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The Application of Principal Component Analysis on Financial Analysis in Real Estate Listed Company

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Abstract

This article is written in the base of the financial reports of the third quarter of 2010, selected 12 real estate listed companies, and compute its various financial indicators, using the principal component analysis in the spss software to its financial performance method, evaluation and analysis.

Keywords: principal component analysis; real estate listed company; financial analysis

1. Overview of listed companies about real estate situation

The real estate industry is the pillar of the national economy industry in the national economy, and has an important position and role, and gradually become the pillar industries of China's economic. Through the performance of listed companies to real estate evaluation and analysis, finding in the operation of real estate market, the existing problems of the real estate industry of our country will help understand the development situation and its development prospect and improve the real estate enterprise comprehensive competitive power. At present Chinese stock market has 135 companies listed companies, based on real estate 12 real estate as sample of listed companies in 2010 to analyze the previous three, because the data is too much, the relationship between index is relatively complex, so using the principal component analysis to analyze the 10 main financial index data , with each company 10 indexes completed with Excel.

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2. The introduction of principal component analysis

Principal component analysis method is a kind of multiple analysis method to search comprehensive index in several indexes, a kind of effective way to solve the problem of multi-target integrated evaluation, a statistical analysis method by dimension reduction techniques to multiple variables into a few principal components (namely variables). The general purpose of principal component analysis is: i). variables of reduced-order; ii).main component explanation.
The main steps of the principal component analysis are as follows:

2.1. Standardization processing on the original data

$$x_{ij}^* = \frac{x_{ij} - \mu_i}{\sqrt{\sigma_j}}, i = 1,2,\cdots p \quad \text{Among them, } \mu_i = \frac{1}{n}\sum_{i=1}^n x_{ij}, \sigma_j = \frac{1}{n-1}(x_{ij} - \mu_i)^2$$

2.2. The correlation coefficient matrix of the standardized data

$$\mathbf{R} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1p} \\ r_{21} & r_{22} & \cdots & r_{2p} \\ \vdots & \vdots & & \vdots \\ r_{p1} & r_{p2} & \cdots & r_{pp} \end{bmatrix} \text{ Among them, } r_{ij} = \frac{1}{n-1}\sum_{i=1}^n x_{ij}^* x_{ik}^*, r_{jj} = 1, r_{ik} = r_{ki}, \text{ that is R is symmetrical}$$

matrix, the data on the diagonal are all 1.

2.3. Calculate the characteristic value of related coefficient and the eigenvalue of the corresponding feature vector, and the contribution of variance

If can through orthogonal transform Q makes $\mathbf{Q'RQ} = \begin{bmatrix} \lambda_1 & & & \\ & \lambda_2 & & \\ & & \ddots & \\ & & & \lambda_P \end{bmatrix}$. And the $\lambda_1, \lambda_2, \cdots, \lambda_p$ is the p

eigenvalues of R. The contribution of each component of the variance $V_K = \frac{\lambda_K}{\sum_{j=1}^P \lambda_j}$. The biggest contribution

is the first principal components, the main component, second for the second principal components, and so forth.

2.4. Determine the number of main components

According to the principle of more than 85% of the total variance contribution rate to determine the number of main components, the calculation formula of accumulative total variance contribution

is $CV_k = \sum_{i=1}^k V_i = \frac{\sum_{i=1}^k \lambda_i}{\sum_{j=1}^p \lambda_j}$. The cumulative variance contribution rate of the current m principal components is

over 85 percent above, determine m, namely the number of the principal components is m.

2.5. Tectonic comprehensive evaluation function, $U = \partial_1 y_1 + \partial_2 y_2 + \cdots + \partial_m y_m$

Calculate the comprehensive function score of each sample, then sorting and evaluation through the score.

3. Data analysis

This article analysis enterprise from operation ability solvency, profit ability, growth ability, Operation ability of the four aspects. Select profit growth as for X_1, net assets yield clamps its X_2, main business for X_3, net profit growth for X_4, the shareholder rights and interests turnover ratio for X_5, flow for X_6, inventory turn over for X_7, total asset turnover for X_8, earnings per share for X_9, total assets growth for X_{10} this 10 financial indicators as analysis start.

Through the SPSS statistical calculation software, we calculate the covariance matrix, correlation coefficient matrix and its eigenvalue and eigenvector, and compute accumulative total contribution and principal component. The analysis of result as in Tab □.

