A Research of Development Ability of Liquor Industry: Evidence from Kweichow Moutai

Yichen Li[1, *]

[1] School of Statistics and Mathematics, Central University of Finance and Economics
*Corresponding author. Email: 2019310894@email.cufe.edu.cn

ABSTRACT
Focusing on the development quality of enterprises in the liquor industry, this paper selects 16 representative listed enterprises, and uses the cross-sectional data in 2021 to score and classify enterprises through factor analysis and cluster analysis. From the perspectives of the industry-level and firm-level development ability, this paper further investigates the development status of kweichow Moutai Co., LTD., a leading enterprise, and uses the relative valuation method to explore its intrinsic value. With the rapid development of the financial industry, the stock market as an important investment channel has attracted extensive attention, and the research on stock forecasting has also made remarkable achievements. In this paper, BP neural network and PCA-BP neural network models are respectively used to predict the next day's closing price of the time series data, and the advantages and disadvantages of the two models are compared respectively. So as to put forward innovative prediction methods for stock price trend prediction.

Keywords: *Liquor industry, Factor analysis, Valuation, BP neural network*

1. INTRODUCTION

Liquor industry is a comprehensive industry, spanning the primary industry, the secondary industry and the tertiary industry. Liquor is one of the characteristic products in China, and the enterprises occupy a dominant position in the market, which has a significant impact on economic development. The listed enterprises in the liquor industry are the main force of the industry, so it has good practical significance to study the listed enterprises in the liquor industry.

As the leading enterprise in the liquor industry, Kweichow Moutai once became the investment representative of value stocks in China. Its price fluctuation has an impact on the industry fluctuation. With its perfect industrial chain and product production, Kweichow Moutai occupies an important market position. Therefore, on the basis of the research on industry development quality, the research on Kweichow Moutai Company can reflect the company level's response to market changes and complement the industry research. In the process of market globalization, promoting the high-quality development of liquor industry has become an important issue in the industry. This paper selected 16 listed liquor enterprises as research samples, explored their financial indicators and risk factors, and studied the overall enterprise development quality of the industry. At the same time, it was committed to the valuation study of Kweichow Moutai Company, providing theoretical basis for the sustainable development of the liquor industry and improving the quality of enterprise development.

The stock market has now become an indispensable financial business of the country, under the influence of national macro-control measures and market economic environment, and the composition of investors in the domestic capital market has certain uniqueness, among which individual investment accounts for more than 99%. In today's information explosion, people urgently need a way to extract the required content from information, which is also the starting point of this paper's research purpose. For the price of the stock presents serial correlation in China, this article will explore the stock price from linear relationship, for " Kweichow Moutai " stock when the opening price, the highest and the lowest price, closing price, trading volume and turnover as independent variables, the next day the closing price as the dependent variable, prediction model is established, at the same time, considering that there are strong correlation between the independent variables, and then USES the principal component analysis (PCA), different models are constantly used to optimize the prediction effect and

make more accurate prediction results for the stock price trend of Kweichow Moutai.

2. VARIABLE SELECTION

2.1.Exploratory Factor Analysis Model

This paper uses cross-sectional data from the third quarter in 2021.

Table 1 Variable declaration of factor analysis

Development Quality	Financial Indicators	Variables
Profitability	Earnings per share (CHN)	a_1
	Asset net interest rate	a_2
Debt paying ability	Current ratio	a_3
	Debt ratio	a_4
Growth ability	Net profit growth rate	a_5
	Growth rate of total assets	a_6
Operation ability	Inventory turnover	a_7
	Total asset turnover	a_8

Data source: XueQiu website

2.1.1. Profitability Development Indicators

This paper chooses earnings per share and net interest rate on assets as indicators of profitability development. The formula is:

$$Earnings\ per\ share = \frac{Profit - preferred\ dividends}{Weighted\ average\ common\ shares} \quad (1)$$

$$\text{Asset net interest rate} = \frac{Net\ profit}{Total\ assets} \quad (2)$$

Earnings per share measures the income that shareholders can get by holding each unit of stock, and net interest rate on assets measures the company's ability to use its own assets to obtain profits. Therefore, these two indicators are used to measure the profitability of liquor enterprises.

2.1.2.Solvency Development Indicators

In this paper, current ratio and debt ratio are selected as indicators of solvency development. Where, the formula is:

$$Current\ ratio = \frac{Current\ Assests}{Current\ Liabilities} \quad (3)$$

$$Debt\ ratio = \frac{Total\ Debts}{Total\ Assets} \quad (4)$$

The current ratio is an indication of an enterprise's liquidity, in many cases a creditor would consider a high current ratio to be preferable to a low current ratio, because a high current ratio indicates that the corporation is more likely to reimburse the creditor.

The debt ratio is the percentage of total liabilities in total assets of an enterprise. Indicators reflect a company's ability to borrow. From the operator's point of view, we should make full use of the borrowed funds to bring benefits to the enterprise and reduce financial risks as much as possible.

