

Research on Competitiveness Evaluation of Chinese Medicine Industry in China Based on Factor Analysis

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Abstract. The paper selects 35 indicators from six aspects as resource competitiveness, innovation competitiveness and others to build up competitiveness evaluation index system in Chinese medicine industry. Based on data in 2009 and using factor analysis, the competitiveness of 31 provinces in China was evaluated to get the overall ranking of competitiveness about Chinese medicine industry. The characteristics and different areas' medicine industry competitiveness as well as reasons were revealed further in the paper. Some suggestions and related policy recommendations were also provided.

Keywords: Chinese medicine industry; Competitiveness; Evaluation; Factor Analysis

1. Introduction

Chinese medicine industry is treasure in Chinese culture, the application of which has history more than thousands of years. With the social development and changes in human environment and natural conditions, various countries are increasingly awareness if important role of herbal medicine in prevention and treatment of diseases as well as human health. The need and attention are unprecedented grew, which brings good opportunities for the development of China's medicine industry, but also poses a serious challenge on it. Evaluation on competitiveness of Chinese medicine industry can not only understand current competitiveness overview of Chinese medicine industry, but also help to acknowledge competitive advantage and existing gap, so as to promote healthy development of Chinese medicine industry and improve overall regional economy competitiveness, which is the main content to be researched in the paper.

2. Index System Selection

Main factors that effect Chinese medicine industry competitiveness include resource conditions, technological innovation, market structure and others. The paper select 35 indexes from 6 aspects as resource competitiveness, innovation competitiveness and others to construct evaluation index system of Chinese medicine industry competitiveness as shown in Table 1. Data of Chinese industry production was selected to evaluate competitiveness, which mainly comes from *China Statistical Yearbook Medicine*, *China Statistical Yearbook 1998-2007*, *Customs Statistics Yearbook*, *Statistical Yearbook of Chinese Medicine* as well as websites of Chinese Medicines and Health Products Import and Export Chamber of Commerce.

Table 1. Evaluation index system of Chinese medicine industry competitiveness.

First-level index	Second-level index	Third-level index
Chinese medicine	Resources	X1 Acreage

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industrial competitiveness	competitiveness	X2 Employee number
		X3 Total assets
		X4 New coefficient of fixed assets
		X5 Average equipment of each worker
	Competitive strength	X6 Enterprises number
		X7 Number of large enterprises
		X8 Industry concentration
		X9 Proportion of former three hundred companies
		X10 Output
		X11 Total profit
		X12 Average corporation size
		X13 Intangible assets
	Innovation competitiveness	X14 Research and development expenses
		X15 New product ratio
		X16 R&D investment ratio
		X17 Ratio of employee education expenses to sales revenue
	Management competitiveness	X18 Mobile asset turnover ratio
		X19 Receivable accounts turnover ratio
		X20 Inventory turnover ratio
		X21 Labor productivity
	Market competitiveness	X22 Product sales revenue
		X23 Advertising
		X24 Funds interest rate
		X25 Product sales ratio
		X26 Sales margin ratio
		X27 ROE
		X28 Market share ratio
		X29 International market share
	X30 Export delivery value	
	Growth Competitiveness	X31 Average growth rate of sales revenue
		X32 Average growth rate of industrial added value
		X33 Average sales profit
		X34 Average sales value
		X35 Growth rate of total assets

3. Empirical Evaluation of Chinese Medicine Industry Competitiveness

Evaluation Methods Selection. As various factors that impact China's medicine industry, competitive level are interrelated, that is, neither of information between the target completely independent nor completely repeated. If directly measure, it is likely to cause multi-collinearity between the indicators. And if extracted by factor analysis evaluation of the competitiveness of Chinese medicine industry firstly, the major dimension is not only effective solution to the overlap of information between the various indicators of the problem, but also to more effectively reflect the competitiveness of China's medicine industry composition dimension. Therefore, after comprehensive consideration and analysis, this paper uses factor analysis on China's medicine industry competitiveness of the region evaluated.

Factor Analysis. solve eigenvalues of the correlation matrix, contribution rate and the cumulative contribution rate, extraction factors as shown in Table 2.

Table 2 Covariance matrix eigenvalues, contribution rate and the cumulative contribution rate

Component	Initial Eigenvalues	Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings
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	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.835	31.341	31.341	7.835	31.341	31.341	6.703	26.813	26.813
2	4.573	18.291	49.632	4.573	18.291	49.632	4.057	16.229	43.042
3	3.177	12.709	62.341	3.177	12.709	62.341	2.979	11.916	54.957
4	2.147	8.589	70.929	2.147	8.589	70.929	2.909	11.635	66.593
5	1.837	7.347	78.276	1.837	7.347	78.276	2.064	8.256	74.848
6	1.390	5.559	83.835	1.390	5.559	83.835	2.020	8.082	82.930
7	1.251	5.002	88.838	1.251	5.002	88.838	1.477	5.907	88.838
8	.641	2.563	91.401						
9	.494	1.975	93.375						

In accordance with the principle of factor analysis, characteristic value of common factor must be greater than 1, and the selected factors to explain the difference between the cumulative percentage should reach 88% or more. From the above table we know that there are 7 eigenvalues greater than 1. The cumulative contribution rate of seven eigenvalues is 88.838. In general, less information is lost original variables, factor analysis results is ideal. Next, we will analyze on value of the factor loadings, the first seven factors corresponding to the rotation matrix shown in Table 3.

