

# Evaluation of Profitability of Listed Real Estate Enterprises

## -- Empirical Research Based on Principal Component Analysis

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### Abstract

Real estate is an important part of the economy, and it has a significant impact on the country's economic development. This paper collects the basic financial statement information of 12 listed real estate companies in China. By using the principal component analysis statistical method, seven variables are selected to analyze and evaluate the relevant aspects of the profitability of listed companies in the real estate industry, and the weighted scores are used for comprehensive ranking to achieve objective evaluation of their performance. The result of the example analysis is built on the Shiny platform for display and other companies can use this platform for related analysis. Finally, I hope that through the objective analysis of the data, I can provide some evaluation and suggestions for the development of real estate enterprises.

### Keywords

Real estate enterprise; performance evaluation; principal component analysis; profitability; Shiny.

## 1. INTRODUCTION

Since the reform and opening up, with the advancement of China's urbanization process, the deepening of urban housing system reform, and the increase in urban real estate investment, the real estate industry has shown a booming trend, And gradually showed many characteristics that are different from the mature real estate market in the West due to the economic environment and national conditions. People's living conditions are constantly improving, and the development of the real estate industry has played an important role in promoting the growth of China's national economy and solving people's livelihood issues. Especially before the outbreak of the financial crisis in 2008, China's economy grew rapidly, and the real estate industry undoubtedly became one of the important pillar industries to promote China's GDP growth. The real estate industry also plays a significant role in raising the employment rate and resettling the surplus labor force. Looking at the number of companies engaged in real estate development, the official statistics released by the National Bureau of Statistics show that the number of enterprises has increased from 440 in 1990 to 94,948 in 2016. During this period, the number of employees in the real estate industry towns and other units has increased from the original speed of 147,000 to nearly 8 million, and the total number has also increased tremendously. Listed companies in the real estate industry take the leading role, the government's management affects economic development, and its profitability should be valued. The healthy development of the real estate industry can promote social stability, enable the normal acceleration of the national economy, promote the development of upstream and downstream, and prevent the real estate bubble to a certain extent. However, in recent years, the real estate industry has also exposed many problems, such as high asset-liability ratio, single

financing channel, unsound system, and urgent need to optimize the capital structure. These problems have greatly affected our national economy, the housing bubble is serious and so on. It can be said that the current rise and fall of China's real estate industry has become a double-edged sword that affects China's economic growth and development.

Moreover, the profitability of listed companies is the most important part of the relevant stakeholders of the company, and the profitability in the financial statements is the most intuitive reflection of the overall situation, and this indicator also indirectly reflects the current operation of the company and prospects for future development. Through profitability analysis, the exposed and potential problems in business management can be found, and the strength of profitability directly affects the solvency of enterprises, which directly represents the ability of enterprises to obtain profits. It is important for business managers, creditors and shareholders to judge the company's prospects.

Therefore, in the current economic new normal, supply-side reform and "destocking, de-capacity" and other economic backgrounds, the research on the profitability of listed companies in the real estate industry will help optimize the company's capital structure and improve its ability to withstand risks. To a certain extent, promote the development of the national economy and the harmony and stability of society.

The principal component analysis method is mainly used to analyze the profitability of listed companies in the real estate industry, and the research is combined with the theory. The main research structure is based on the theoretical basis of principal component analysis, and then selects the real estate industry data from the Guotaian database, selects the analysis indicators, and uses the new package of the main component of the R software to analyze the selected data and obtain a comprehensive ranking. Make conclusions and make recommendations.

## 2. THEORY ANALYSIS

### 2.1. Principal Component Analysis Theory

At present, with the continuous development and improvement of statistical analysis methods, the application of statistical analysis methods in economic issues or comprehensive evaluation of enterprises is more extensive.

In this paper, the principal component analysis method is used to simplify the evaluation index of some representative listed real estate enterprises in China into several important impact factors, and calculate the comprehensive scores for ranking. Finally, the profit level is evaluated and analyzed

Principal component analysis aims to use the idea of dimensionality reduction to transform multiple indicators into a few unrelated comprehensive indicators.

The basic idea of principal component analysis is to recombine a number of related factors into a set of unrelated comprehensive indicators by a certain method, and this set of comprehensive indicators can also well express the information to be expressed by the cause. These comprehensive indicators are new variables, which are linear combinations of the original factors, also known as the principal components of the original factors. The principle of extracting comprehensive indicators can not only reflect the information originally expressed, but also ensure that the information remains non-overlapping (unrelated to each other). The specific analysis steps are as follows.

#### (1) Data extraction

Let the estimated number of samples be  $n$ , and the number of financial indicators selected  $p$ , then the matrix  $X=(x_{ij})_{m \times p}$  can be obtained from the original data of the estimated samples, where  $i$  and  $j$  represent the  $j$ th financial indicator of the  $i$ th listed public data.