2.1.3.Growth Ability Development Indicators

In this paper, the growth rate of net profit and total assets are selected as the indicators of growth ability development. Net profit growth rate measures the ability of enterprise net profit growth, total assets growth rate measures the ability of enterprise capital accumulation expansion.

2.1.4.Operational Capacity Development Indicators

In this paper, inventory turnover and total asset turnover are selected as operational capacity development indicators. The formula is:

$$Inventory\ turnover = \frac{Cost\ of\ Goods\ Sold}{Average\ Inventory\ at\ Cost} \quad (5)$$

$$Total\ asset\ turnover = \frac{Net\ Sales\ Revenue}{Average\ Total\ Assets} \quad (6)$$

The inventory turnover is a measure of the number of times inventory is sold or used in a time period such as a year. It is calculated to determine if a company has excess stock relative to its sales level. The asset turnover, the total turnover of the asset, is a financial ratio which measures the effectiveness of the use of its assets by the enterprise to generate sales revenue or sales revenue for the enterprise.

2.2BP Neural Network Model

In this model, this paper uses time series daily data from 2001 to 2021 to make prediction.

Table 2 Variable declaration of BP model

variable	Variable descriptions	Variable explanations
Y	Next day close	CNY
X_1	Opening price	CNY
X_2	The highest price	CNY
X_3	The lowest price	CNY
X_4	Closing price	CNY
X_5	Turnover	CNY

X_6	Volume	numbers

Data source: Wind

3. MODEL DESCRIPTION

3.1.Exploratory Factor Analysis Model

Exploratory factor analysis (EFA) is a method of dimensionality reduction in data analysis. Its core lies in classifying variables and condensing them into a few factors for further analysis and research. The formula of the factor model is as follows:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + a_{i3}F_3 + \cdots + a_{im}F_m + \varepsilon_i \ (i = 1, \ldots, p) \quad (7)$$

The original measurable correlation variables $X_1, X_2, \cdots, X_p$ are described by means of m unobstructed and independent common factors $F_1, F_2, \cdots, F_m$ and a special factor ε_i.

After factor extraction, validity test or weight index calculation can be carried out. We will classify the factors and name them to facilitate the subsequent cluster analysis. Exploratory factor analysis will use SPSS to extract principal component factors, using the maximum variance rotation method.

3.2.K-mean Clustering Analysis

3.2.1.Algorithm Concept

K-means clustering, which comes from a vector quantitation method in signal processing, is most popular in the field of data extraction as a clustering method. The N points (which may be an observation or an instance of the sample) are divided into groups K, so that each point belongs to the cluster corresponding to its nearest mean (i.e. the cluster center), which is taken as the clustering standard. The first cluster analyses were developed in the archeological classification and classification of insects to find the objective "natural subclasses" hidden in the data. "Natural subclasses" are characterized by similar intra-class structures and significant differences in class bond structures.

3.2.2.Basic Principle

(1) Suppose that we wanted to group N sample observations into categories K, and first select K points as the initial central points.

(2) Based on the principle of the minimum distance from the initial central point, all observations are divided in the class in which each central point is located; There are multiple observations in each class, and the mean values of all sample points in class K are calculated as central points K in the second iteration.

(3) Then repeat steps 2 and 3 according to this central until convergence (the central point does not change or reaches the specified number of iterations), and the clustering process is completed.

3.3.Relative Valuation Model

Relative valuation model is an easy way to find companies with solid foundations. The relative valuation consists of PE, PB, PEG, EV/EBITDA and other valuation methodologies. Generally compared with a number of other stocks, if below the average of the corresponding index the price of stocks is underestimated, the price of stocks should increase.

The P/E ratio is the ratio of price to earnings per share, which is the most basic method for estimating the price of ordinary shares. In general, a high P/E ratio means that investors pay more for each unit of earnings, which means that equities have a promising future. However, too high a P/E ratio will cause high equity volatility, leading to investment risks.

3.4.BP Neural Network Model

The neural network BP (Back Propagation) is a concept put forward by scientists under the direction of Rumelhart and McClelland in 1986. It is a multi-layer advance neural network formed according to the error reverse propagation algorithm, and it is one of the most widely used neural network models. As an intelligent information handling system, the heart of the artificial neural network is the algorithm. The BP neural network is a sort of multi-layer feedforward network formed by error feedback propagation (abbreviated as error feedback propagation). Its algorithm is known as a BP algorithm. Its basic idea is gradient descent method to minimize the mean square error of the actual output value and the expected output value of the network. The basic BP algorithm includes two processes: signal forward propagation and error reverse propagation [1]. During direct propagation, the input signal acts on the output node through the hidden layer and produces the output signal by non-linear transformation. If the actual output is not in accordance with the expected output, the error propagation process will be performed. In this case, the trained neural network can process the input information of similar samples with the least output error after non-linear transformation.