Table 3 Rotated factor loading matrix

	Component						
	1	2	3	4	5	6	7
Output	.933	.073	.227	-.064	.179	.051	.004
Total assets	.911	.114	-.042	.038	.301	.150	-.020
Product sales revenue	.907	.013	.278	-.009	.256	.106	.042
Enterprises number	.901	-.136	.251	-.091	-.135	-.077	.049
Total profit	.882	.115	.058	-.006	.282	.069	.222
Employee number	.828	-.166	.327	-.019	.230	-.001	.109
Proportion of former three hundred companies	.823	.126	.030	-.017	-.205	-.110	-.001
New coefficient of fixed assets	-.044	-.940	.069	-.078	-.018	-.026	-.005
Ratio of employee education expenses to sales revenue	-.151	.896	-.015	-.091	-.097	-.062	.228
Labor productivity	.376	.856	-.166	.032	.064	-.127	-.204
R&D investment ratio	-.241	.839	.076	-.016	-.118	-.040	.343
Research and development expenses	.490	.766	-.173	.065	.095	-.181	-.132
Mobile asset turnover ratio	.303	-.181	.877	.037	-.018	-.137	-.053
Inventory turnover ratio	.334	-.060	.832	.047	.140	.177	.033
Receivable accounts turnover ratio	.043	.071	.806	-.072	.164	.077	.204
Sales margin ratio	-.163	.296	-.576	-.024	.017	-.200	.527
Average sales profit	-.054	.011	.000	.964	.119	-.056	-.036
Average sales value	-.068	.027	-.010	.946	.154	.060	-.054
Average growth rate of sales revenue	.012	.003	.011	.945	.001	.037	.005
Industry concentration	.165	-.106	.085	.279	.873	.201	.076

Number of large enterprises	.451	.035	.233	.086	.824	-.009	.020
Export delivery value	.146	-.137	.196	-.116	.209	.848	-.043
International market share	-.296	.046	.060	.089	.116	.787	-.348
Market share ratio	.319	-.270	-.150	.185	-.230	.643	.301
ROE	.290	.135	.194	-.079	.108	-.091	.797

From the factor loading matrix (Table 3), we can see that factor 1 mainly reflects the competitive strength of output, number of enterprises, total profits, three hundred and reflect the proportion of enterprises competitive resources, number of employees and total assets; factor 2 mainly reflect resources from the competitive coefficient of fixed assets and to reflect the innovation and new competitive employee education expenses account for the proportion of product sales, R & D investment ratio and research and development costs are explained; factor 3 mainly reflects the competitiveness of current assets management turnover, receivables turnover and inventory turnover rate in the explained; growth factor 4 mainly reflects the competitiveness of the average growth rate of sales profits, sales growth and sales revenue of the average value of the average growth rate of the explanation; factor reflected mainly by the 5 competitive strength of industry concentration ratio and the number of large companies explained. Factor 6 reflects the market competitiveness mainly by the export delivery value, market share and market share of international explained; factor 7 primarily reflects the competitiveness of the market return on equity explained.

4. Evaluation Result Analysis

Based on Chinese medicine industry data in regions in 2009, we evaluate on Chinese medicine industry competitiveness of China's 31 provinces. The overall and result of each dimension are shown in Table 4.

