Financial Risk Assessment Based on Factor Analysis Model

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Abstract. Based on factor analysis,this paper establishes a financial risk assessment model at the company level,and determines the influence degree of the solvency,operation ability,profitability, development ability and the ability to obtain cash flow on the model,and collects a large amount of relevant information and data ,calculates the index weight .Finally, based on the analysis of the actual situation of each real estate company in China,the SPSS software is used for empirical analysis, and divides the risk levels of these 120 real estate companies.And then we put forward corresponding suggestions.

1. Introduction

The connotation of the factor analysis method is to study the dependence of the correlation matrix between the multiple variables collected, and classify the closely related variables into the same category. Variable dimensionality reduction means that most of the information of the original variables are reflected centrally with fewer correlation factors, and there is no overlap with each other. The correlation between factors is weak and has a high cumulative contribution rate. The original variables are expressed and processed through linear combination, and the subjective components are reduced accordingly. Using research on this method, the main common factors can be analyzed and calculated. Mathematical transformation and 0-1 standardized ranking can be used to describe the original variables and explain complex relationships, which is conducive to comprehensive evaluation . Find out the common factors that can reflect all variables to the greatest extent through matrix transformation, and then express the original variables as a linear combination of common factors.

Factor analysis methods are widely used in major fields. Pay attention to the financial status of real estate listed companies and conduct financial risk analysis on them. Operators can find signs as early as possible and take measures; and investors can also make effective judgments to avoid blindness of investment . Therefore, this paper builds a set of financial risk assessment system that conforms to the actual situation of real estate enterprises based on integrating various internal and external factors as much as possible, which has certain practical significance for identifying and judging the financial risks of real estate enterprises in my country as early as possible and preventing the emergence of financial crisis.

2. Mathematical model of factor analysis

The specific steps are to use the original variables to calculate the variable correlation coefficient matrix, select the common factors based on the index with eigenvalues greater than 1, calculate the initial matrix using the principle of principal component analysis, and calculate the rotated matrix using the maximum variance method. Obtain the variance contribution rate result, do factor weighting after determining the common factor to obtain the factor analysis weight .

2.1. Establish the factor load matrix.

Enter the standardized decision matrix $P = \begin{bmatrix} P_{11} & \cdots & P_{1m} \\ \vdots & \ddots & \vdots \\ P_{n1} & \cdots & P_{nm} \end{bmatrix}$ into SPSS to get the factor load matrix a_{ij} , find the factor analysis factor load Q_j, and do the percentage treatment to get W_j.

$$W_j = \frac{Q_j}{\sum_{j=1}^{m} Q_j} \quad (1)$$

2.2. Calculate the public variance.

The public variance of the i is defined as the square sum of the elements in the i row of the factor load matrix a_{ij}, and m is the number of allocation principles.

$$h^2 = \sum_{j=1}^{m} a_{ij}^2 \quad (2)$$

2.3. Calculate the factor variance contribution rate.

The variance contribution rate is the sum of the squares of the elements in the jth column of the factor load matrix, which reflects the explanation of the total variance of the original variables by the jth factor. The higher the value, the higher the importance.

$$s_j^2 = \sum_{i=1}^{n} a_{ij}^2 \quad (3)$$

3. Empirical process and analysis based on factor analysis

This paper selects 120 listed real estate companies for research, using the A-share market as the sample source. The three-year data from 2017 to 2019 was selected in the period. Due to the limited space, this article will conduct detailed factor analysis on the 2017 data on the sample companies. The other two years will not be displayed one by one, and the 2017 method will be used for analogy.

3.1. Index system establishment

This paper determines five types of financial indicators that reflect the company's solvency, operating ability, profitability, development ability, and ability to obtain cash flow, constructs a financial risk evaluation indicator system for listed real estate companies, and ranks then according to X1 to X14.As shown in Table 1:

Table 1 Evaluation index system

solvency	X1	Current ratio = current assets/current liabilities
	X2	Quick ratio = (current assets-inventory) / current liabilities
	X3	Asset-liability ratio = total debt/ total assets × 100%
operation ability	X4	Inventory turnover = main business cost / average inventory balance
	X5	Current Assets Turnover = main business income / average balance of current assets
	X6	Total asset turnover = main business income / average total assets
profitability	X7	Operating net interest rate = net profit / main business income
	X8	Net interest rate of total assets = net profit / average total assets
	X9	Return on Equity= net profit / average total assets
the ability to obtain cash flow	X10	Operating income cash content = operating income cash / main business income
	X11	Net cash content of operating profit = net cash flow from operating activities / operating profit
development ability	X12	Operating income growth rate = increasing operating income
	X13	Increase in net profit / Net profit in the previous period
	X14	Increase in total assets / Total assets in the previous period