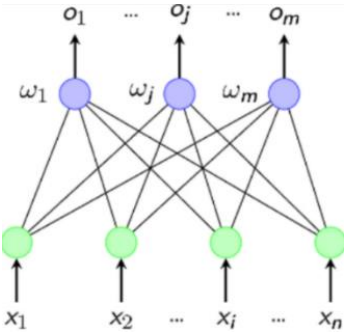

Figure 1 BP Neural Network Model structure

4.ANALYSIS OF EMPIRICAL RESULTS

4.1.Exploratory Factor Analysis Model

4.1.1Descriptive Analysis of Data

Table 3 descriptive analysis of data

	Min	Max	Mean	Standard Deviation
a_1	-0.22	29.67	3.64	6.95
a_2	-3.71	21.38	10.24	8.14
a_3	1.13	7.98	3.27	1.90
a_4	8.71	57.54	30.74	14.24
a_5	-35.58	117.69	37.46	45.14
a_6	-3.77	66.17	21.50	17.80
a_7	0.22	1.30	0.52	0.27
a_8	0.18	0.75	0.43	0.18

Firstly, z-score method is used to standardize data, so as to eliminate the influence of different dimensions on data analysis. As can be seen from the table 3, the 16 listed companies are in good development status, and the mean values of 8 variables are all greater than 0. Among them, the standard deviation of net profit growth rate is the largest, indicating that the fluctuation range is the largest, reflecting the fluctuation of liquor industry caused by COVID-19 in 2020. Indicators representing growth capacity were the most volatile, while those representing operational capacity were the least volatile.

4.1.2Applicability Analysis

Table 4 KMO test and Bartlett test

KMO Value		0.508
Bartlett	approximate chi-square	76.900
Sphericity	df	28
Test	Sig.	0.000

The KMO test consists in comparing the single correlation coefficient and the partial correlation coefficient between the variables. The closer the KMO value is to 1, the greater the correlation between the variables and the more appropriate the original variables are for factorial analysis. Based on the exit results, the KMO value is 0.508, greater than 0.5, indicating that this data is suitable for factorial analysis on small samples. At the same time, the Bartlett sphericality test (Sig =0.000) was passed, and the validity of the structure was obtained.

4.1.3Factor Extraction and Interpretation

In this exploratory factor analysis showed in Table 5, three factors were extracted with a fixed number, and the cumulative variance explanation rate was 78.575%, indicating that the factor could represent 78.575% of the interpretation amount of the overall data. In the case of a small sample, we accepted these three factors.

As can be seen from the Figure 2, the eigenvalues of the samples are all less than 1 from the third factor, and the decline speed is slowing down. The difference of eigenvalues is small, so only the first three factors are used [2].

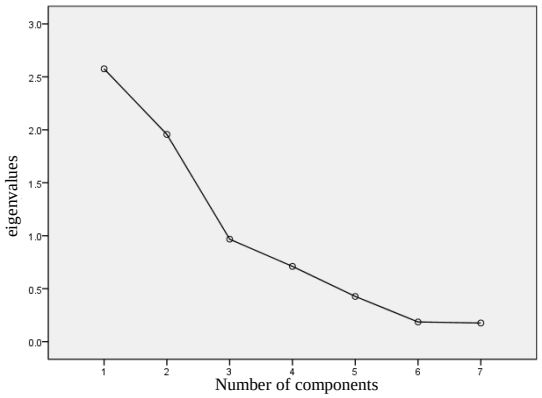

Figure 2 Lithotriptic diagram

Table 5 EFA variance interpretation

Total variance of interpretation									
component	Initial eigenvalue			Extract the sum of squares			Rotate squares		
	sum	variance	cumulative	sum	variance	cumulative	sum	variance	cumulative
1	2.576	36.801	36.801	2.576	36.801	36.801	2.205	31.498	31.498
2	1.957	27.954	64.754	1.957	27.954	64.754	2.019	28.848	60.346
3	.967	13.821	78.575	.967	13.821	78.575	1.276	18.230	78.575

4	.711	10.151	88.726
5	.427	6.103	94.829
6	.186	2.656	97.485
7	.176	2.515	100.000

4.1.4Rotation Factor Matrix

The maximum variance rotation method was used to output the rotation factor matrix for the first factor analysis. In the first factor analysis, the phenomenon of "double load" appeared in the variable of total asset turnover, for the load of component 1 and component 2 were both greater than 0.6. Therefore, this variable a_8 should be deleted for the second exploratory factor analysis.

