 0.160X2 - 0.363X3 - 0.364X4 - 0.118X5 + 0.028X6 + 0.015X7 - 0.004X8 - 0.125X9 - 0.016X10 + 0.005X11 - 0.009X12 + 0.086X13 + 0.049X14 - 0.036X15 - 0.023X16 + 0.076X17 - 0.180X18$$

$$f3 = -0.018X1 - 0.007X2 - 0.012X3 + 0.001X4 + 0.065X5 + 0.051X6 - 0.036X7 + 0.011X8 + 0.002X9 - 0.005X10 - 0.079X11 - 0.003X12 + 0.180X13 + 0.362X14 + 0.335X15 + 0.308X16 + 0.033X17 + 0.118X18$$

$$f4 = -0.030X1 + 0.138X2 + 0.192X3 + 0.197X4 + 0.224X5 + 0.068X6 + 0.298X7 + 0.332X8 - 0.101X9 - 0.051X10 - 0.198X11 - 0.040X12 - 0.022X13 + 0.134X14 + 0.112X15 + 0.045X16 + 0.009X17 + 0.474X18$$

$$f5 = -0.019X1 - 0.117X2 - 0.072X3 - 0.062X4 - 0.040X5 + 0.023X6 - 0.077X7 - 0.046X8 + 0.007X9 - 0.035X10 - 0.035X11 - 0.032X12 - 0.451X13 - 0.133X14 + 0.078X15$$

According to the contribution rates of each factor in Table 4, the linear expression of the financial risk assessment model is obtained as follows:

$$F = 0.26044f1 + 0.19460f2 + 0.16306f3 + 0.15065f4 + 0.06655f5$$

3. Results

The standardized data of the samples were substituted into the five factor analysis expressions to calculate the f1, f2, f3, f4, and f5 of each sample company. These values were then substituted into the financial risk evaluation model to calculate the comprehensive score F. The calculation results and financial risk rankings are shown in Table 7.

Table 7. Comprehensive Factor Scores and Rankings of Listed Companies in the Steel Industry.

