Original Research Article

Comprehensive Evaluation and Analysis of Listed Companies with Insurance

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ABSTRACT

This paper mainly used the financial data of three insurance companies listed in China, and used SPSS software to carry on comprehensive ranking to eight indexes which are representative of the three companies for six years, then use the cluster analysis to analyze the business situation of the company classification, and finally make a comprehensive analysis and evaluation.

KEYWORDS: listed insurance company factor analysis cluster analysis comprehensive evaluation

1. Introduction

In the domestic insurance companies listed only China Life Insurance, China Pacific Insurance, China Ping An, three insurance companies, so in a competitive insurance market, the three companies in the past few years the comprehensive situation is necessary to understand the insurance, you can understand the insurance company's development, and growth. The rapid development of China's insurance industry can also learn from the role.

2. Mathematical model of factor analysis

2.1. The basic idea of factor analysis

Factor analysis is to find the common factor between the variables of the model analysis method, it is based on the main components to build a number of more obvious meaning of the common factor, with these factors decomposition of the original variable, in order to test the original variable contact and difference. The basic purpose of factor analysis is to use a few factors to describe the link between many indicators, that is, a few variables with a strong correlation in the same class, each variable becomes a factor, these intricate variables synthesize a few factors with fewer numbers, and these factors reflect most of the information of the original variable.

2.2. Analysis steps for factor analysis

Factor analysis model

If the study of a problem involves P indicators, marked as , we assume that the mean vector E (X) = 0, the covariance matrix Cov (X) = Σ, and the covariance matrix Σ is equal to the correlation matrix R. Assuming that (m <p) is an unmeasurable vector, the mean vector E (F) = 0, the covariance matrix Cov (F) = I, that is, the components of the vector are independent of each other. and F are independent of each other, and E (e) = 0, e covariance matrix Σ is a diagonal matrix, that is, each component e is independent of each other, then the factor analysis model:

The matrix form is:

, abbreviated as X = AF + e

Since the model is for the variables, the factors are orthogonal, so also known as the R-type orthogonal factor model. Equation known as the common factor or latent factor vector, the matrix is called the factor load matrix, called the special factor vector.

Factor load is the correlation between the original variables in the factor structure and the common factors in the factor analysis. The factor load is the correlation coefficient between ith variable and the jth common factor .

Under the premise that the factor is not relevant, the factor load is the correlation coefficient between the variable and the factor , which reflects the degree of the correlation between the variable and the factor . Equation of means the more close to 1, then the stronger the correlation between the factor and the variable . Factor load as an important statistic in the factor analysis model shows the degree of correlation between the original variable and the common factor.

Analysis steps

1. The correlation coefficient matrix is a covariance matrix after the variable normalization, which can reflect the correlation between the data, so as to judge whether the factor analysis can be carried out.

2. KMO test:

$$KMO = \frac{\sum\sum_{i \neq j} r_{ij}^2}{\sum\sum_{i \neq j} r_{ij}^2 + \sum\sum_{i \neq j} a_{ij}^2}$$

Where the simple correlation coefficient between the two variables; is the partial correlation coefficient between the two variables.

The value of KMO is between 0 and 1, and when KMO is closer to 1, it indicates that the correlation between variables is stronger. When KMO is close to 0, the correlation between variables is weaker.

The following is a selection of criteria for factor analysis:

KMO> 0.9	is very suitable
0.8 <KMO <0.9	is suitable
0.7 <KMO <0.8	General
0.6 <KMO <0.7	is not suitable
0.5 <KMO <0.6	is not suitable

3. Factor rotation:

Let the factor load matrix be:

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ a_{p1} & a_{p2} & \cdots & a_{pm} \end{pmatrix}$$

The variance of the factor is greatly followed by the maximum rotation

$$A^{(k)} = A\prod_{i=1}^{k} C_i, A^{(k)} = AC$$

The factor load matrix after rotation.

: Non-rotating factor load matrix

: The factor load matrix after sub-rotation

: The product of the wheel rotation matrix

4. Factor score estimation: In this paper, the regression method is used to estimate the factor score. Assuming that the variable X and the common factor F are normalized, the common factor is represented as a linear combination of variables:

Which is the score coefficient matrix.

5. Comprehensive ability of the order: the proposed m cumulative contribution rate of more than 80% of the previous factor, save factor analysis obtained after the corresponding factor scores, marked as respectively, and then, according to the factor analysis of the m factor after the eigenvalues, the weights of the m factors are calculated separately.