(2) Data processing

Raw data is standardized to eliminate the magnitude and dimensional differences between the indicators.

(3) Establish correlation matrix

The establishment of the covariance matrix  $R$  according to the standardized data matrix is a statistical indicator reflecting the close relationship between the standardized data. The larger the value, the more necessary to perform principal component analysis on the data.

(4) Find the eigenvalues and eigenvectors of the correlation matrix

Observing the characteristic values of each component, generally, the feature value greater than 1 is selected as the main component.

(5) Calculating the variance contribution rate and the cumulative variance contribution rate

The contribution rate of each principal component represents the percentage of the total amount of the original data.

(6) Determining the principal component

According to the principle of selecting the number of principal components, the eigenvalue is greater than 1 and the cumulative contribution rate is 80%-95% of the eigenvalue  $\lambda_m$ , where the integer  $m$  is the number of main components.

(7) Establish an initial factor load matrix to explain the principal components.

The factor load is the correlation coefficient  $R$  between the principal component  $Z$  and the original index  $X$ , which explains the degree of correlation between the principal component and each financial indicator. It can better explain the economic significance of the principal component.

(8) Calculating the composite score

The correlation coefficient of the original index is used as the weight of each principal component, and each component is expressed as a linear combination of the original indicators, and the principal component scores are obtained. Then, the variance contribution rate of each principal component is used as the weight, and the linear combination is used to obtain the comprehensive evaluation function, and finally the comprehensive score is calculated.

(9) Comprehensive ranking

Sort according to the comprehensive score obtained in (8).

## 2.2. Profitability and Evaluation Index

Profitability refers to the ability of an enterprise to obtain profits, also known as the capital or capital appreciation ability of a company. It usually shows the amount of the company's income and its level in a certain period of time.

Profitability is a key factor in the interest of all parties inside and outside the enterprise. For external investors, the most important investment income, the historical profitability of the company is related to its owner's equity; for creditors, the profitability has security about its principal and interest and investment funds; and the relevant government departments pay attention to the enterprise. Profitability, especially for companies with deep influence on the national economy, depends on whether they can pay more taxes, protect the government's fiscal revenue, and exercise its social management functions. Internally, corporate employees are more concerned about the profitability of the company. A company's profitability is directly related to the employee's own interests. Therefore, under the combined influence of many factors, profitability is the most important in the four aspects of corporate financial capability analysis, namely, profitability, operational capability, solvency and development capability.

Profitability is proportional to profit margin, the higher the income, the lower the cost, the higher the profit margin and the stronger the profitability. There are a wide variety of indicators for measuring profitability, with relative and absolute indicators. The profitability indicators mainly include six operating profit margins, cost and profit margins, surplus cash guarantee multiples, total return on assets, return on net assets, and return on capital. In practice, listed companies often use the indicators of earnings per share, dividends per share, price-earnings ratio, and net assets per share to evaluate their profitability. After comprehensive analysis of the indicators, this paper selects seven indicators to evaluate profitability. That is, X1: return on assets, X2: net profit margin of total assets, X3: return on net assets, X4: cost and profit margin, X5: operating profit margin, X6: earnings per share, X7: net assets per share.

### 3. CASE ANALYSIS

#### 3.1. Dataset

The data used in this paper is derived from the Guotaian database real estate sector data and the quarterly data of Phoenix Finance Network.

The total data selected in this paper is sorted by the financial indicators of main business income, and the top 12 listed real estate companies are selected. Seven financial indicators are selected from the total data as the indicator basis of the evaluation model. The selected data is the quarterly data for June 2017.

#### 3.2. The Running Process of Principal Component Analysis

Selection and extraction of principal components

The R-statistics software was used to perform principal component analysis on the data, and the eigenvalues, variance contribution rates and cumulative variance contribution rates of the sample indicators were obtained. As shown in Table 1.

**Table 1.** Characteristic value and contribution rate of each component

Principal component	eigenvalue	variance contribution rate	cumulative variance contribution rate
Dim.1	4.1684	59.5479	59.5479
Dim.2	1.5515	22.1646	81.7125
Dim.3	1.0062	14.3743	96.0868
Dim.4	0.1750	2.5001	98.5868
Dim.5	0.0616	0.8796	99.4665
Dim.6	0.0364	0.5206	99.9871
Dim.7	0.0009	0.0129	100.0000

The gravel criterion can be used to observe the contribution of variance more intuitively. Look at the gravel map, as shown in Figure 1. Dim.1, Dim.2 two components of the variance contribution accumulation rate reached 81%, the first principal component is significantly higher than the other principal components, the second principal component fold line is also relatively steep, the remaining component fold line tends to be gentle. And meet

the criteria for Kaiser-Harris eigenvalues greater than 1. Then choose these two components as the main component to keep the original data information as much as possible, and the other components have a small degree of interpretation, which can be ignored.