Stock code	f1	f2	f3	f4	f5	F	Ranking
002756	4.72205	-0.44603	0.64426	2.51997	-0.47372	1.596173714	1
603995	0.63971	-0.46202	3.31013	0.29826	0.15235	0.67151854	2
601686	0.1138	-0.19087	2.75719	0.07414	0.20256	0.46673173	3
002978	-0.67884	0.78575	-0.40404	3.35163	-0.13773	0.405984226	4
000629	0.21286	0.72625	0.88381	0.27724	0.16922	0.393907364	5
002478	2.89187	0.23110	-1.04338	-1.74006	-0.02554	0.364157414	6
000655	-0.87872	1.95220	0.13293	1.07501	-0.62179	0.293289981	7
000898	-0.59769	0.84152	0.48387	-0.68581	3.93839	0.245779829	8
000825	-0.50844	0.48296	0.63578	-0.50887	3.20249	0.201700633	9
002318	0.63884	0.35516	-0.64173	0.27981	0.12227	0.181143577	10
600022	-0.21616	-0.24648	1.44533	0.04737	0.47055	0.169865184	11
600295	0.27866	-0.27146	-0.15765	0.94542	0.20329	0.149998158	12
605158	0.40621	-0.13839	0.29221	-0.19047	0.71739	0.145558400	13
000932	0.20291	-0.04260	0.55507	-0.10706	0.05545	0.122627243	14
833751	0.20308	0.63811	-0.86208	0.48808	0.16914	0.121281115	15
601969	0.08938	0.15667	-0.37400	0.66930	0.18079	0.105643289	16
002545	0.81843	0.38480	-1.13723	-0.00954	-0.08491	0.095509304	17
000708	0.39397	-0.42954	0.12443	0.21787	0.19323	0.084988191	18
600126	-0.32670	0.97528	0.53285	-0.70534	-0.11619	0.077598346	19
001203	-0.29067	0.13426	-0.59290	1.41261	0.16027	0.077222292	20
600782	-0.11239	0.25961	0.79917	-0.52088	-0.09309	0.066896203	21
600507	0.09028	-0.01682	0.25217	-0.13485	0.30725	0.061490526	22
000717	-0.92627	0.47773	2.45597	-0.51034	-1.72433	0.060562085	23
601121	-0.40753	-0.41491	-0.69968	2.11982	0.58310	0.057187768	24
000923	-1.04081	1.34646	-1.01196	1.50021	-0.37425	0.027042661	25
002443	-0.14193	0.87744	-0.33675	-0.50196	0.16141	0.013996681	26
600019	0.03624	0.15088	-0.15556	-0.37091	0.48345	-0.010270014	27
002075	-0.07437	0.24975	0.17870	-0.36616	-0.52536	-0.031753463	28
603878	0.35513	0.76351	-0.90796	-0.85162	-0.03353	-0.037510829	29
000778	0.05845	0.09213	-0.25140	-0.41646	0.15422	-0.060318426	30
600382	-1.35703	2.11861	-1.33378	1.05484	-0.92854	-0.061512245	31
600282	0.06035	-0.27509	-0.10088	-0.30719	0.13939	-0.091266222	32
002110	-0.50931	0.65479	1.34146	-0.71381	-3.15102	-0.103719952	33
000959	-0.2086	-0.58883	0.06906	-0.17293	0.81783	-0.129278496	34
601005	-0.58751	0.49822	0.50428	-0.82864	-0.79520	-0.151584772	35
601096	0.52368	-0.51476	-0.72559	-0.69117	0.44960	-0.156303663	36
835857	0.33678	-0.02878	-0.52042	-0.84652	-0.75031	-0.180210659	37
300881	0.71315	0.52534	-1.04210	-1.68977	-0.73886	-0.185695860	38
600399	-0.00277	0.33431	-0.88230	-0.74919	0.00191	-0.192270894	39
000761	-0.51279	-0.06766	0.01192	-0.70684	-0.01220	-0.252071344	40
600808	-0.18899	-0.68418	-0.09174	-0.40748	-0.75997	-0.309283974	41
000709	0.10135	-1.58093	-0.51117	0.00657	0.40066	-0.336951071	42
600010	-0.36629	-0.27721	-0.81843	-0.70958	-0.16578	-0.400725715	43
688186	0.60143	-0.43380	-1.42823	-1.40402	-0.87440	-0.430375168	44
600307	-0.94338	-0.84533	-0.03939	-0.53934	-0.08476	-0.503510388	45
601003	-0.98559	-2.25465	-0.09548	0.41978	-0.39917	-0.674335825	46
600569	-1.77724	-1.72930	-0.69743	-0.19431	0.01090	-0.941656508	47
600581	-0.84856	-4.07319	-0.54732	0.82317	-0.57646	-1.017240592	48

4. Discussion

4.1. Overall Analysis

Among the 48 listed steel companies, 26 companies have an F value greater than 0, and 22 have an F value less than 0. The larger the F value, the lower the financial risk level of the enterprise; the smaller the F value, the higher the financial risk level. The maximum F value among the sample companies is 1.596, and the minimum is -1.017, with a difference of 2.613, indicating significant differences in financial risk levels. This reflects the uneven development of China's steel industry, and there are substantial differences in the financial risk levels among enterprises in the industry.

4.2. Factor Analysis

Based on the results of factor analysis, the statistics of positive and negative factors are shown in Table 8:

Table 8. Statistics of Positive and Negative Factors (Unit: pieces).

Item	f1		f2		f3		f4		f5	
	> 0	< 0	> 0	< 0	> 0	< 0	> 0	< 0	> 0	< 0
F > 0	14	12	16	10	15	11	15	11	17	9
F < 0	9	13	9	13	5	17	4	18	8	14
Total	23	25	25	23	20	28	19	29	25	23

4.2.1. Industry-Based Factor Analysis

From Table 8, it can be seen that f3 and f4 have significantly more negative values than positive values, indicating that most steel companies in 2022 had weak operational capacity and profitability and cash acquisition capabilities.

