GROWTH ANALYSIS OF CHINESE LIQUOR LISTED COMPANIES BASED ON PRINCIPAL COMPONENT ANALYSIS

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Abstract

The growth of listed companies has always been a topic of concern for investors. Based on the cross-sectional data of 18 listed Chinese liquor companies in 2021, the principal component analysis method is adopted to analyze their growth. The results showed that the growth of the liquor industry was affected by the epidemic, but in the long run, with the recovery of the economy, the growth of the liquor industry will be further enhanced.

Keywords: Liquor Listed Companies, Principal Component Analysis, Growth Analysis

Introduction

As a traditional distilled alcoholic spirit that holds great cultural significance in China, Chinese liquor is considered one of the oldest and most renowned spirits in the world, with a history dating back thousands of years. Due to the impact of the Covid 19 epidemic, the economy has been subject to certain shocks. The Chinese liquor industry is no exception, with offline sales and consumption scenarios being affected. However, with the improvement of industrial structure and the continuous development, the Chinese liquor industry is getting more concentrated. Under the current policy focus on stimulating consumption and expanding effective demand, the Chinese liquor industry holds a significant position in the overall food consumption due to its large consumer base, unique brewing techniques, and long history of liquor culture. Additionally, in the capital market, listed companies in the Chinese liquor sector have attracted significant attention from investors, and their growth prospects are among the topics of interest. Therefore, conducting a scientific analysis of the growth prospects of listed companies in the Chinese liquor sector is not only a topic of concern for consumers but also for investors, and it holds practical significance.

With the continuous development of the Chinese liquor industry, empirical research on listed companies in the Chinese liquor sector is ongoing. However, the focus of research has mostly been concentrated on the operational performance and financial analysis of enterprises. For instance, Yanmin Peng and Chen Du (2014) employed multiple regression analysis and principal component analysis to examine the relationship between changes in company value and changes in financial indicators within the Chinese liquor industry. Chenggang Li and Kang Pan (2017) utilized factor analysis and cluster analysis to evaluate the performance of all listed companies in China. Weimei ZHANG (2018) employed the Grey Relational Degree method to assess the core competencies of the ten listed liquor companies. Ying Li, Yung-Ho Chiu, Miao Wu, Yushan Li, and Tai-Yu Lin (2021) applied a dynamic two-stage directional distance function (DDF) model to analyze the production efficiencies of Chinese listed liquor companies. Yaomeng Zhu (2023) conducted factor analysis to rank the performance of enterprises in the high-end liquor industry. Numerous scholars have conducted extensive research and analysis on the financial and operational performance of Chinese liquor enterprises using different models and methods. However, relatively little research has been conducted on the growth prospects of Chinese liquor enterprises.

When studying the growth prospects of enterprises, scholars commonly employ methods such as principal component analysis, factor analysis, and cluster analysis. For instance, Richard G. P. Mcmahon (2001) used nonlinear principal components analysis to study the business growth and performance of manufacturing SMEs. Principal component analysis can transform multiple indicators into a few composite indicators, making the research results more explicit and aligning with the reality in an objective manner. Therefore, principal component analysis is a commonly used research method when studying the growth prospects of enterprises.

Methods

Indicator Selection

As for analysing business growth, Lan C. Macmillan, Lauriann Zemann and P. N. Subbanarasimha (1987) identified the most common selection criteria are characteristics of the venture team, characteristics of the proposed product or service, characteristics of the target market, and forecast financial characteristics. Laurence G. Weinzimmer, Paul C. Nystrom and Sarah J. Freeman (1998) identified the determinants of organizational growth from environmental dimensions, strategy characteristics and managerial attributes aspects. Erkki K Laitinen (2002) put forward a dynamic integrated performance measurement system containing factors of two external factors (financial performance and competitiveness) and five internal factors (costs, production factors, activities, products, and revenues). Based on the research findings of

numerous scholars, this study intends to select from a total of five primary indicators, namely debt-paying ability, profitability, operating efficiency, growth potential, and risk level. Specifically, the following ten secondary indicators, including current ratio, quick ratio, debt-to-assets ratio, return on equity, earnings per share, total asset turnover, current asset turnover, total asset growth rate, financial leverage, and operating leverage, will be chosen to analyze the growth prospects of 18 listed companies in the Chinese liquor industry. Refer to Table 1 for specific indicator calculations.