Weight formula:

Weight i = the sum of the eigenvalues of the factor i / the sum of the m-factor eigenvalues (i <m)

Synthetic Factor Score Formula:

Synthetic Factor Score = * Weight 1 + * Weight 2 + ... + * Weight m

Finally, according to the required comprehensive factor score in accordance with the order from large to small ranking.

3. The basic idea of cluster analysis and analysis steps

3.1. The basic idea of cluster analysis

Clustering analysis is a method of simplifying data by data modeling, classifying samples or indicators, requiring reasonable classification according to their own characteristics, classifying data into different classes or families, so the same objects in the cluster have great similarity, and the objects between the clusters are very different.

3.2. Cluster analysis and analysis steps

Cluster analysis model

Set the variables of the p indicators, these indicators for n observations, get n group observations , the n group of observations is n samples. Each sample can be regarded as a point in the p-dimensional space. N samples make n points of the p-dimensional space, and the distance between the samples is measured by the distance. Formula is the distance between the sample and the distance, assuming that the distance used in the cluster is Euclidean distance:

In order to divide the n samples into k classes, the two samples and , which are farthest away from the sample, are selected for the initial two points and , then,

And then select the third point of intersection , so that the distance from the first two points is the smallest of all the remaining , and the distance is the biggest between the smaller, the formula is as follows:

In accordance with the same principles, select , followed by the election k points

Let k be a set of non-initial gather points:

Implement the initial classification with the following principles:

The samples are divided into disjoint k classes to get the initial classification:

Calculate in turn, when sorting

When the two are identical, the calculation ends and the classification is complete.

Analysis steps

1. Calculate the distance between the data samples and the distance , using European distance:

$$d_{ij} = \sqrt{\sum_{k=1}^{p}(x_k - x_k)^2}, i = 1,2,\cdots,n; j = i+1, i+2,\cdots,p$$

2. Data sample grouping: n samples will be divided into n categories, the distance between the two categories into a class;

3. After merging the class, if the number of classes is greater than 1, the distance between categories is recalculated until all samples are classified as one class;

4. Mapping the clustering spectrum: According to different classification criteria and classification principles, different classification results are obtained.

4. Establishment of index system

This paper is mainly for the listed insurance company's comprehensive ranking, so from the profitability of these companies, solvency and growth capacity of these three aspects of analysis, for each company six years eight indicators, respectively, the total assets profit margin , return on net assets, return on net assets, net profit growth rate, net asset growth rate, total assets growth rate, asset-liability ratio and shareholder equity ratio were analyzed, factor analysis and cluster analysis. This article comes from Sina Finance.

First explain the corresponding indicators, easy to understand:

Indicator	Explanation	
1	Total assets profit margin	Total profit / total assets * 100%
2	Net return on net assets	Net profit / net assets * 100%
3	Net return on net assets	Net profit / average net assets * 100%
4	Net profit growth rate	(Net profit for the year - net profit for the previous year) / net profit for the previous year * 100%
5	Net assets growth	(Net assets at the end of the period - net assets at the beginning of the period) / net assets at the beginning of the period * 100%
6	Total Assets Growth	Total Assets in the Year / Total Assets at the Beginning * 100%
7	Total liabilities	Total liabilities / Total assets * 100%
8	Shareholders 'equity ratio	Total shareholders' equity / total assets

Year	Serial no.	x1	x2	x3	x4	x5	x6	x7
2010	1	2.397	19.9178	16.11	2.3459	-1.0814	15.0313	85.0788
	2	1.8215	14.9538	10.66	15.9508	7.7676	19.77	82.857
	3	1.531	18.2396	15.45	23.8641	27.4026	25.2124	90.0239
2009	4	2.6941	18.8217	15.58	223.7237	56.59	23.8438	82.6483
	5	1.8815	13.9231	9.85	428.1272	53.7194	24.358	80.9478
	6	1.5477	19.6473	16.34	1558.877	12.6109	32.2299	90.1954
2008	7	1.0306	11.9715	7.46	-63.9361	-20.5788	10.6818	86.2769
	8	0.443	8.1397	2.75	-79.983	-22.2564	3.3591	84.5869
	9	0.1234	4.1746	0.84	-94.397	-25.407	8.6831	88.4872
2007	10	3.1631	19.6582	16.52	95.4348	47.3673	23.0398	80.8754
	11	2.2876	14.6839	11	440.8569	377.318	52.1535	79.5084
	12	2.393	16.4423	14.1	107.8575	134.2427	40.5398	83.2257
2006	13	1.9914	16.3915	9.7	162.5861	83.1992	39.3406	84.0325
	14	0.6436	24.2123	9.04	44.1014	80.8836	25.8753	93.468
	15	1.618	20.821	16.3	122.5653	40.4863	60.8058	89.9358
2005	16	1.0567	15.1344	8.67	85.5941	9.5037	27.9753	87.8552
	17	0.5622	12.3671	17.12	83.649	175.818	32.7238	95.4544
	18	1.169	16.8821	10.2	27.7209	8.3581	20.5623	88.4802