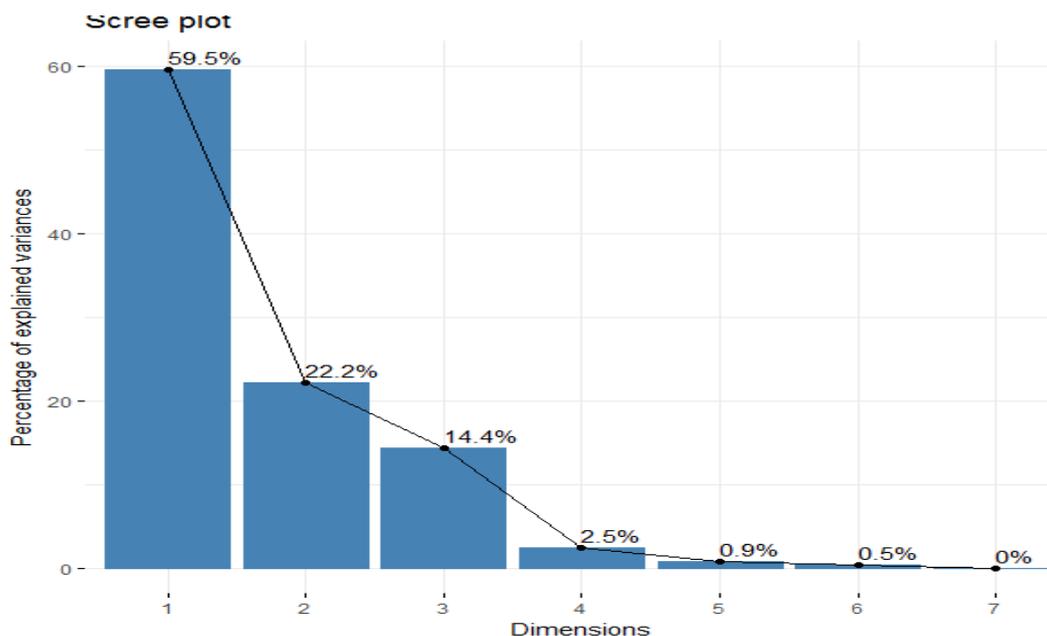


Fig 1. Scree plot

By running the R software, the correlation representation (\$coord), square cosine (\$cos2), and variance contribution rate (\$contrib) of each variable on the principal component (PC) are obtained, which represent the correlation between the variable and the PC, and the variables are The contribution of the mass and variables represented on the factor component map to each principal component. Tables 2, 3, and 4 are shown below

Table 2. Correlation (\$coord)

Index	Dim.1	Dim.2
X1	0.9307	-0.1740
X2	0.9576	-0.1458
X3	0.7251	-0.0207
X4	0.8946	0.1804
X5	0.8924	0.1753
X6	0.3760	0.8127
X7	0.3483	0.8809

Table 3. Square cosine(\$cos2)

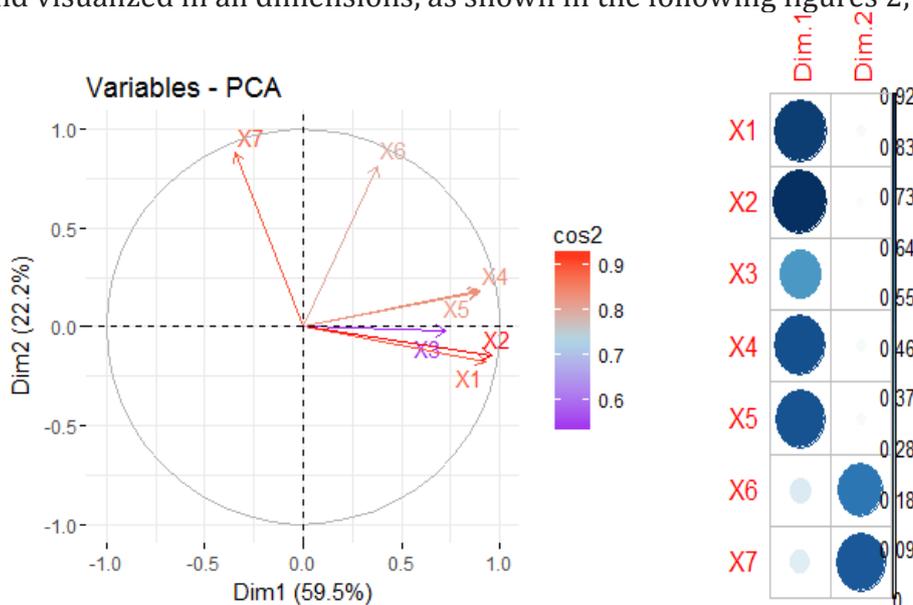
Index	Dim.1	Dim.2
X1	0.8661	0.0303
X2	0.9170	0.0213
X3	0.5258	0.0004
X4	0.8002	0.0325
X5	0.7964	0.0307
X6	0.1414	0.6604
X7	0.1213	0.7759