Table 1. Indicators and Explanation

Primary Indicators	Secondary Indicators	Indicator Explanation
Debt-paying Ability	Current Ratio X_1 Quick Ratio X_2 Debt-to-Asset Ratio X_3	Current Assets/Current Liabilities Quick Assets/Current Liabilities Total Liabilities/Total Liabilities
Profitability	Return on Equity X_4 Earnings per Share X_5	Net Profit/Average Equity Net Profit/Weighted Average Number of Shares
Operating Efficiency	Total Asset Turnover X_6 Current Asset Turnover X_7	Operating Revenue/Average Total Assets Net Operating Revenue/Average Current Assets
Development Capability	Total Asset Growth Rate X_8	Current Year Asset Increase/Total Assets at the End of the Previous Year
Risk Level	Financial Leverage X_9 Operating Leverage X_{10}	(Total Profit + Financial Expenses)/Total Profit Main Operating Profit/（Total Profit + Financial Expenses）

Sample Selection and Data Sources

Listed companies are representative of industry development. Therefore, 18 listed liquor companies are selected as the research sample. Based on data availability, financial data for the year 2021 is collected to analyze the growth prospects of the liquor industry. To ensure the credibility and representativeness of the sample companies, liquor companies marked with "ST" and companies with alcohol revenue accounting for less than 10% of their total revenue among the 21 listed companies on the Shanghai Stock Exchanges and Shenzhen Stock Exchanges as of December 31, 2021, are excluded.

The financial data mentioned above primarily comes from the 2021 annual reports of 18 listed liquor companies. The sample companies include: Luzhou Laojiao (000568), Anhui Gujing Distillery (000596), Jiugui Liquor (000799), Wuliangye Yibin (000858), Qinghai Huzhu TianYouDe Highland Barley Spirit (002646), Jiangsu Yanghe Brewery (002304), Xinjiang Yilite Industry (600197), Anhui Golden Seed Winery (600199), Kweichow Moutai (600519), Hebei Hengshui Laobaigan Liquor (600559), Shede Spirits (600702), Sichuan Swellfun (600779), Shanxi Xinghuacun Fen Wine Factory (600809), Anhui Kouzi Distillery (603589), Jiangsu King's Luck (603369), Anhui Yingjia Distillery (603198), Beijing Shunxin Agriculture (000860) Jin Hui Liquor (603919). Supplemental data from Sina Finance is also included.

Result and Discusssion

The core of principal component analysis (PCA) is dimension reduction, achieved by orthogonal transformation. It recombines multiple variables that may have some correlation into a new set of mutually uncorrelated variables, serving as substitutes for the original indicators.

Data Standardization and Correlation Analysis

Before processing the data, it is necessary to standardize the data to avoid variations in different variables. The standardization formula is denoted as

$$Z_{ij} = \frac{x_{ij} - \overline{x}_j}{s_j}$$
$$(i = 1, 2, \ldots, n;\ j = 1, 2, \ldots, p)$$

resulting in a standardized matrix Z. Using SPSS 26.0, the correlation among the 10 evaluation indicators of the 18 listed liquor companies was calculated, producing a correlation matrix. Table 2 reveals that there is a certain degree of correlation among the evaluation indicators, thus meeting the conditions for conducting principal component analysis.

Table 2. Correlation Matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	1.000									
X_2	.762	1.000								
X_3	-.541	-.896	1.000							
X_4	.069	-.248	.296	1.000						
X_5	.665	.428	-.232	.294	1.000					
X_6	-.341	-.638	.767	.671	-.110	1.000				
X_7	-.606	-.695	.652	.406	-.357	.783	1.000			
X_8	.049	-.131	.123	.614	.059	.458	.235	1.000		
X_9	-.243	-.180	.359	-.577	-.185	.000	.013	-.629	1.000	
X_{10}	-.259	-.144	.216	-.183	-.206	.216	.461	.047	.197	1.000

KMO Test and Bartlett's Test of Sphericity

In this study, KMO and Bartlett's tests of sphericity were conducted on the data using SPSS 26.0, and the results are shown in Table 3.