The output results of the second exploratory factor analysis are as follows:

Table 6 Rotating component matrix

	Component		
	1	2	3
a_1	.043	-.146	.968
a_2	.744	.174	.509
a_3	-.259	-.869	-.027
a_4	.184	.908	-.052
a_5	.904	.082	-.144
a_6	.772	.054	.122
a_7	-.367	.615	-.206

As can be seen from the rotating component matrix, the first factor has a high load on net asset interest rate, net profit growth rate and total asset growth rate, so factor 1 can be defined as growth capacity factor. The second factor presents a high load in liquidity ratio, asset-liability ratio and inventory turnover ratio, so factor 2 can be defined as a solvency factor. The third factor shows a high load on earnings per share (0.968), so factor 3 can be defined as a profitability factor. The composition of silver is shown in the figure below:

Table 7 Factor composition table

Factor	Composition	Definition
F_1	a_2, a_5, a_6	Growth ability factor
F_2	a_3, a_4, a_7	Solvency factors
F_3	a_1	Profitability factor

$$F_1 = -0.159a_1 + 0.260a_2 - 0.020a_3 - 0.008a_4 + 0.489a_5 + 0.369a_6 - 0.225a_7 \quad (8)$$

$$F_2 = 0.045a_1 + 0.067a_2 - 0.435a_3 + 0.455a_4 - 0.089a_5 - 0.052a_6 + 0.347a_7 \quad (9)$$

$$F_3 = 0.823a_1 + 0.316a_2 - 0.085a_3 + 0.037a_4 - 0.302a_5 - 0.045a_6 - 0.024a_7 \quad (10)$$

According to the cumulative contribution rate of the three factors as the weight, the score model of the comprehensive development of listed enterprises can be obtained:

$$F = \frac{0.315}{0.786}F_1 + \frac{0.288}{0.786}F_2 + \frac{0.182}{0.786}F_3 \quad (11)$$

4.2.K-mean Clustering Analysis

Cluster analysis refers to sample clustering, which aims to classify samples. K-mean clustering analysis was used to output the ANOVA table:

Table 8 ANOVA table

	Clustering		Error		F	Sig.
	Square	df	Square	df		
F_1	3.800	3	.354	13	10.736	.001
F_2	3.346	3	.459	13	7.296	.004
F_3	4.509	3	.190	13	23.704	.000

In the Table 8, the categories obtained from the cluster analysis show significant differences in the three factors (Sig =0.000), indicating that the three factors play a good role in the cluster analysis, so the cluster analysis results are valid. The final clustering results of 16 companies are in Table 9 below:

Using k-mean clustering method, we divided 16 listed companies into four levels: rank 1, rank 2, rank 3, and rank 4. The higher the grade, the more investment value, investment risk is relatively small.

Table 9 Clustering analysis results

Rank 1	Rank 2	Rank 3	Rank 4
Kweichow Moutai	Luzhou laojiao	Shunxin Agriculture	Guyue Longshan
	Gujinggong Liquor	Tempting wine	ELET
	Shede Wine		Jingfeng wine
	Shanxi fenjiu		Yanghe shares

Jin shi yuan	Golden seed wine
Shui jing fang	Dongfeng wine
Jiugui Liquor	

From clustering analysis, we classified 16 listed enterprises into four categories, Kweichow Moutai with excellent factor score ranked first, its profit ability factor's score is 3.51, far more than other enterprise's profit factor score. And Kweichow Moutai with its complete industry chain and brand reputation degree, especially on profitability. However, its growth ability factor and debt paying ability factor are slightly less than 0, which is consistent with the limited expansion of Kweichow Moutai Company in recent years. Kweichow Moutai has limited market expansion. While it has a stable domestic market, it has little market extension abroad. SWOT analysis will be detailed in the following article. The factor scoring matrix is shown in Table 10.

Table 10 Factor score coefficients table

Stock code	F_1	F_2	F_3	F
600519	-0.3862	-0.7317	3.51135	0.3902
000568	0.2513	-0.1980	0.4136	0.1239
000596	0.7741	0.1869	-0.0426	0.3689
000860	-1.9236	2.3478	-0.2085	0.04108
600059	0.17698	-2.1442	-1.0769	-0.9641
600197	-0.4172	-0.2352	-0.5348	-0.3772
600559	-0.4629	1.1031	-0.2863	0.1524
600616	-1.3470	-1.5755	-0.5438	-1.2431
600702	1.1865	0.2510	-0.1156	0.5407
600809	1.5224	0.7711	0.0684	0.9085
601579	-0.4608	-0.4499	-0.7108	-0.5141
603369	0.1099	0.12774	-0.0639	0.0761
002304	-0.2862	-0.1668	0.52646	-0.05391
600779	1.4242	0.7831	-0.0487	0.8464
600199	-1.0646	0.0399	-0.6937	-0.5726
000799	1.3605	-0.0303	-0.4996	0.41848

4.3.Valuation of Kweichow Moutai

4.3.1.Company Overview

Kweichow Moutai Co., Ltd. is the only manufacturer of Kweichow Moutai series products, and its leading products have won the gold award. Guizhou Moutai liquor has a long history. It is not only the originator of Liquor enterprises in China, but also a name card of Chinese culture in the world. In 2020, the profit margin of the company's main business is 76.78%, indicating that the company has a strong profitability; the current ratio is 4.06, indicating that the company has good solvency. Besides, inventory turnover is 0.30, indicating that the company has a good operating capacity [3].

4.3.2.SWOT Analysis

4.3.2.1. Strength

Kweichow Moutai Co., Ltd. has a long history, and it has a good brand reputation, occupies a stable market position in the market, has innovative core technology in technology. In terms of organizational system, the company's years of practical experience has laid a good decision support for its development, and long-term cooperation with upstream and downstream enterprises has provided a good win-win relationship.