**Table 4.** Variance contribution rate (\$contrib)

Index	Dim.1	Dim.2
X1	20.7790	1.9508
X2	21.9993	1.3709
X3	12.6149	0.0276
X4	19.1980	2.0964
X5	19.1068	1.9797
X6	3.3924	42.5653
X7	2.9096	50.0093

From the comparison and analysis of the three graphs, the five variables of X1, X2, X3, X4 and X5 have a large contribution in the first principal component, and their correlation with the first principal component (which can also be considered as the factor load factor). It is 0.93, 0.96, 0.73, 0.89, and 0.89. X6 and X7 have a large contribution in the second principal component correlation, and the correlation on the second principal component, that is, the factor load is 0.81 and 0.88, respectively.

In order to more intuitively observe which main components are related to which indicators, the variable correlation diagrams drawn with the values of \$cos2 and \$contrib are respectively visualized and visualized in all dimensions, as shown in the following figures 2, 3 is shown.



**Fig 2.** \$cos2

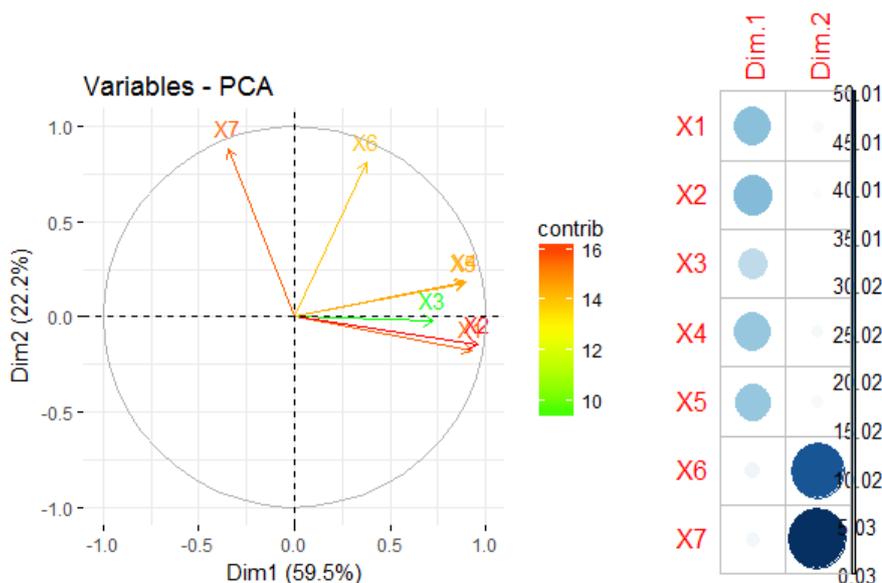


Fig 3. \$conTRIB

In the visualization of each dimension, the darker the color, the larger the size of the circle represents the greater the proportion of this indicator in this dimension (here referred to as the principal component). As can be seen from the above figure, the variable indicators X1 to X5 occupy a large proportion on the first principal component, and the second principal component is light in color, and the area of the circle is small, indicating that the proportion on the second principal component is small. X6 and X7 account for a large proportion of the second principal component, and the contribution and square cosine are large.

Using R software, clustering each indicator, the following results were obtained(Fig. 4 cluster). Consistent with the above analysis results.

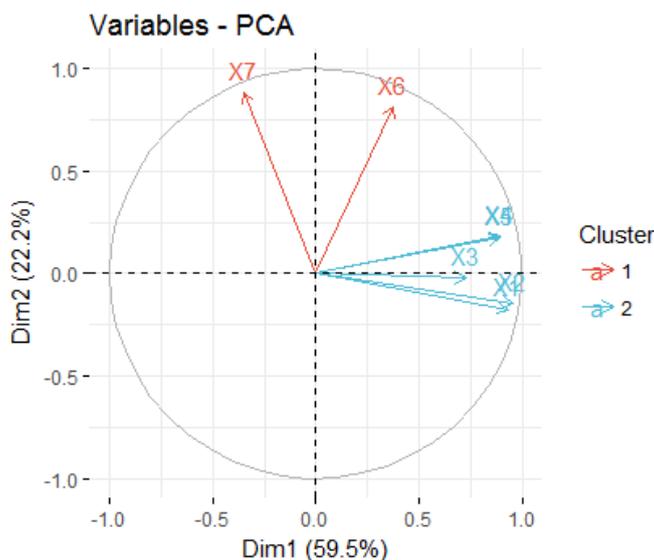


Fig 4. Cluster

The practical interpretation of the principal component

As can be seen from the above, the first principal component mainly explains the return on assets, the net profit margin of total assets, the return on net assets, the profit margin of cost and the operating profit margin. These five indicators reflect the overall profitability, capital profitability, free capital profitability, cost control capability, and sales operation efficiency of