3.2. Factor practicability test

This article chooses to use KMO test and Bartlett sphericity test method. The value of KMO statistic is between 0 and 1, and 0.5 is used as the cut-off point of data acceptance. When the square sum of simple correlation coefficients among all variables is much larger than the square sum of partial correlation coefficients, the KMO value is greater than 0.5, which means that the original Factors can be used for variables with strong correlation. As shown in Table 3-3 below, the 2017 sample data's KMO test result

is 0.619, so the data can be used for the main component analysis. From the results of the Bartlett sphericity test, the result of the statistical value is larger, 579.844, the significance probability is 0.000, which is far less than the critical value of 0.05, indicating that the data are relevant and can accept the results of factor analysis. As shown in Table 2:

Table 2 KMO test and Bartlett sphericity test

Kaiser-Meyer-Olkin		0.619
Bartlett's sphericity test	Approximate chi-square	579.844
	df	91
	Sig.	0.000

3.3. Common factor extraction

Table 3 shows the variance contribution rate of the original variables and the factors. It can be seen that the 7 selected common factors with eigenvalues equal to 1 explain 82.683% of the total variance, which can already be summarized by the 16 original variables. Most of the information, the results are more satisfactory.

Table 3 The variance contribution rate

	Initial characteristic root			Extract the sum of squares			Load rotation square and load		
	Total	variance%	Grand total%	Total	variance%	Grand total%	Total	variance%	Grand total%
1	3.064	21.882	21.882	3.064	21.882	21.882	2.332	16.659	16.659
2	2.198	15.699	37.581	2.198	15.699	37.581	2.280	16.288	32.948
3	1.874	13.385	50.966	1.874	13.385	50.966	2.040	14.569	47.517
4	1.569	11.205	62.171	1.569	11.205	62.171	1.663	11.878	59.395
5	1.063	7.593	69.764	1.063	7.593	69.764	1.157	8.262	67.657
6	.983	7.019	76.783	.983	7.019	76.783	1.065	7.604	75.261
7	.826	5.900	82.683	.826	5.900	82.683	1.039	7.422	82.683
8	.562	4.011	86.694						
9	.456	3.256	89.950						
10	.409	2.921	92.871						
11	.377	2.691	95.562						
12	.275	1.965	97.527						
13	.187	1.338	98.865						
14	.159	1.135	100.000						

3.4. Common factor naming

Because the extracted factor variables are correlated with the original multiple financial indicator variables, and the load difference of the same factor variable on different financial indicators is not obvious, it is difficult to explain the initially extracted factor variables. To make the extracted factors easier to interpret in an economic sense, this paper chooses the orthogonal variance method of maximum variance to convert it to obtain a rotated factor load matrix. As shown in Table 4:

Table 4 Rotating component matrix

	Index components						
	1	2	3	4	5	6	7
X1	-0.112	0.82	-0.041	-0.236	0.058	0.165	0.037
X2	-0.013	0.864	-0.037	-0.094	0.338	-0.012	-0.009
X3 forward	0.051	-0.872	-0.044	-0.03	0.088	0.123	-0.039
X4	-0.009	0.17	-0.011	0.031	0.942	-0.001	-0.037
X5	0.067	-0.232	0.016	0.821	0.301	0.03	-0.028
X6	0.129	-0.041	0.032	0.884	-0.212	0.039	-0.157
X7	0.832	-0.011	-0.016	0.093	0.028	-0.108	0.242
X8	0.911	-0.058	0.129	0.194	-0.022	0.029	0.021
X9	0.867	-0.100	0.082	-0.065	-0.018	0.09	-0.121

X10	0.092	0.053	-0.044	-0.155	-0.039	0.041	0.96
X11	0.014	0.005	-0.047	0.049	0.000	0.963	0.037
X12	0.057	-0.008	0.845	0.206	-0.069	0.009	-0.105
X13	0.098	0.005	0.851	0.006	0.008	0.128	0.009
X14	0.024	-0.019	0.753	-0.15	0.041	-0.229	0.035

To sum up,it can be seen that the factor F1 has a large load on the three indicators of X7 (operating net interest rate), X8 (total asset net interest rate), and X9 (return on net assets), so it can be named profitability accordingly. Factor; factor F2 has the largest load on X1 (current ratio) and X2 (quick ratio), so it can be named as the solvency factor; F3's load is concentrated in X12 (operating income growth rate), X13 (net profit growth rate)) And X14 (total asset growth rate), we named it as the growth capability factor; most of the load of F4 is reflected in X5 (current asset turnover rate) and X6 (total asset turnover rate), and is named Operating capacity factor A; F5 is only named as operating capacity factor B on X4 (inventory turnover rate); F6 is named because of concentrated load X11 (operating profit cash content) and has a higher load on X3 Comprehensive factor of debt service and cash flow; F7 concentration X10 (operating income cash content) can be named as cash flow capacity factor.

3.5. Calculate factor score

This paper uses the regression method in SPSS21.0 software to estimate the factor's score coefficient and output the factor score coefficient matrix.