Table 3. KMO and Bartlett's tests of sphericity

KMO Measure of Sampling Adequacy		.559
Bartlett's tests of sphericity	Approximate Chi-Square	140.723
	Degrees of Freedom	45
	Significance	.000

According to Table 3, the KMO measure is 55.9%, which is greater than 50%, indicating that principal component analysis can be applied. The Bartlett's test of sphericity yields a test statistic of 140.723, with a significance level of 0.000 < 0.05, leading to the rejection of the null hypothesis that the variables are independent. Therefore, the use of principal component analysis is deemed appropriate for this study.

Extracting Principal Components

The financial indicators were imported into SPSS 26.0, and the results of the explained variance are shown in Table 4. From Table 4, it can be observed that the eigenvalues of the first three principal components are greater than 1, and the cumulative contribution rate reaches 79.109%, indicating that they capture 79.109% of the information from the original data. Therefore, the first three principal components were selected for the analysis of the 18 listed companies in the Chinese liquor industry.

Table 4. Total variance explained

Component	Initial eigenvalues			Extraction loadings sum of squares			Rotated loadings sum of squares		
	Total	Variance percentage	Cumulative %	Total	Variance percentage	Cumulative %	Total	Variance percentage	Cumulative %
1	4.220	42.196	42.196	4.220	42.196	42.196	3.502	35.017	35.017
2	2.594	25.936	68.132	2.594	25.936	68.132	2.286	22.861	57.878
3	1.098	10.977	79.109	1.098	10.977	79.109	2.123	21.232	79.109
4	.988	9.882	88.991						
5	.420	4.199	93.190						
6	.339	3.394	96.584						
7	.179	1.789	98.373						
8	.111	1.109	99.481						
9	.038	.385	99.866						
10	.013	.134	100.00						

Note: Extraction method：principal component analysis

According to Table 4, the contribution rates of the three principal components were used as initial weights (35.017%, 22.861%, 21.232%). The final weights for calculating the comprehensive scores of the sample companies were determined by the ratio of each indicator's initial weight to the cumulative contribution rate (79.109%).

Model Construction

By importing the data into SPSS 26.0, the factor score coefficient matrix can be obtained, as shown in Table 5. Based on the factor score coefficient matrix, the scores of the principal components can be calculated.

First principal component：

$$F_1 = -0.021X_1 - 0.233X_2 + 0.347X_3 + 0.190X_4 + 0.170X_5 + 0.287X_6 + 0.140X_7 - 0.048X_8 + 0.194X_9 - 0.086X_{10} \quad (1)$$

Second principal component：

$$F_2 = 0.004X_1 + 0.066X_2 - 0.171X_3 + 0.230X_4 - 0.091X_5 + 0.052X_6 + 0.097X_7 + 0.410X_8 - 0.470X_9 + 0.073X_{10} \quad (2)$$

Third principal component：

$$F_3 = 0.336X_1 + 0.042X_2 + 0.154X_3 + 0.221X_4 + 0.521X_5 + 0.123X_6 - 0.161X_7 - 0.119X_8 + 0.162X_9 - 0.322X_{10} \quad (3)$$

Based on Table 4 and F_1, F_2, F_3, the scores of each principal component can be calculated：

$$F = 0.443F_1 + 0.289F_2 + 0.268F_3 \quad (4)$$

Table 5. Factor score coefficient matrix

	1	2	3
X_1	-.021	.004	.336
X_2	-.233	.066	.042
X_3	.347	-.171	.154
X_4	.190	.230	.221
X_5	.170	-.091	.521
X_6	.287	.052	.123
X_7	.140	.097	-.161
X_8	-.048	.410	-.119
X_9	.194	-.470	.162
X_{10}	-.086	.073	-.322

Note. Extraction method: principal component analysis. Rotation method: Kaiser normalization (Maximum Variance Method).

Scoring Calculation and Result Analysis

Scoring Calculation and Ranking Based on the values of F_1, F_2, F_3, F obtained earlier, the scores for the sample companies' principal components and overall scores can be calculated. The sample companies can then be ranked based on their overall scores. Table 6 presents the principal component scores, overall scores, and specific ranking information.