Table 4 Chinese medicine industry evaluation results in 2009

	Comprehensive competitiveness		Resources competitiveness		Competitive strength		Innovation competitiveness		Management competitiveness		Market competitiveness		Growth Competitiveness	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Beijing	25.64	23	62.08	21	30.76	16	35.22	8	15.1	27	43.2	27	17	26
Tianjin	51.11	10	75.62	13	66.19	2	36.46	7	37.73	17	55.44	17	59.21	2
Hebei	47.45	11	76.68	10	51.58	6	5.93	20	57.58	8	49.71	8	34.47	7
Shanxi	0.00	31	60.23	23	7.28	25	0	27	5.77	30	20.12	30	9.66	30
Inner Mongolia	20.94	26	56.49	25	3.41	30	0	28	63.27	7	22.94	7	39.86	4
Liaoning	29.03	22	62.61	19	14.94	21	2.91	26	71.33	4	48.65	4	27.83	14
Jilin	100.00	1	84.94	7	100	1	91.61	2	30.76	21	100	21	27.63	15
Heilongjiang	60.97	4	65.25	18	49.06	9	58.63	5	34.73	20	53.49	20	46.06	3
Shanghai	56.46	6	62.32	20	24.28	20	12.37	15	35.43	19	52.51	19	100	1
Jiangsu	46.45	12	76.59	11	49.17	8	32.36	9	49.5	12	75.87	12	22.16	23
Zhejiang	33.37	20	65.5	17	29.86	17	16.89	12	28.03	22	51.75	22	25.33	20
Anhui	15.86	27	67.44	16	9.1	23	14.45	14	23.31	25	33.74	25	25.84	18
Fujian	21.55	25	61.93	22	14.29	22	4.41	23	23.67	24	46.84	24	27.85	13
Jiangxi	56.21	7	100	1	59.07	4	5	21	100	1	66.62	1	22.93	21
Shandong	66.44	2	75.56	14	60.47	3	7.33	19	99.39	2	95.83	2	10.77	29
Henan	31.67	21	92.82	3	39.77	13	9.68	17	56.26	9	55.95	9	11.68	28
Hubei	34.02	18	76.24	12	24.37	19	4.71	22	74.47	3	57.74	3	17.85	25
Hunan	37.89	15	80.89	9	41.71	11	17.46	11	64.25	6	55.17	6	15.83	27
Guangdong	61.63	3	89.08	4	49.21	7	3.49	25	37.43	18	87.05	18	25.82	19
Guangxi	35.55	17	87.06	5	33.73	14	9.54	18	38.54	16	43.39	16	27.3	16
Hainan	56.07	8	41.56	29	4.98	28	100	1	47.1	14	29.94	14	29.95	12
Chongqing	45.27	13	74.83	15	40.4	12	44.23	6	51.17	11	85.91	11	22.73	22

Sichuan	56.06	9	95.8	2	52.57	5	25.62	10	65.92	5	77.52	5	27.09	17
Guizhou	41.36	14	86.33	6	43.1	10	11.14	16	40.68	15	39.52	15	30.39	11
Yunnan	56.73	5	55.93	26	31.77	15	65.66	3	25.1	23	41.86	23	37.4	5
Tibet	3.41	30	55.32	28	5.76	26	0	29	0	31	15.78	31	21.57	24
Shaanxi	36.65	16	81.85	8	25.84	18	3.81	24	54.69	10	40.55	10	34.38	8
Gansu	22.81	24	59.34	24	8.46	24	60.11	4	8.83	29	14.39	29	0	31
Qinghai	4.85	29	32.08	30	5.17	27	0	30	20.15	26	17.37	26	30.44	10
Ningxia	33.89	19	0	31	3.98	29	16.54	13	49.03	13	0	13	35.76	6
Xinjiang	8.51	28	55.4	27	0	31	0	31	9.19	28	28.87	28	32.11	9

From the overall evaluation of China's medicine industry competitiveness in different parts in Table 4 we can see that, Jilin, Shandong, Guangdong and Heilongjiang composite score ranked the first four, scored 60 points or more, are the first tier, in the provinces become medicine industry, the mainstay of overall competitiveness, leading the Chinese medicine industry of China's overall development. Medicine from different regions of China's industrial competitiveness of the dimensions of evaluation results can be seen, Jilin in 2009 to remain competitive, innovative strength and competitiveness of absolute advantage are ranked No. 1 and No. 2. Shandong in 2009 in the management of competitiveness, market competitiveness and competitive strength of both in a dominant position, were arranged in No. 2, No. 2 and No. 3, the new competitive upgrade more quickly. Heilongjiang been arranged in the first echelon, in its growth competitiveness, competitiveness, strength, innovation and competitive advantage, were arranged in paragraphs No. 3, No. 9 and No. 5 respectively. Competitiveness in resources, Guangdong ranked No. 4. Overall, the foundation of industrial development in these areas is good medicine, technologically sophisticated, rapid economic development, market demand is good.

5. Summary

With the development of China's economic and technological progress, the competitiveness of China's medicine industry has been greatly improved, especially as China's western development strategy forward, the western parts of China's medicine industry has improved. However, due to the various regions in the level of economic development, there are differences in Chinese medicine industrial base and technological level, which also led to the competitiveness of China's medicine industry in different regions showing difference. Through empirical analysis we can identify shortcomings and to play between elements of competitiveness and leading role as well as local conditions, Chinese medicine industry in China will achieve a better development.

6. References

- [1] B. Jin. Discuss on nature of enterprises competitiveness. *China Industrial Economics*, vol. 10, 2001, pp. 5-10.
- [2] Q. Xiao. Research on Competitiveness of Traditional Chinese Medicine Industry of Sichuan Province. Chengdu: Sichuan University, 2007.
- [3] S. Q. Li, R. T. Zan and W. W. Chen. Evaluation on Guangdong Chinese Medicine Industry, *World Science and Technology*, vol. 11, 2009, pp. 319-327.
- [4] China's industrial competitiveness study group in Renmin University of China. Automobile manufacturing industry competitiveness evaluation analysis on 30 Chinese provinces and cities. *Management World*, vol. 10, 2004, pp. 68-78.