the company. The summary is summarized as the sales operation profit indicator. The variance contribution rate of this principal component ranks first, reaching 59.55%, with nearly 60% of interpretation ability, playing a very important role. Sales and operation is the main source of income for listed real estate companies, which is related to the profitability of this quarter. Main business income accounts for a large proportion of total profits. Listed real estate enterprises affect the national economy, and their profitability is mainly related to the profit rate of the enterprise, which can reflect the development and growth of the enterprise. The first principal component has a direction-directed role for business development and its investors.

The second principal component mainly explains the earnings per share and the net assets per share. These two indicators reflect the equity return of the owner of the shareholding and the net profitability of the return on investment. Summarized as a return on investment profit indicator or quality indicators per share. The variance contribution rate of this principal component ranked second, at 22.2%. The return on investment profitability has a great impact on investors, which is related to their level of income. The net asset value per share reflects the net asset value of the company represented by each share of stock, and the earnings per share represents the income of the company's stock. The larger the net asset value per share, the greater the earnings per share, indicating that the stronger the wealth of the company's stock per share, the stronger the ability to generate profits and the ability to withstand external factors, the greater the company's development potential and the investment value of its stock. The investment risk that investors bear is smaller. From the perspective of company development, real estate enterprises use the funds collected by the stock market efficiently, rationally allocate the effective allocation of various development aspects, maximize the company's revenue, and feedback the investors. This kind of virtuous circle makes the company more socially. The appeal can play a double harvest for propaganda effects and efficient development.

### 3.3. Score Ranking and Evaluation

#### (1) Principal component score

According to the load factor matrix in the table, the principal component can be expressed as a linear combination of the variables. The resulting main component score coefficient is:

$$F1=0.9306684X1+0.9306684X2+0.7251435X3+0.8945625X4+0.8924346X5+0.3760419X6-0.3482553X7$$

$$F2=-0.17397577X1-0.14583928X2-0.02068627X3+0.18035085X4+0.17525675X5+0.81265589X6+0.88085474X7$$

According to this set of expressions, the scores of the two factors corresponding to each individual enterprise can be calculated, which is called the principal component score. Using R software, the visualized graph of the individual component scores of the enterprise is shown in Figure 5. The horizontal and vertical coordinates respectively represent the contribution of individual enterprises on the first and second principal components. The size and color of the circle represent the value of the contribution.

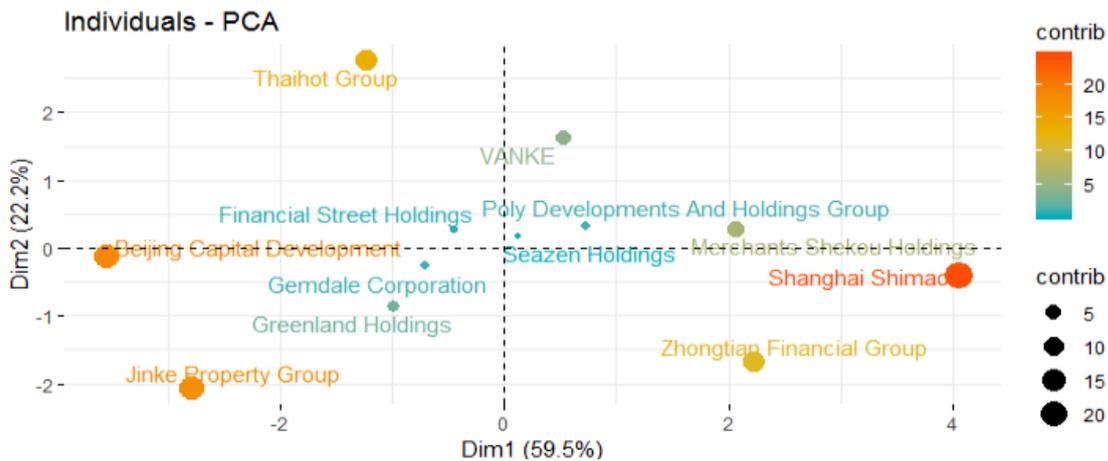


Fig 5. Individual principal component distribution map

It is clear from the main component score chart that the top four companies with the highest scores on the main components of sales operations are World Trade shares, China Merchants Shekou, Zhongtian Finance, Vanke A, and the scores of Shimao shares are significantly higher than other companies. In this quarter, the sales of World Trade shares are better than other companies. Let's look at the main component of the return on investment. The top scores are Taihe Group, Vanke, Poly Real Estate and China Merchants Shekou. Taihe Group is obviously superior to other companies in this indicator, indicating that its investment return performance is good in this quarter, and it has performed very well in the stock market and is trusted by investors.