Table 1:

Serial number 1, 4, 7, 10, 13, 16 are China Life Insurance Company; serial number 2,5,8,11,14,17 are China Pacific Insurance; No. 3,6,9,12, 15,18 are safe in China.

Variant explanation: x1: total assets profit margin; x2: return on net assets; x3: return on net assets; x4: net profit growth rate;

X5: net asset growth rate; x6: total asset growth rate; x7: asset-liability ratio; x8: shareholder equity ratio

5. Descriptive analysis

The mean value, standard deviation, skewness and kurtosis were obtained for each index. Where xi and yi should be the same indicators. FResults Analysis: From the table we can see that x4 average net profit growth rate of the largest, indicating that the net profit growth rate may be relatively high number; from the standard value, the net profit growth

rate is the largest, indicating from 2005 to 2010, the growth rate of net profit growth, the three companies in the index there is a big difference, followed by x5 net asset growth rate, the value of the net profit growth rate is slightly smaller. While the total assets of the minimum standard value of profit margins, indicating that the index data is relatively stable, the company is not very different. From the skewness and kurtosis point of view, the net profit growth rate are the largest positive value, so the data is a lot of right and the distribution was coarse tail, the dispersion is relatively large, indicating that the past six years, the rapid development of insurance companies, growth capacity relative to other ability to be strong. In general, the insurance company with the development of the times progress, the company stable operation, rapid growth.

6. Factor analysis results

The coefficients of the correlation coefficient matrix and the KMO test value are obtained by factor analysis of the data without dimension. The tables are as follows:

Table 3 Correlation Coefficient Matrix

Correlation matrix

x1	x2	x3	x4	x5	x6	x7	x8		
Related	x1	1.000	.519	.623	.196	.278	.351	-.684	.684
	x2	.519	1.000	.706	.271	.101	.450	.112	-.112
	x3	.623	.706	1.000	.346	.255	.514	.090	-.090
	x4	.196	.271	.346	1.000	.163	.317	.012	-.012
	x5	.278	.101	.255	.163	1.000	.646	-.202	.202
	x6	.351	.450	.514	.317	.646	1.000	.014	-.014
	x7	-.684	.112	.090	.012	-.202	.014	1.000	-1.000
	x8	.684	-.112	-.090	-.012	.202	-.014	-1.000	1.000

From the correlation coefficient matrix we can see that more than half of the value is greater than 0.3, which can be done factor analysis, and then from the KMO test form validation, KMO value of 0.591, although the value is not large, but greater than 0.5 Relevance is not very strong, according to the corresponding metrics can barely do factor analysis. And the spherical test statistic is 302.085, and the corresponding probability Sig is 0.000, so the correlation coefficient matrix can be considered to be significantly different from the unit matrix.

Table 5 Eigenvalue contribution rate

Explain the total variance

Component	The initial eigenvalue			Extraction squaring and loading			Rotation squaring and loading		
	Total	Total variance%	Accumulated%	Total	Total variance%	Accumulated%	Total	Total variance%	Accumulated%
1	3.146	39.325	39.325	3.146	39.325	39.325	2.567	32.087	32.087
2	2.338	29.228	68.553	2.338	29.228	68.553	2.421	30.267	62.354
3	1.132	14.153	82.705	1.132	14.153	82.705	1.628	20.351	82.705
4	.815	10.183	92.889						
5	.313	3.914	96.802						
6	.237	2.967	99.769						
7	.018	.231	100.000						
8	2.056E-8	2.570E-7	100.000						

Extraction method: Principal component analysis.

It can be seen from the table that the contribution rate of the first eigenvalue 3.146 is 39.325% and the contribution rate is the largest. When the eigenvalue is greater than 1 and the cumulative contribution rate in the table reaches 82.705%, the eigenvalue takes the third value, so the eight variables of the original data are reduced to three principal component factors. The three factors have enough information to describe the original data.