Through the correlation coefficient matrix of variables, we can see a strong link among the indexes selected. Meanwhile, the SPSS output results show that from the KMO and Bartlett, KMO inspection sphericity in 0.685, can mean value for principal component analysis.

Use SPSS software; analyze 10 financial index dates of 12 real estate listed companies in 2010 on principal component analysis, with the first four principal component accumulation contribution rate reached 86.19%. So, select the first four principal components to express full information of primitive indexes. As in Tab Ⅲ.

Tab □ dozen real estate financial index of listed companies

company	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Vanke	10.63	8.13	0.027	7.7	0.077	1.65	0.13	0.14	0.3	36.57
Investment real estate	48.48	8.11	0.046	8.02	0.107	2.13	0.18	0.19	0.83	13.53
Cofco real estate	30.14	14.73	0.036	57.03	-0.129	0.272	0.042	0.0208	1.46	14.84
Deep Great Wall	30.01	9.56	32.21	8.56	0.415	2.214	0.136	0.138	0.897	-0.03
Catic real estate	159.8	10.44	6.74	9.03	0.086	2.47	0.1	0.12	0.92	25.02
Financial street	-31.4	4.18	0.021	1.7	0.017	2.28	0.07	0.07	0.22	10.41
Beichen industrial	-71.3	2.01	0.015	0.84	-0.01	2.61	0.2	0.17	0.05	-2.22
Rhine home buyers	-12.84	7.87	7.34	28.06	1.62	1.456	0.375	0.355	0.137	28.06
Enterprise shares	-33.7	-5.13	10.17	1.46	0.022	1.39	0.17	0.17	-0.111	52.09
Wanfang real estate	-10.6	8.04	9.29	10.91	0.11	1.75	0.26	0.16	0.11	24.81
The enterprise	-51.1	3.91	0.016	4.07	0.048	2.37	0.1	0.11	0.11	54.69
Binjiang group	20.27	11.82	0.026	11.15	0.096	1.51	0.08	0.08	0.33	45.08

From Tab Ⅲ, we can see, in the first principal component F_1, stockholders' equity turnaround, inventory turnover, total asset turnover occupy larger load, show that the first principal component reflects enterprise's operation ability, In the second principal components, inventory turnover, total asset turnover occupied large quantities factor loading, therefore the principal component F_2 mean operation ability; In the third main component F_3, net profit growth, net assets yield, earnings per share, the three indexes of the factor loading amount is larger, so, conclude that the third principal component F_3 reflects the profitability; In the forth principal component F_4, the current ratio play a decisive part, therefore the principal component F_4 called solvency principal component.

Tab Ⅱ correlation matrix

		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X	X
correlation	Y	1.000	.589	.166	.208	-.042	-.011	-.251	-.153	.683	-.093
	X_2	.589	1.000	.001	.628	.084	-.328	-.221	-.265	.744	-.264
	X_3	.166	.001	1.000	-.095	.285	.118	.193	.191	.148	-.269
	X_4	.208	.628	-.095	1.000	.198	-.819	-.044	-.121	.638	-.124
	X_5	-.042	.084	.285	.198	1.000	-.068	.767	.837	-.178	-.011
	X_6	-.011	-.328	.118	-.819	-.068	1.000	.060	.146	-.332	-.225
	X_7	-.251	-.221	.193	-.044	.767	.060	1.000	.940	-.452	-.052
	X	-.153	-.265	.191	-.121	.837	.146	.940	1.000	-.420	.015
	X	.683	.744	.148	.638	-.178	-.332	-.452	-.420	1.000	-.422
	X_{10}	-.093	-.264	-.269	-.124	-.011	-.225	-.052	.015	-.422	1.000

Tab Ⅲ Explain the total variance

ingredients	Initial eigenvalue			Extraction squares loaded			Rotating squares loaded		
	aggregate	variance %	accumulation %	aggregate	variance %	accumulation %	aggregate	variance %	accumulation %
1	3.557	35.566	35.566	3.557	35.566	35.566	2.858	28.581	28.581
2	2.509	25.088	60.654	2.509	25.088	60.654	2.290	22.904	51.485
3	1.662	16.617	77.272	1.662	16.617	77.272	2.075	20.749	72.234
4	.892	8.921	86.192	.892	8.921	86.192	1.396	13.959	86.192
5	.762	7.616	93.808						
6	.314	3.135	96.943						
7	.174	1.736	98.679						
8	.082	.816	99.495						
9	.047	.469	99.964						
10	.004	.036	100.000						

