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The growth pole selection for pharmaceutical manufacturing industry in northern Anhui based on factor analysis

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ABSTRACT

An evaluation index system of regional competitive advantage for pharmaceutical manufacturing industries had been established, based on relevant data of pharmaceutical manufacturing industry in 2012 statistical yearbook of Anhui province and 6 prefecture-level cities, such as Bozhou, Bengbu, etc. Using the theory of factor analysis and SPASS software tool, comprehensive score and ranking of pharmaceutical manufacturing industries for 6 prefecture-level cities were put forward, the result had been corresponding explained. On the foundation of quantitative analysis, The growth pole selection and development suggestion of pharmaceutical manufacturing industry in North Anhui had been brought forward: choosing Bozhou, Bengbu as industrial growth pole, enlarging the scale of pharmaceutical manufacturing industries, promoting the regional differences advantages and developing characteristic medical economy.

KEYWORDS

Northern anhui; Pharmaceutical manufacturing industry; Growth pole; Selection.



INTRODUCTION

In this paper, Northern region refers to the narrow northern areas along the north of the Huaihe in Anhui province, including Bengbu City, Huainan City, Fuyang City, Bozhou City, Suzhou city and Huaibei City^[1]. "The revitalization of Northern Anhui" is one of the development strategies of Anhui provincial government to insist for a long time, if northern areas sluggish, Anhui is hard to powerful. In recent years, northern area has cultivated and developed strategic emerging industries in the large-scale, but in the process, it also presents traditional industry investment "wave phenomenon", there are some problems, such as technology introduction, the same layout, in big city, the concept of speculation, low level competition, the vicious competition's result is to make strategic development areas of Northern Anhui the lack of a clear line of emerging industries, when the industry form effective capacity, it is likely to be in the low level competition, which win the market not relying on technology, but still relying on price. Therefore, the author intends to take pharmaceutical manufacturing industry as an example, apply the growth pole theory thought into the layout and planning of the industry development, using quantitative analysis method, to find medicine manufacturing industry development "growth pole" in Northern Anhui, to guide the northern Anhui cities develop suitable emerging industry according to the local comparative advantages, thus to form reasonable layout, sustainable development of strategic emerging industry in Northern Anhui, and promote sound and rapid development of economy in Northern Anhui area.

An evaluation index system of regional competitive advantage for pharmaceutical manufacturing industries had been established, based on relevant data of pharmaceutical manufacturing industry in 2012 statistical yearbook of Anhui province and 6 prefecture-level cities, such as Bozhou, Bengbu, etc. Using the theory of factor analysis and SPASS software tool, comprehensive score and ranking of pharmaceutical manufacturing industries for 6 prefecture-level cities were put forward, the result had been corresponding explained. On the foundation of quantitative analysis, The growth pole selection and development suggestion of pharmaceutical manufacturing industry in North Anhui had been brought forward.

THE EXPERIMENT CONTENT

The key to reasonable layout and promote the development of pharmaceutical industry in northern Anhui, is to determine the influence factors of industrial layout and the degree of influence. The current pharmaceutical enterprise resource in Northern Anhui is relatively decentralized, and the enterprise's scale is uneven, that is easy to cause waste of the resource base. In order to solve the existing problem of spatial distribution, using statistical analysis tools, the paper do the quantitative research on related problems about the development of pharmaceutical industry in Northern Anhui.

Factor analysis is a multivariate statistical analysis method which put some perplexing relationship variables attributed to a few comprehensive factor of several unrelated on the relationship of correlation matrix of internal research from the index^[2]. Because there is not a systemic evaluation system to evaluate the pharmaceutical industry competitive advantage of location comparative, and the data is difficult to collect, it can only set the index which is easy to collect and existing statistical data, so as to enhance operability. Following scientific, systematic, comparable and feasible principles of selecting statistical index system, it design evaluation index system as follows (see TABLE 1).

In this paper, the Statistical analysis tool used is SPASS19.0.

It can be seen from the output results: the KMO value is 0.742, which is greater than 0.5, showed that the KMO test is significant, it means that without too much difference correlation degree of each index variable, it is suitable for factor analysis; meanwhile, the Bartlett spherical test chi square value is 689.202 (freedom 138), significantly less than 0.05, which showed that common factors existing in correlation coefficient index of matrix variables, it is suitable for factor analysis.