Figure 1 for the factor analysis of the gravel diagram, x-axis represents the number of components of the variable, y-axis that the corresponding eigenvalues. The parameters are linear, showing the change of the eigenvalues in the principal component analysis. There is a significant inflection point in the curve. The slope of the straight line between the first three points is larger and the slope is steep, indicating that the difference of the eigenvalues is large. The

difference between the five eigenvalues is relatively slow and the difference between the eigenvalues is small. So, with the first three cumulative contribution rate of 82.705% of the eigenvalues, the extraction of public factors can fully summarize the vast majority of the original data.

Table 6. Rotation component matrix

1	2	3	
x1	.758	.620	.117
x2	-.033	.904	.032
x3	.007	.899	.197
x4	-.035	.438	.274
x5	.174	.037	.927
x6	-.026	.448	.797
x7	-.990	.095	-.055
x8	.990	-.095	.055

Table 6 shows the rotation component matrix after the rotation of the factors. After the rotation, the explanations of the factors are more obvious. From the table, it can be seen that the factors are differentiated from the poles. The corresponding factors can be classified and the explanations of sufficient practical significance are given.

The absolute value of F1 is y1, y7, y8, which are the total assets profit rate, asset-liability ratio and shareholder's equity ratio, which are classified as solvency. The absolute value of F2 is y2, y3, Y4, respectively, for the return on net assets, net assets yield, net profit growth rate, will be classified as profitability; F3 absolute value of the value of y5, y6, respectively, net asset growth rate, total assets growth rate, will be classified as growth capacity. According to the rotation component matrix, write the corresponding factor expression, as follows:

Table 7. Component score coefficient matrix

	1	2	3
x1	.285	.264	-.112
x2	-.030	.435	-.182
x3	-.026	.394	-.062
x4	-.041	.152	.104
x5	.001	-.199	.664
x6	-.076	.035	.488
x7	-.394	.075	.010
x8	.394	-.075	-.010

Table 7 for the factor score coefficient matrix, according to the table to find the factor score as the basis for ranking. The expression of the factor after rotation is as follows:

And then according to the factor score and the eigenvalue of the principal component of the three insurance companies together for six years ranking, the formula is as follows:

Comprehensive score F = (3.146 * + 2.338 * + 1.132 *) / 6.616

The ranking table is as follows:

From the ranking table can be seen in the three insurance companies in the rankings of each year, the following companies will be the three types of capacity analysis, to understand its development.

(1) From the solvency point of view: in 2007 the three insurance companies ranked relatively forward, and which China Life's solvency strongest, from 2005 to 2006, three insurance companies solvency basically no change, while its solvency in 2007 increased the most and the strongest, with the increase in the year, its solvency gradually weakened. On the whole, the three insurance companies in China Life's solvency the strongest, followed by China Pacific Insurance, China's weakest security

(2) From the profitability point of view: in 2008 the three insurance companies the weakest profitability, the other year is not very large fluctuations, of which China's strongest profitability, followed by China Life, China Insurance is the weakest. China Pacific Insurance profitability and the gap between the two foreign insurance companies relatively large.

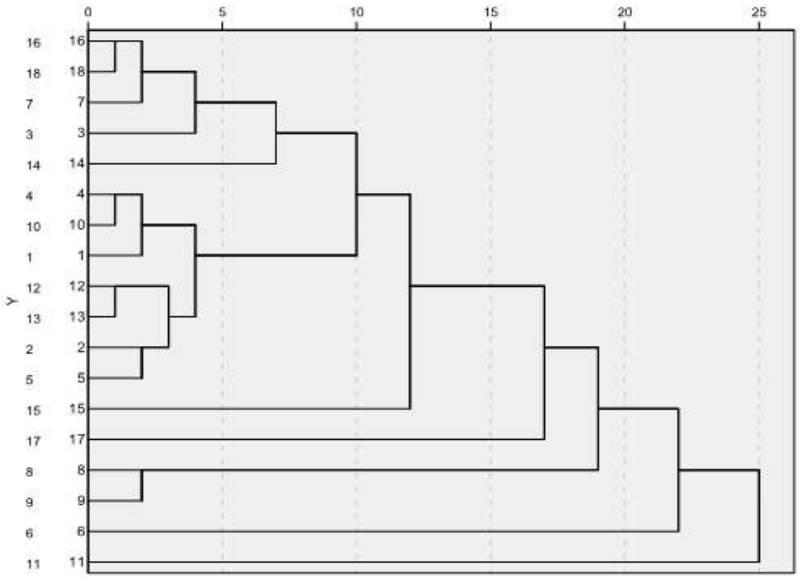
(3) From the growth capacity of view: the first three years of the three insurance companies growing capacity is relatively strong, and then gradually weakened three years, the weakest growth in 2010, according to the actual situation, the development of these companies may be affected by the 2010 impact of the global subprime mortgage crisis, the pace of development slowed down. China's peace from the beginning of growth capacity in 2006 gradually increased, in general, its growth capacity is the strongest of the three insurance companies, China Pacific Insurance, and