(2) Comprehensive score and ranking

After that, the two principal component scores are weighted according to their respective variance contribution rates, and the comprehensive scores of the individual firms are calculated.

That is, the comprehensive score  $F = 0.595F_1 + 0.222F_2$ . And sorted according to the score, the results are shown below (Table 5).

Table 5. Comprehensive score and ranking

Company Name	component score		Comprehensive score	Ranking
	F1	F2		
Shanghai Shimao	4.0519	-0.4201	2.8367	1
Merchant Shekou	2.0567	0.2862	1.5756	2
Zhongtian Financial	2.2336	-1.6764	1.1712	3
VANKE	0.5228	1.6115	0.8187	4
Poly Group	0.7314	0.3260	0.6213	5
Seazen Holdings	0.1183	0.1691	0.1321	6
Thaihot Group	1.2340	2.7583	-0.1492	7
Financial Street	-0.4490	0.2828	-0.2502	8
Gemdale	-0.7037	-0.2657	-0.5847	9
Greenland Holdings	-0.9922	-0.8717	-0.9595	10
Jinke Group	-2.7893	-2.0693	-2.5936	11
Beijing Capital	-3.5465	-0.1308	-2.6184	12

According to the comprehensive rankings reflected by the above companies, the top ranked companies include Shanghai Shimao, China Merchants Shekou, Zhongtian Financial Group, VANKE and Poly Developments And Holdings Group. Back ranked are Greenland Holdings, Jinke Property Group and Beijing Capital Development.

In the past, the Shanghai Shimao has implemented strategic cooperation with other well-known real estate companies such as Evergrande Real Estate Group, Country Garden, Vanke, Greenland Group and China Merchants Real Estate to expand its scale and achieve strategic win-win. The Shimao actively cooperates with the government's development plan and is committed to adopting environmental protection measures and has obtained government support to a certain extent. It has promoted regional industrial renewal in an all-round way and accelerated urban evolution. The implementation of urban complex construction, around the housing to create a large-scale urban complex covering residential, office, shopping, tourism, entertainment, leisure and high-end medical integration. Typical is the Shimao Sky City project. In addition, it conforms to the Internet era, and combines the O2O model in the commercial community to create an experiential e-commerce platform and lead the industry. Moreover, as a large company, the company itself has strong strength, continuous optimization of capital structure, and rational use of financial leverage according to the efficiency of its own funds to maximize profits. So it is not surprising that it performed extremely well during the quarter. From the above analysis, the overall principal component contribution rate is nearly 60%, which is much larger than the second component 22%. The score of the first principal component is 4.05, which is the highest among all individual enterprises, and eliminates the influence of the negative value of the second principal component on the total score, indicating that it has outstanding performance in operating profitability, even in per share. There are poor performance indicators on the quality indicators, and will not affect the overall status of the first. Looking at the raw data, we find that the variable X4 cost margin included in the operating profit indicator is very high, indicating that its ability to control costs is particularly good. And the operating profit rate and total net asset interest rate also ranked first, indicating that in the quarter, operating profit in its main business income accounted for the majority of total revenue.

Ranked second is China Merchants Shekou. China Merchants Shekou Industrial Zone Holding Co., Ltd. is the flagship enterprise of China Merchants Group (a key state-owned enterprise directly managed by the central government and one of Hong Kong's four major Chinese-funded enterprises). It is an important core asset integration and business collaboration platform of China Merchants Group. With the development model of "Former Harbor-Central District-Backtown", the company focuses on "integration of production, network, integration and city development", and cooperates with the development and operation of the park, community development and operation, and cruise construction and operation. The company provides a wide range of products and services covering the entire life cycle. While continuing to promote the upgrading of 46 cities across the country, follow the development strategy of China Merchants Group "going out" and develop and replicate the "Shekou Mode" in the countries and regions along the "Belt and Road" to realize the development of the Free Trade Zone and the "Belt and Road" An effective stack of strategies. In the reporting period 2017-06-30, the real estate industry income was 7.118 billion, accounting for 51.62%, the profit was 4.304 billion, accounting for 64.38%, and the gross profit margin was 60.47%. As a well-known and influential state-owned holding company, in line with the development of the times, the indicators of profitability in this quarter are better, ranking second.