Before rotating, the cumulative variance contribution of the first 5 factors rate reach 94.612%, the characteristic value of the first 5 factors is greater than 1, after rotating, the characteristic value of the 5 factor is greater than 1, the cumulative contribution rate is unchanged, so it is ideal to select the first 5 factors to analyze.

Then, we gained the factor loading matrix, as follows in TABLE 4:

According to the rotated factor loading matrix, summary the variables which have higher load in each factor, as shown in TABLE 5:

After comprehensive consideration, factor F1 is defined as industry scale factor, factor F2 is defined as science and technology innovation factor, factor F3 is defined as industrial development environment factor, factor F4 is defined as the medical infrastructure factor, factor F5 is defined as regional potential development factor.

RESULT AND DISCUSS

Using SPASS19.0 to calculate 5 common factor score of the 6 cities, then do regression analysis according to the calculation formula: $F = 0.2879F_1 + 0.2809F_2 + 0.2554F_3 + 0.1010F_4 + 0.02114F_5$, the comprehensive score and ranking of pharmaceutical manufacturing industry of each city are detailed in TABLE 6.

TABLE 1 : Evaluation index system of regional competitive advantage for pharmaceutical manufacturing industries

The first level factor	The second level factor	Index design	code
Market factor	The size of the market	Total GDP	A1
	The speed of economic development	The growth rate of GDP	A2
		The second industry growth rate of GDP	A3
		The third industry growth rate of GDP	A4
		Average wages in manufacturing	A5
	The cost of labor	Average number of employees in pharmaceutical manufacturing industry	A6
Technology factor	The quantity and quality of labor force	The number of R&D personnel in pharmaceutical manufacturing industry	A7
		Third industry GDP/GDP	A8
	The level of service industry	Number of R&D institutions in pharmaceutical manufacturing industry	B1
	Science and technology innovation scale	Research expenditure of R&D in pharmaceutical manufacturing industry	B2
Scale factor	Science and technology innovation level	Number of patent authorization in pharmaceutical manufacturing industry	B3
		Number of pharmaceutical manufacturing enterprises	C1
	Enterprise cluster	Number of leading enterprises in pharmaceutical manufacturing industry	C2
		Total output of that year in pharmaceutical manufacturing industry	C3
Infrastructure factor	Medical infrastructure	Sales income in Medicine manufacturing industry	C4
		Number of health institutions	D1
	General infrastructure	Number of beds	D2
Road area per capita		D3	
Policy factor	The general policy environment	GDP Per capita	E1
		The expenditure per capita	E2
	The pharmaceutical industry environment	Government funds in Pharmaceutical manufacturing R&D research funding	E3

TABLE 2 : Kaiser-Meyer-Olkin Measure and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.742
Bartlett's Test of Sphericity	Approx. Chi-Square	689.202
	Df	138
	Sig	.000

TABLE 3 : Initial, extraction and rotation characteristic value and the contribution rate of each factor

Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
7.427	36.088	36.088						
4.905	25.816	61.904						
3.865	20.340	82.244						
1.766	9.0292	91.536	7.427	36.088	36.088	5.469	28.785	28.785
1.038	3.076	94.612	4.905	25.816	61.904	5.336	28.085	56.870
0.311	1.383	95.915	3.865	20.340	82.244	4.852	25.539	82.409
0.252	0.979	96.974	1.766	9.0292	91.536	1.918	10.097	92.506
0.166	0.605	97.579	1.038	3.076	94.612	1.424	2.106	94.612
0.103	0.203	97.782						
.....						
.001	.007	100.000						