China's life is the weakest. As China Life is the earliest listed, with the growth of time, its development will stabilize, so the slowest growth is also understandable.

(4) From the comprehensive ability point of view: in 2007 the three insurance companies integrated capacity relative to other years the strongest. China Life's strongest comprehensive capacity, followed by China Pacific Insurance, China's weakest security In real life, China Life is also the largest insurance company, so the factor analysis after the ranking is still more realistic.

7. Cluster analysis results

Figure 3. clustering situation



According to the chart we can see: 2009 China's Ping An and 2007 China's CPIC were a class, the other classified as a class. Indicating that the two insurance companies compared in the corresponding year's ability and other times were quite far away. In general, China Life's six years of development is still relatively stable, there is no year or years there is a big gap; and China Pacific Insurance in 2007 when the development capacity relative to other years have a greater difference, so you can understand the company's operating conditions this year has led to changes in the emergence of differences, and then the overall situation of the three years to return to normal; for China's peace in 2009 when the operation and other years vary widely, although the company operating differences in 2010 But the company can make an in-depth study of the 2010 company's operations and find solutions to the problem in order to be able to develop a stable and healthy future.

8. Conclusions

This article mainly uses the SPSS software to carry on the comprehensive rank analysis and the simple classification to the financial indexes of the three domestic listed insurance companies. As China Life Insurance, China Pacific Insurance, China Ping An is the largest domestic insurance company, so the operation of the three insurance companies are the direction of the domestic insurance industry, their operations to a certain extent, reflects the overall domestic insurance industry situation. After the comprehensive evaluation and analysis of the eight financial indicators of the three companies for the six years, the financial situation can be studied in depth for the years with the lowest comprehensive ability to explore the reasons for the decline of their operational capacity, To solve the problem of the program, as a reference to make it in the global economic integration trend to explore a suitable for their own development of a set of business management model. And the actual combination, found that the insurance industry by the impact of the economic crisis is still relatively large, so the company more healthy and stable development, and enhance its competitiveness, reference to a variety of information, the following proposed to improve the development of China's insurance companies in five opinions:

(1) The implementation of meticulous management, strengthen the risk of control, improve the quality of underwriting, sound operation, is to control the overall cost rate, and improve the operating profit of the most direct and effective way. After careful management, the insurance company's management is more comprehensive and effective,

the mechanism is more sound and reasonable, and each service has a basis for the protection of the interests of insurers to reduce the occurrence of fraudulent fraud cases, safeguarding the interests of the company.

(2) Attention to innovation, adjust the product structure, and strive to develop new products, broaden the use of foot sales channels, and improve service levels. Compared to other financial industries, the insurance industry's biggest advantage lies in sales, only the development of new products, in order to more attract the attention of consumers to meet the different needs of different customers. Strengthen service awareness, in order to win the trust of consumers, customers can get on the insurance sales rely on trust.

(3) Insurance integrated management, the development of mixed products, to strategic cooperation, the establishment of joint ventures, holding and other high-level form. Some developed countries in the world have entered the comprehensive management system, their models have been more mature, summed up the international insurance business model of the formation of a typical business model, characteristics and impact, will give the development of China's insurance companies to bring useful inspiration.

(4) To vigorously cultivate the introduction of outstanding talent, because foreign insurance companies are relatively mature, so our insurance companies can be excellent personnel sent overseas to carry out professional training, or from abroad to employ executives, experts, make good use of talent, and improve the staff enthusiasm and creativity.

(5) To enhance opening up, expand overseas markets, the insurance industry to international development. Strengthen international exchanges and cooperation, learn from foreign advanced technology, reference to the use of mature and sound management system to speed up the process of internationalization, and international standards, so that the domestic insurance industry rapid and sound development.

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