4.3.2.2. Weakness

The production of products is subject to the geographical environment, brand expansion is limited. In 2020, Moutai's domestic revenue is 92.39 billion yuan, and its overseas revenue is 2.43 billion yuan, which is less than 3% of the total revenue, indicating that the company's overseas business expansion capacity is insufficient and needs to be improved [4].

3.3.2.3. Opportunity

China's macro economy continues to improve, liquor industry in good business form. Strong market demand, along with the continuous improvement of national income, consumer disposable income continues to grow, will help liquor enterprises to enhance brand competitiveness.

4.3.2.4. Threat

The competition in liquor industry is fierce, and the change of population characteristics leads to the shift of consumption taste, which may cause the possibility of substitution for Moutai. At the same time, an aging population could lead to a decline in Moutai consumption.

4.3.3.Relative Valuation Method

The stock price will fluctuate around the intrinsic value of the stock. When the stock value is undervalued, that is, when the stock market value is lower than its intrinsic value, investment can be made to obtain excess returns. When a stock is overvalued, that is, its market

value is higher than its intrinsic value, it is sold for a profit. So stock valuation is valuable for investors to make decisions. This paper uses the relative valuation method to analyze the stock valuation, which can be called the PE ratio method[1].

This paper selects the 16 enterprises mentioned above and removes the two outliers of Golden Seed Wine and Golden Maple Wine to obtain the following data:

Table 11 Financial index

Stock code	Earnings per share	Market value per share	P/E ratio
600519	29.67	1707.79	43.18
000568	4.28	203.88	38.22
000596	3.85	186.00	42.91
000858	4.46	167.90	28.21
000860	0.50	23.61	35.32
600059	0.15	9.79	52.48
600197	0.57	26.28	34.91
600559	0.28	21.00	56.65
600702	3.78	179	47.72
600809	4.02	274.34	51.46
601579	0.20	9.63	36.65
603369	1.35	44.38	24.58
002304	4.82	144.00	22.57
600779	2.05	87.20	31.93
000799	2.22	166.90	56.48
Mean value			40.22

As can be seen from the table, The P/E ratio of Kweichow Moutai is high, higher than the average level of the industry, and its earnings per share is much higher than that of other enterprises, which indicates that the stock value of Kweichow Moutai is good. This paper selects the average P/E ratio of the above enterprises in the liquor industry as the P/E ratio in the relative valuation method of Kweichow Moutai Company.

Thus we use the formula:

$$Intrinsic\ value = \frac{P}{E} ratio \times Earnings\ per\ share \quad (12)$$

The intrinsic value of Kweichow Moutai can be calculated as $40.22 \times 29.67 = 1193.33$ CNY, this value is lower than the market price of Kweichow Moutai, which is an error caused by the volatility of the liquor industry, but we can also see that Kweichow Moutai shares have good investment value from whole angles.

4.4.Prediction

4.4.1.Descriptive Analysis of Data

First, we draw the general trend of the next day's closing price of the variables in Figure 1. As can be seen from the figure, the closing price of the next day stabilize at a small value at the beginning, but gradually increase and the fluctuation range became larger as time goes by. The overall trend is exponential.

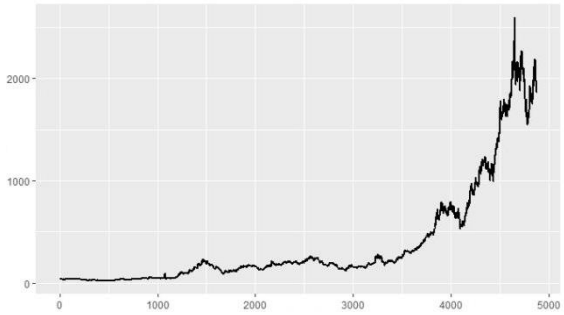

Figure 3 Closing price trend

As can be seen from the descriptive statistical results of variables, the distribution of each variable is not normally distributed. Therefore, Spearman correlation coefficient between variables is calculated and the correlation graph is drawn as shown in Figure 2. It can be seen from the figure that the correlation coefficients between Y and X1, X2, X3, X4 and X5 are all above 0.9, indicating that the dependent variable has a highly positive correlation with these five independent variables and a strong linear relationship. At the same time, X1, X2, X3, X4 and X5 have a strong linear positive correlation, so collinearity should be taken into account in the subsequent model and prediction process.

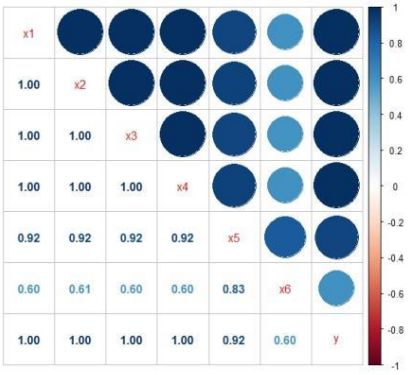

Figure 4 Correlation coefficient diagram

4.4.2.Data Processing

First, the sample data are normalized:

$$f(x) = \frac{x - \min(x)}{\max(x) - \min(x)} \quad (13)$$

Then divide the training set and test set in a 7:3 ratio. The basic idea of the BP neural network model is to get the connection weight of each node after meeting the performance requirements, by adjusting the number of hidden nodes under the principle of reducing the error between the simulated output and the actual output.