Ranked third is Zhongtian Finance. Zhongtian Financial Group is an ecological chain system integrating insurance, securities, funds, private banks and inclusive finance, technology finance and green finance. In the real estate industry, Zhongtian Investment is the operating platform, with the Belt and Road, the Yangtze River Economic Belt, the Beijing-Tianjin-Hebei, and the poverty-stricken areas as the core, and the national strategic layout of the physical business. Its

main investment areas involve basic public facilities construction, cultural tourism, finance, and real estate development. Its business scope is wide, and the main products are reported in 2017-06-30, residential income is 3.922 billion, accounting for 40.84%, profit is 1.384 billion, accounting for 36.83%, gross profit margin is 35.29%. The property development project has a secure housing project and a future Ark. In its operating profit index, although its asset return rate and total net asset interest rate are relatively high, the overall profitability is good, but the cost control and operating profit are not as good as the first two, and the performance of each quality indicator is generally ranked third.

In the middle of the rankings are Vanke, Poly Developments And Holdings Group, Seazen Holdings, Thaihot Group, Financial Street Holdings and Gemdale Group. They have average profitability indicators and are in the middle position. Among them, Taihe Group scored the highest in the second principal component investment return quality index.

In the back, there are Greenland Holdings, Jinke Property Group and Beijing Capital Development. The scores of the three components of the three companies are low, indicating that the three companies have some shortcomings in their profitability.

Finally, look at the scatter plot of the factor and the information overlay of the original coordinates in the direction of the factor (ie, the biplot), which fully reflects the relationship between the factor and the original data. From the biplot (Figure 6), we see that the different variables are strongly different in each company. The first principal component indicator variable responded strongly to companies such as Shimao and China Merchants Shekou, indicating that the index values of these companies are relatively high. Shanghai Shimao shares are higher in the index X2 (total net asset rate) and X4( cost margin), while Thaihot Group is significantly higher in the indicator X7 (net assets per share). The Beijing Capital Development, Jinke Property Group, Greenland Holdings and Gemdale Group were significantly lower in various indicators.

In general, the top ranked companies have some obvious characteristics or advantages. These companies have diversified development strategies, and create profits from other fields during the downturn of real estate. Also have sufficient capital, and comply with the government's call to resist risks. Strong ability to maintain profitable growth during the period of real estate turmoil, and obtain higher evaluation of the profitability of listed companies. Some companies with lower rankings have a single strategic development project, and there are some problems in the capital structure, which are not good in the profitability evaluation system.



Fig 6. Biplot

## 4. SHINY DISPLAY

### 4.1. Introduction to Shiny

Shiny is an R package that makes it easy to build interactive web applications directly from R. You can host standalone applications on your web pages, or you can embed them into R Markdown documents or build dashboards. Using Shiny, R users of non-traditional programmers can complete some simple data visualization work according to their own business without relying on the front-end and back-end engineers, and quickly verify the reliability of the idea.

### 4.2. This Example Shows the Results of Shiny Visualizatio

The visualization results of using RStudio statistical software to analyze the profitability of some listed real estate companies in China are shown in the following figure. Mainly show four parts. The first part is shown in the blue circle in Figure 4.2-1. There are two sub-labels under each label, which show the basic diagram of the principal component analysis method, and divide it into variables and individuals to display them separately in two pieces. The second part As shown by the red circle in Figure 7, the overall result graph is displayed, similar to the double-label map, which is intended to show the approximate result through a graph; the third part is the selected part of the black rectangular border in Figure 7. The result data is intended to calculate the specific value; the fourth part is shown in the selected part of the yellow rectangular frame in Figure 7. In Figure 8, showing the raw data. Figure 9 is only for display.



Fig 7.