Table 5 Component score coefficient matrix

	Index components						
	1	2	3	4	5	6	7
X1	0.008	0.352	0.003	-0.066	-0.056	0.151	-0.027
X2	0.048	0.371	-0.015	0.029	0.164	-0.018	-0.048
X3 forward	-0.004	-0.454	-0.015	-0.165	0.219	0.132	-0.032
X4	0.004	-0.058	0.015	-0.012	0.849	0.001	-0.002
X5	-0.077	-0.046	-0.004	0.524	0.254	-0.01	0.153
X6	-0.028	0.134	-0.022	0.576	-0.237	-0.014	0.006
X7	0.357	0.027	-0.059	0.006	0.036	-0.12	0.171
X8	0.392	0.043	-0.003	0.032	-0.022	0.013	-0.041
X9	0.425	-0.011	-0.025	-0.186	-0.003	0.086	-0.244
X10	-0.055	-0.014	0.034	0.095	-0.002	0.013	0.967
X11	-0.01	-0.01	0.025	-0.015	0.003	0.91	0.013
X12	-0.048	0.028	0.417	0.094	-0.05	0.043	-0.024
X13	-0.019	0.003	0.433	-0.028	0.028	0.164	0.046
X14	-0.028	-0.03	0.375	-0.098	0.064	-0.175	0.059

According to the factor score coefficient and the standardized value of the original variable, we can calculate the score coefficient of each factor, the expression is as follows:

F1=0.008X1+0.048X2-0.004X3+0.004X4-0.077X5-0.028X6+0.357X7+0.392X8+0.425X9-0.055X10-0.010X11-0.048X12- 0.019X13-0.028X14
F2=0.352X1+0.371X2-0.454X3-0.058X4-0.046X5+0.134X6+0.027X7+0.043X8-0.011X9-0.014X10- 0.01X11+0.028X12+0.003X13-0.03X14
F3=0.003X1-0.015X2-0.015X3+0.015X4-0.004X5-0.022X6-0.059X7-0.003X8-0.025X9+0.034X10+0.025X11+0.417X12+0.433X13+0.375X14
F4=-0.066X1+0.029X2-0.165X3-0.012X4+0.524X5+0.576X6+0.006X7+0.032X8-0.186X9+0.095X10-0.015X11+0.094X12-0.028X13-0.098X14
F5=-0.056X1+0.164X2+0.219X3+0.849X4+0.254X5-0.237X6+0.036X7-0.022X8-0.003X9-0.002X10+0.003X11-0.050X12+0.028X13+0.064X14
F6=0.151X1-0.018X2+0.132X3+0.001X4-0.010X5-0.014X6-0.120X7+0.013X8+0.086X9+0.013X10+0.910X11+0.043X12+0.164X13-0.175X14
F7=-0.027X1-0.048X2-0.032X3-0.002X4+0.153X5+0.006X6+0.171X7-0.041X8-0.244X9+0.967X10+0.013X11-0.024X12+0.046X13+0.059X14

Figure 1 Score coefficient expression

The above seven factors reflect the contribution rate of individual indicators from different angles, but the use of a single factor cannot comprehensively evaluate all variables.We take the rotated variance contribution rate as the comprehensive score of the weight calculation factor: F=0.16659F1+0.16288F2+0.14569F3+0.11878F4+0.08262F5+0.07604F6+0.07422F7

Using the above formula, we can use the SPSS21.0 and EXCEL, calculate the final scores of the main factors and comprehensive factors of each sample in 2017-2019, and sort and count them.

Table 6 Score summary of 2017-2019

Overall rating	2017	2018	2019
F≥0	49	48	46
F<0	71	72	74
High risk ratio	59.17%	60%	61.67%

4. Result analysis

The study found that in 2017, a total of 71 of the 120 sample companies selected had negative factor scores, that is, they had higher financial risks, compared with 72 and 74 in 2018 and 2019, respectively. Therefore, we can think that the development of my country's real estate industry has been very stable in recent years, and most enterprises still face serious financial risks.Besides, in the scoring results, *ST Songjiang, S*ST forwards, ST horses, and other companies that have been specially treated are ranked lower, which also shows that the model modeled in this article is consistent with the actual situation of the company. As for why *ST Hongsheng can get a good ranking in the analysis results of 2018 and 2019, the reason is not the accident of the data model. It can be seen from the original data obtained in this article that Hongsheng Group has been losing money continuously in recent years, but its asset-to-liability ratio is very good, even surpassing the industry's leading companies, so comprehensively considering the financial risks of *ST Not too high, just because it is ST, it is very inappropriate to simply think that it has a higher financial risk.From an industry perspective, both the tightening of macro policies and the strategic choices of real estate companies will force them to continue to face various challenges in the future. After all, the "Golden Decade" has ended. If you want to remain in an undefeated position in today's low-growth development environment, you must strengthen financial management and strictly prevent and control financial risks while seizing the opportunity.

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