In this section, we use BP neural network model and PCA-BP neural network model respectively, and compare their prediction differences.

4.4.3.BP neural network model

4.4.3.1. Neural Network Diagram

In the model, the six variables open, close, high, low, price and volume are used as input variables to predict the stock price of the next day. The neural network with an implicit layer of 1 is used to fit the training data, and the results are shown in the figure below:

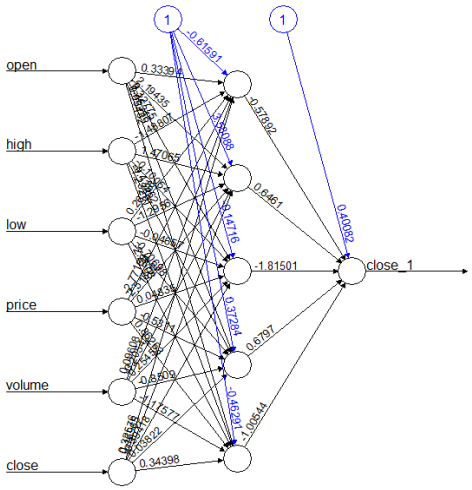

Figure 5 BP neural network model

The black line in the figure 5 represents the direct relationship between each layer and its relevant weight, while the blue line represents the error term added to the blue line for each step in the fitting process. The values in the test set were predicted and their mean variance (MSE) was calculated, and the correlation coefficients between predicted values and true value were examined. MSE is 0.0818 and correlation coefficient is 0.6549, indicating accuracy to some degree.

4.4.3.2. Results

The result is shown in Figure 6 at the bottom of the page. We can see that the prediction differs from the actual value in the later period, indicating that the prediction is not accurate enough in that time even it has an overall accuracy depends on the correlation coefficient.

4.4.4.PCA-BP Neural Network Model

When the six variables, open, close, high, low, price and volume, are used as explanatory variables, it is necessary to conduct principal component analysis on these variables due to the large correlation degree between variables and some correlation coefficients greater than 0.9 [5].

According to the "multiple regression analysis", extraction of the first two principal components can make the cumulative variance explanation rate of 0.98, indicating that the two principal components can well represent the original information. The two rotated principal components "RC1, RC2" were used as input vectors of BP neural network to build the model. Through continuous back testing, the parameter whose predicted value was closest to the actual value was selected and the optimized PCA-BP combined model was finally formed.