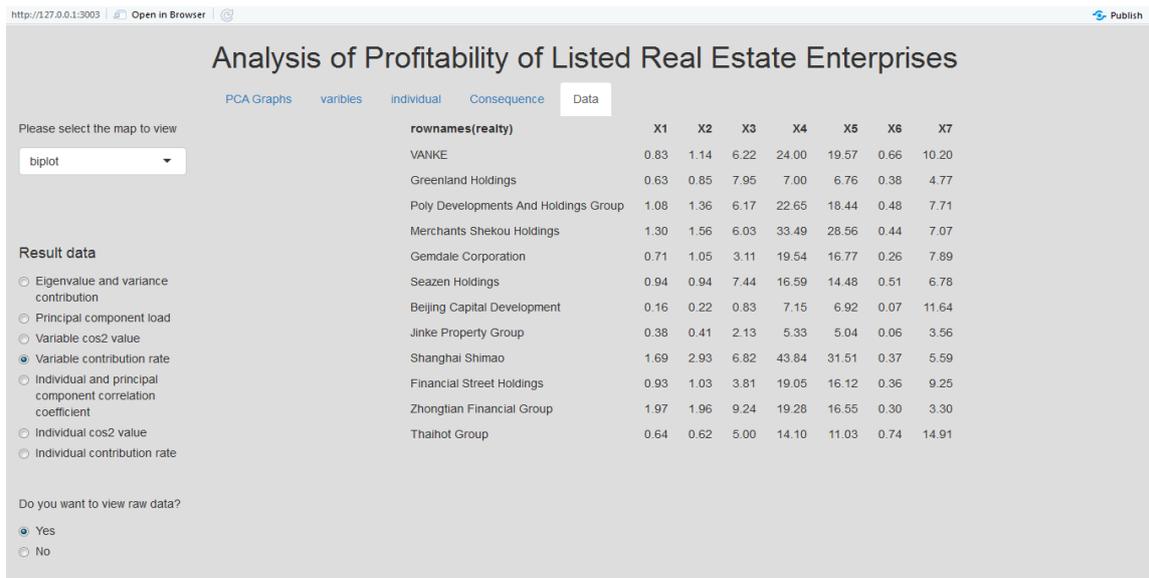


Fig 8.



Fig 9.

### 5. CONCLUSION AND SUGGESTION

Through the analysis of the ability of China's listed listed profit companies by principal component analysis method and the understanding of China's real estate development, we can find that China's real estate industry is still in the process of rising tortuous. On the whole, due to government interventions and various policies such as “restricted housing orders”, the real estate market is gradually under pressure and the housing market is gradually moving towards normal. However, there are still many problems in the market, such as the backlog of finished houses, the situation of some small real estate developers' capital chains, and the development of real estate shoulders the social stability and promotes the heavy responsibility of the economy. Therefore, it is necessary to develop a long-term, local-oriented business model based on stability.

Specifically, through the analysis of principal components, most high-asset large-scale real estate listed companies have played a very good role in profitability. The reduction of real estate investment has gradually threatened the profitability of these leading enterprises. Among the real estate industry, companies such as the Shanghai shimao and Vanke can still create high

returns that are much higher than the average profitability of the industry. Enterprises in the middle and below need to constantly innovate, change the way of profit, control costs, find opportunities in the challenge, stand out from the middle level, and then drive the real estate industry in China.

If a real estate listed company wants to make a breakthrough in its profitability, it is necessary to ensure the good returns of the asset return rate, total asset net profit rate, return on net assets, cost and profit margin, and operating profit margin. In addition to profitability, financial analysis also has three aspects: growth, debt service, and operation. In developing profitability, it is also necessary to take into account the common progress of other capabilities, so as to enhance the overall performance of the company.

Finally, four suggestions are given. First, listed companies in the real estate industry must work to improve profitability. Second, strive to build a good image and establish a brand. Third, strengthen the financial risk management of real estate enterprises. Fourth, real estate enterprises can also increase their investment in science and technology research by strengthening financing channels, and cooperation with intermediaries to improve their own profitability and promote the good development prospects of the real estate industry.

## REFERENCES

- [1] Binhui Wang: Multivariate Statistical Analysis and R Language Modeling (Jinan University Press, China 2010).
- [2] Binhui Wang.: Data Statistical Analysis and R Language Programming (Peking University Press, China 2014).
- [3] Wenjun Wei. Empirical Analysis of the Profitability of China's Construction Enterprises from the Perspective of SCP (MS., East China University of Political Science and Law, China 2016).
- [4] Wei Hu. Design of financial data analysis system for listed companies based on data mining (MS., Suzhou University, China 2014).
- [5] Gaoqing Chen. An Empirical Analysis of the Relationship between Capital Structure and Profitability of Listed Companies (MS., Tianjin University of Finance and Economics, China 2014).
- [6] Jingyi Ouyang. Empirical Analysis of Profitability of Real Estate Listed Companies in China (MS., Chongqing University, China 2014).
- [7] Yiyu Wu. Financial Analysis of Listed Companies in Communication Equipment Manufacturing Industry Based on Factor Analysis Method (MS., Wuhan University of Technology, China 2011).
- [8] Enquan, Lü, Jiangtao Liu. Analysis of Profitability of Real Estate Companies Based on DuPont Method [J]. Economic Forum, 2010(2). (In Chinese)
- [9] Xuanmin Zhao, Xiaoyang Zhang. An Empirical Analysis of Factors Affecting Profitability of Real Estate Listed Companies [J]. Finance and Accounting News, 2009(03).