4.2.2. Company-Based Factor Analysis

Table 9. Summary of Impact Factors.

Classification	Influencing Factors
Listed Steel Companies	Operational Capacity, Profitability and Cash Acquisition Capability
Steel Companies with Lower Financial Risk	Solvency, Operational Capacity, Cash Acquisition Capability
Steel Companies with Higher Financial Risk	Operational Capacity, Profitability

For steel companies with an F value higher than 0, i.e., those with lower financial risk levels, f2, f3, f4, and f5 have significantly more positive values than negative values. It can be seen that f2 and f5 have a greater impact, so stronger solvency, operational capacity, profitability, and cash acquisition capabilities are the main reasons for the lower financial risk of these steel companies.

For steel companies with an F value lower than 0, i.e., those with higher financial risk levels, f3 and f4 have significantly fewer positive values than negative values, indicating that their impact is relatively large. This shows that weaker operational capacity and profitability are the main reasons for the higher financial risk levels of these enterprises.

In summary, for the entire industry and companies in different financial situations, the key factors affecting their financial risk levels vary. The influencing factors are summarized in Table 9.

5. Conclusions

This paper selects 48 listed steel companies as research samples and uses the factor analysis method to establish a financial risk evaluation model. The model analyzes influencing factors from both industry and company perspectives. The study finds that listed steel companies with lower financial risks are significantly influenced by solvency, operational capacity, and cash acquisition capabilities; those with higher financial risks are significantly influenced by operational capacity and profitability. Therefore, the following recommendations are made:

5.1. Reasonably Determine the Capital Structure and Reduce Debt Risk

The steel industry is a capital-intensive industry. Seeking sufficient capital guarantees through debt operations and using financial leverage to amplify profits and save taxes is common in the production and operation of the steel industry. However, excessive debt scale can increase capital costs, erode operating profits, and exacerbate corporate financial risks. Therefore, optimizing the debt structure and controlling the debt scale are important tasks to prevent systemic debt risks, reduce financial leverage, eliminate the hidden dangers of high-interest debts, and lower financial risks to prevent enterprises from suffering immeasurable losses. In the current context of capacity reduction, the rising cost of financing, aggressive expansion does not create more benefits but instead increases the demand for funds sharply, widening the capital gap and leading enterprises into a vicious cycle of borrowing to repay debts. In the post-pandemic period, steel enterprises financing for supplementing working capital or project construction, but excessive debt, mismatched with operating income and capital structure, can easily lead to a break in the capital chain and even face bankruptcy. Therefore, steel enterprises should pay attention to the debt structure and reasonably control the financing amount.

5.2. Manage Inventory and Production, Adjust Investment Structure

Since the steel industry is a cyclical industry, it is greatly affected by fluctuations in iron ore and external environments. Therefore, enterprises in the industry, while reducing inventory and accelerating the collection process, can consider using the futures market to hedge against the impact of raw material fluctuations on their costs. At the same time, while maintaining the main position of the steel business, they can deeply integrate investments around the steel ecological industry chain, optimize industrial layout, increase investment in technological R&D, upgrade technology integration platforms, and establish business management advantages. In investment decision-making, it is necessary to strengthen policy interpretation, market research, and risk control analysis, enhance investment budget management, control investment processes, and achieve pragmatic and effective diversified development against the backdrop of capacity reduction.

5.3. Establish a Risk Warning Mechanism

In the face of the current sluggish industry situation, it is necessary to make full preparations for potential risks, strengthen the timeliness of risk response, and improve the financial risk warning mechanism. Establish a financial risk warning position, allocate professional personnel, assign dedicated responsibilities, and ensure enterprise risk control and early warning. The improvement of risk awareness should not be limited to financial personnel; a comprehensive management training system for employees' risk prevention and response capabilities should be established. Pre-formulate risk response plans to ensure sufficient plans and measures are in place at the first sign of risk.

5.4. Accelerate Transformation and Improve Profitability

Keep up with the national "Belt and Road" initiative, promote industrial transformation and upgrading, especially green transformation and upgrading, increase investment in product R&D, and enhance sustainable profitability.

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