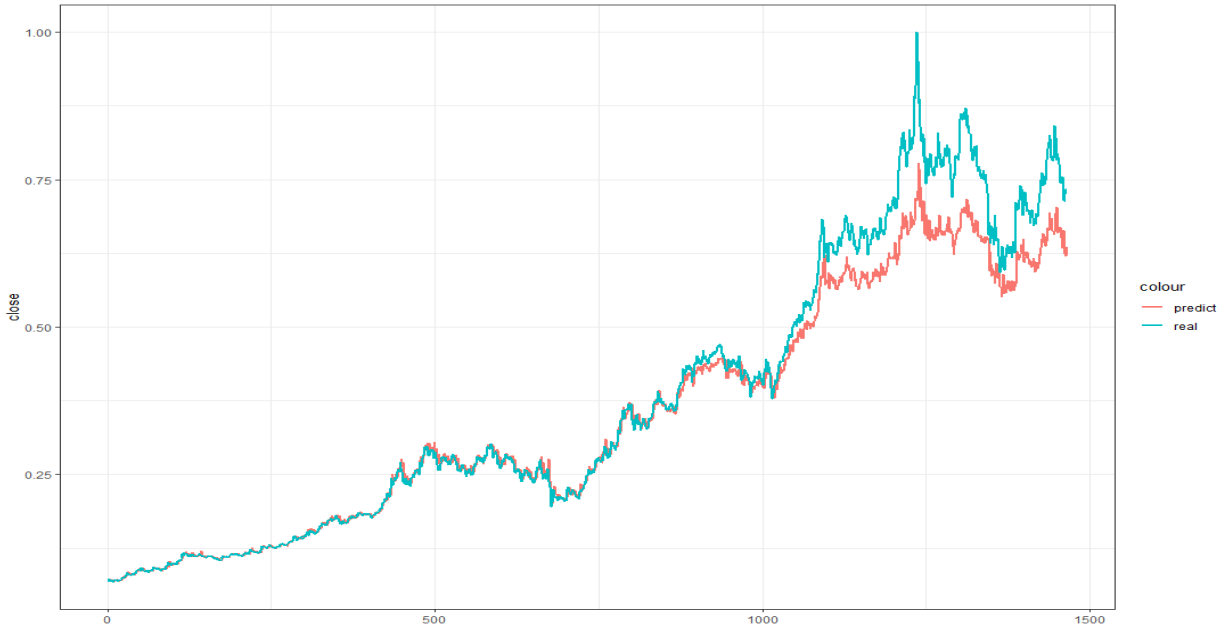

Figure 6 Results of BP model

4.4.4.1. Neural Network Diagram

The neural network with hidden layer 1 was still used to fit the training data. The MSE was 0.0014 and the correlation coefficient was 0.9919, among which the MSE was lower than that of the BP model alone. The reason was that the BP model based on principal components had a better fitting degree in the short term, as detailed in the next section "Model Comparison".

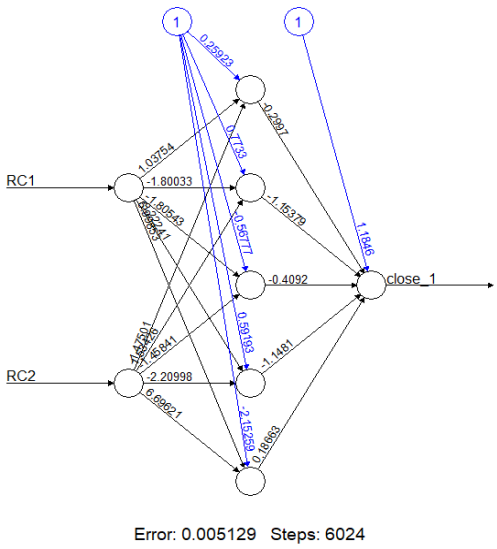

Figure 7 PCA-BP neural network model

4.4.4.2. Results

The result is shown in Figure 8 below, and we can see the prediction indicates high accuracy.

4.4.5.Model Comparison

In order to further verify the prediction effect of the model, the average relative error between the predicted value and the real value is calculated and compared with the BP neural network model without PCA processing (10 groups of data in the middle of prediction are taken).

Table 12 Model comparison

Index	Real value	PCA-BP prediction	BP prediction
1	0.2818	0.3049	0.2625
2	0.2829	0.3080	0.2577
3	0.2827	0.2917	0.2546
4	0.2918	0.2860	0.2549
5	0.2918	0.3004	0.2606
6	0.2882	0.2941	0.2618
7	0.2900	0.2873	0.2592
8	0.2931	0.2905	0.2594
9	0.2773	0.2889	0.2613
10	0.2795	0.3017	0.2547
Mean error	/	0.0094	0.0272

Figure 8 Results of PCA-BP model

It can be seen from the data in the table that the average error of the PCA-BP model is 0.0094, while the average error of the BP neural network model alone is 0.0272, which proves that the combination of the PCA and BP neural network model has higher accuracy and stability than the BP neural network. The graph is as follow:

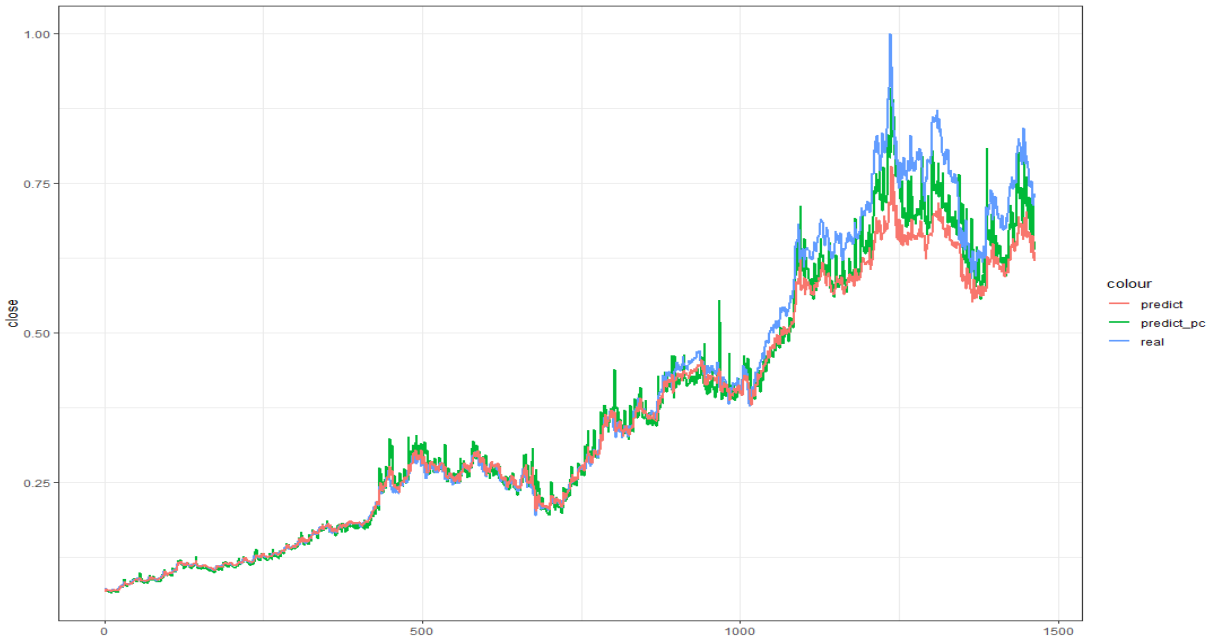

Figure 9 Model comparison

The PCA-BP model represented by the green line is significantly closer to the real value than the BP model represented by the red line. At the same time, the stock price fluctuates greatly in a long time, and neither of the two models can predict the long-term trend accurately, and the predicted value in the long term is lower than the predicted value. In general, PCA-BP model is better in prediction, and the correlation coefficient between the predicted value and the real value is as high as 0.9919.

5. CONCLUSION

5.1.Key Findings

5.1.1.Liquor Industry Development Quality

From the point of growth ability factor, according to the listed companies scored 16 liquors, the highest score

of shanxi fenjiu: 1.52 points, the second name is shuijingfang: 1.36 points, the third is Jiugui Liquor: 1.36 points, to illustrate the strong ability to the growth of the three companies, enterprise business development ability is stronger, is closely related with the concept of "sustainable development". Shunxin Agriculture and Golden Maple Wine received the lowest growth ability scores, indicating that the two companies need to improve in product development and business expansion.

In terms of the solvency factor, the scores of Golden Maple Wine and Guyue Longshan Wine are both less than -1, indicating that their asset and liability structures need to be improved, otherwise, due to financial pressure caused by excessive financial leverage, the company's cash flow will be adversely affected.

In terms of profitability factor, Kweichow Moutai scored 3.51, much higher than other 15 liquor enterprises, which is related to its high earnings per share. At the same time, Kweichow Moutai can appropriately increase its financial leverage, take advantage of the low capital cost of debt financing, and improve the utilization rate of funds and profitability as much as possible while ensuring the healthy asset structure of the enterprise. The score of Guyue Longshan is less than -1, indicating that the company should focus on product development and product sales to improve the profitability of the enterprise.

5.1.2.Valuation and Prediction of Kweichow Moutai

Then the paper shows the valuation of Kweichow Moutai, its P/E ratio is high. Besides, its valuation intrinsic value is lower than the market value, but it does not mean that Kweichow Moutai has no investment value. On the contrary, this is due to the high volatility of the liquor market and the selection of stocks. Based on the financial data of Kweichow Moutai and its company operations, it still has great investment value.

When coming to the prediction, it can be seen that the prediction effect of BP neural network model is very good in the short-term trend, but the predicted value is lower than the real value in the long-term trend, which is related to the high volatility of stock price. For PCA-BPA model, it can be seen from the output results that has a good prediction effect in the short-term trend, while the prediction value in the long-term trend is slightly lower than the real value, which is related to the high volatility of stock prices, and the prediction effect is significantly better than the BP neural network model. Both the index of MSE and correlation coefficient of the PCA-BP model is better than the BP model.

5.2.Research Significance

The research of this paper is helpful to the investors of liquor industry from both the angle of industry and firm. The paper analyzes the development quality of listed enterprises in the overall liquor industry, classifies the representative enterprises, provides investment suggestions for investors with the scoring of factor model, helps investors comprehensively consider the profitability, debt paying ability and development ability of enterprises. The paper also provides suggestions for enterprise development through the factor scoring. By predicting the valuation and closing price of Kweichow Moutai, we present future investment opportunities for investors as well.

5.3.Future Study and Limitation

In subsequent studies, we can optimize the selection of factors. For example, the dimension of enterprise development capability can be added, and the representative variables of each dimension can be expanded to increase the KMO test value and follow-up analysis. At the same time, the selection of liquor market representative enterprises can also be optimized.

In the use of valuation model, this paper simply uses P/E valuation method. However, in actual investment, investors have different attitudes to risk, so they should be divided into risk aversion, risk neutrality and risk preference, and establish different valuation models respectively to obtain more accurate enterprise valuation. At the same time, this paper uses industry average P/E ratio as the P/E valuation index of Kweichow Moutai Co., LTD. Simple weighted average cannot make better use of existing information, so scoring model can be used to assign different weights in future studies to improve accuracy.

The PCA-BP combined model is used to predict a large number of data, and the predicted value is very close to the actual value. At the same time, due to the selection of data fitting method, the prediction of the model is more accurate in a short period of time, and has greater advantages. However, at the same time, the principal component analysis inevitably has certain information loss, so the principal component with high cumulative contribution rate should be selected as far as possible.

When BP neural network is searching parameters, it is limited by computer ability and the number of iterations is limited, so the problem of hyperparameter cannot be solved. It is also related to the degree of adaptation of the data itself. The accuracy of ordinary neural network is still insufficient, and LSTM model can be used for prediction in subsequent model improvement to avoid the gradient disappearance problem of conventional RNN to a greater extent.

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