Table 6. Growth Scores and Rankings of Chinese Listed Liquor Enterprises

Enterprises	F_1	Ranking	F_2	Ranking	F_3	Ranking	F	Ranking
Kweichow Moutai	6.55	1	-3.73	18	22.79	1	7.93	1
Luzhou Laojiao	0.81	3	-0.44	14	3.15	3	1.08	3
Anhui Gujing Distillery	0.42	9	-0.03	4	2.15	6	0.75	6
Jiugui Liquor	0.43	8	-0.13	7	1.15	10	0.46	10
Wuliangye Yibin	0.52	7	-0.44	14	4.05	2	1.18	2
Jiangsu Yanghe Brewery	0.73	5	-0.46	16	2.69	4	0.91	5
Xinjiang Yilite Industry	-0.33	17	-0.04	5	0.45	14	-0.04	14
Anhui Golden Seed Winery	-0.09	15	-0.46	16	1.21	9	0.15	13
Hebei Hengshui Laobaigan Liquor	0.05	13	0.08	2	-1.08	17	-0.24	16
Shede Spirits	0.59	6	-0.27	12	1.94	7	0.71	7

Sichuan Swellfun	0.79	4	-0.09	6	0.97	13	0.58	8
Shanxi Xinghuacun Fen Wine Factory	0.91	2	-0.23	11	2.29	5	0.95	4
Qinghai Huzhu TianYouDe Highland Barley Spirit	-1.01	18	0.38	1	-1.28	18	-0.68	18
Anhui Kouzi Distillery	0.28	10	-0.28	13	1.7	8	0.5	9
Jiangsu King's Luck	0.21	11	-0.16	10	0.99	12	0.31	11
Anhui Yingjia Distillery	0.13	12	-0.15	8	1.07	11	0.3	12
Beijing Shunxin Agriculture	-0.01	14	-0.15	8	-0.98	16	-0.31	17
Jin Hui Liquor	-0.24	16	0.01	3	-0.07	15	-0.12	15

Based on Table 6, it can be observed that in 2021, the top three Chinese listed liquor companies in terms of growth composite scores are Kweichow Moutai, Wuliangye Yibin, and Luzhou Laojiao, while Qinghai Huzhu TianYouDe Highland Barley Spirit ranks the lowest. Furthermore, there are a total of three companies with growth composite scores above 1, indicating strong growth performance. There are ten companies with growth composite scores between 0 and 1, indicating average growth performance. Lastly, there are five companies with growth composite scores below 0, indicating relatively weaker growth performance.

Kweichow Moutai ranks first in terms of growth composite score among the sample companies, highlighting its leading position in the liquor industry. The growth of listed liquor companies has been impacted by the COVID-19 pandemic, with Qinghai Huzhu TianYouDe Highland Barley Spirit, Beijing Shunxin Agriculture, and Hebei Hengshui Laobaigan Liquor being the most affected companies

Conclusion

The development of the liquor industry has been impacted by the COVID-19 pandemic, and the analysis of the growth performance of listed liquor companies based on financial data reveals significant differences and severe differentiation. "Moutai, Wuliangye, and Luzhou Laojiao" dominate the industry, while other companies need further improvement in their growth performance.

Firstly, it is important to fully utilize the consumption habits, cultural characteristics, and advantages of the liquor industry and make timely adjustments to optimize the market structure while clearly defining industry development goals. Liquor is closely linked to people's daily lives and has become an integral part of their lives. The liquor culture it generates deeply influences social development. Liquor enterprises should strengthen self-positioning and enhance self-awareness, grasp the current industry development issues and opportunities, adjust and optimize the market structure, and promote high-quality development of both the companies and the industry.

Secondly, it is crucial to broaden sales channels and leverage the advantages of the internet and social media to expand the market. In the era of the internet and big data, the advantages and influence of the internet are undeniable. The liquor industry should make full use of the internet, establish an online brand, strengthen connections and communication with consumers, realize social marketing, and thereby enhance brand awareness and reputation. Additionally, collaboration with major e-commerce platforms such as Taobao, Tmall, and JD.com should be strengthened. By leveraging their convenience, ease of operation, and high customer traffic, brands can enhance their influence, improve the consumer experience, and elevate their growth potential.

Lastly, it is crucial to broaden horizons and vigorously explore international markets. Liquor enterprises have unparalleled advantages in the domestic market, with a large consumer base due to its rich cultural charm and unique brewing techniques. Moreover, in the era of economic globalization, liquor is not only a part of Chinese culture but also a remarkable symbol of China. Liquor companies should broaden their horizons, explore new consumer markets, increase brand promotion efforts, enhance comprehensive capabilities, and expand into the international market.

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