Tab Ⅳ rotating ingredients matrix a

	ingredients			
	1	2	3	4
X_1	-.069	-.017	.959	-.007
X_2	-.089	.414	.682	.200
X_3	.327	-.243	.279	.243
X_4	.041	.190	.234	.103
X_5	.932	.144	.069	.036
X_6	.008	-.903	-.008	.716
X_7	.924	.731	-.236	.061
X_8	.956	.832	-.128	-.016
X_9	-.315	.048	.691	.388
X_{10}	.030	-.028	-.047	-.959

Principal component expression is as follows:

$$F_1 = 0.08X_1 + 0.31X_2 + 0.121X_3 + 0.038X_4 + 0.352X_5 - 0.15X_6 + 0.314X_7 + 0.342X_8 - 0.064X_9 + 0.068X_{10}$$

$$F_2 = 0.228X_1 + 0.123X_2 - 0.16X_3 + 0.446X_4 + 0.065X_5 - 0.454X_6 + 0.045X_7 - 0.037X_8 + 0.102X_9 - 0.06X_{10}$$
$$F_3 = 0.651X_1 + 0.282X_2 + 0.151X_3 - 0.081X_4 + 0.107X_5 + 0.141X_6 - 0.069X_7 + 0.052X_8 + 0.225X_9 + 0.242X_{10}$$
$$F_4 = 0.267X_1 + 0.014X_2 + 0.281X_3 + 0.074X_4 - 0.041X_5 + 0.129X_6 + 0.054X_7 - 0.048X_8 + 0.179X_9 - 0.787X_{10}$$

12 listed companies to rank, as shown in table Ⅴ

Judging from the principal component scoring sheet, Rhine has the highest score in the first principal component, other enterprises are all smaller than 1, show that the Rhine is far better than other enterprises on operating ability; The second principal component reflects the enterprise growth capacity, besides zhongliang real estate has higher score, others are low, show that enterprises should strengthen the ability of long-term development; The third main component reflects enterprise's profit ability, we can see, 12 companies' profit ability difference is not obvious; The fourth principal component reflects enterprise debt-repaying ability, each enterprise scoring distribution also is even, explain each enterprise has certain solvency and all can better maintain enterprise operation.

Tab Ⅴ each main component scores and ranking

company	The 1st main		The 2nd main		The 3th main		The 4th main	
	F_1 score	ranking	F_2 score	ranking	F_3 score	ranking	F_4 score	ranking
company	-0.19909	7	0.01810	4	0.05699	6	-0.75724	9
Vanke	0.08601	5	-0.26041	6	0.52932	3	0.32394	5
Investment real estate	-1.16485	12	2.75209	1	0.29104	5	0.50537	4
Cofco real estate	0.29814	3	-0.64862	11	0.87123	2	1.95873	1
Deep Great Wall	-0.21765	8	-0.97786	12	2.23810	1	-0.33762	8
Catic real estate	-0.92918	11	-0.46665	8	-0.83099	10	0.57929	3
Financial street	-0.19460	6	-0.60372	10	-1.58532	12	1.29129	2
Beichen industrial	2.80040	1	0.91560	2	-0.11266	7	-0.20265	7
Rhine homebuyers	0.11242	4	-0.43545	7	-1.02821	11	-1.15943	11
Enterprise shares	0.42799	2	0.01311	5	-0.33858	8	0.12643	6
Wanfang real estate	-0.49043	9	-0.55539	9	-0.53090	9	-1.18898	12
The enterprise	-0.52916	10	0.24921	3	0.43997	4	-1.13913	10

The premise that any kind of method is accurate is that the enterprise financial data released actually and reliability, because now the public company accounting information distortion is still existed, and inevitable, so if the enterprise's financial data can't react the real enterprise's financial condition, there will be a certain extent on the accuracy of this method.

Through some financial index analysis of the listed company of real estate, this article make principal composition analysis for financial index, and simply to make evaluation, just through the data to evaluate the financial position of the company, there is a certain one-sided quality, but this is really an important way that enterprise's financial position evaluation, a method that can combine the index analysis and such as factor analysis and the environmental impact, do further research for the financial performance of listed companies.

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