TABLE 4 : Rotation factor loading matrix

Index	code	Factor loading				
		1	2	3	4	5
		.726*	-	-	0.136	0.392
Total GDP	A1	-	0.487	0.297	0.250	.940*
The growth rate of GDP	A2	0.156	0.044	-	-0.049	.728*
The second industry growth rate of GDP	A3	-	-	0.450	-0.386	.696*
The third industry growth rate of GDP	A4	0.327	0.107	-	-0.674	0.010
Average wages in manufacturing	A5	-	0.077	0.051	0.356	-
Average number of employees in pharmaceutical manufacturing industry	A6	0.230	0.134	-	-0.101	0.032
The number of R&D personnel in pharmaceutical manufacturing industry	A7	.764*	0.091	0.521	0.388	-0.051
Third industry GDP/GDP	A8	.911*	.704*	0.125	-0.163	0.124
		0.086	0.342	.778*		0.156
Number of R&D institutions in pharmaceutical manufacturing industry	B1	0.446	.716*	0.178	0.012	0.120
Research expenditure of R&D in pharmaceutical manufacturing industry	B2	-	.945*	0.177	0.234	-
Number of patent authorization in pharmaceutical manufacturing industry	B3	0.015	.760*	0.357	0.035	0.083
			0.486			0.017
Number of pharmaceutical manufacturing enterprises	C1	.827*	-	0.271	0.074	0.324
Number of leading enterprises in pharmaceutical manufacturing industry	C2	.669*	0.177	0.323	0.338	-
Total output of that year in pharmaceutical manufacturing industry	C3	.946*	-	0.033	-0.180	0.171
Sales income in Medicine manufacturing industry	C4	.947*	-	0.038	-0.188	-
			0.201			0.162
Number of health institutions	D1	-	0.400	0.246	.859*	0.039
Number of beds	D2	0.201	-	-	.671*	0.156
Road area per capita	D3	0.400	0.411	0.117	0.152	0.233
		-	0.211	.856*		
		0.105				
GDP Per capita	E1	-	-	.956*	0.123	0.250
The expenditure per capita	E2	0.085	0.038	.878*	0.147	0.201
Government funds in Pharmaceutical manufacturing R&D research funding	E3	-	0.101	0.085	0.118	0.142
		0.241	.972*			
		0.121				

“*”represents variable j has higher load in factor i.

As can be seen from TABLE 6, the highest score city is Bozhou, followed by Bengbu, then from high to low are Fuyang, Huainan, Huaibei, Suzhou. Such ranking is basically consistent with the current situation of the development of Pharmaceutical manufacturing industry in Northern Anhui, is also consistent with the relevant policies of the state. In August 3, 2012, the Ministry of industry and information technology announced a “ Guidance catalogue of industry transfer ”, the directory pointed out that the pharmaceutical industry should be transferred to the north of Anhui and Huaihe River Economic Zone, including Huaibei, Bozhou, Suzhou, Bengbu, Fuyang, Huainan six cities, the key is Bo-beng medicine base [3].

Bozhou wins the highest score, its pharmaceutical manufacturing base is relatively good and its industrial hardware facilities is relatively perfect, especially the traditional Chinese medicine industry, has been listed as the characteristic industry base of national torch plan, but the score of economic potential development and medical infrastructure is low. The advantage of Bengbu lies in its scientific and technological innovation, Bengbu has the most scientific research institutes, universities, research institutions in northern Anhui, but the industry development environment and medical infrastructure

have to be strengthened, as one of the earliest industrial city in Anhui Province, its development potential is still to be improved. A concrete analysis of several other cities shall not be repeated.

Based on the obtained results from TABLE 6, we can choose Bozhou, Bengbu two cities as the growth pole of Pharmaceutical manufacturing industry in north Anhui.

TABLE 5 : Summary for variables with higher load in each factor

Factor	The original index with higher load	Code	Factor	The original index with higher load	Code
F1	Total GDP	A1	F3	Third industry GDP/GDP	A8
	Average wages in manufacturing	A5		The expenditure per capita	E2
	Number of pharmaceutical manufacturing enterprises	C1		GDP Per capita	E1
	Number of leading enterprises in pharmaceutical manufacturing industry	C2	Road area per capita	D3	
	Total output of that year in pharmaceutical manufacturing industry	C3	F4	Number of health institutions	D1
	Sales income in Medicine manufacturing industry	C4		Number of beds	D2
	Average number of employees in pharmaceutical manufacturing industry	A6	F5	The growth rate of GDP	A2
F2	The number of R&D personnel in pharmaceutical manufacturing industry	A7		The second industry growth rate of GDP	A3
	Number of R&D institutions in pharmaceutical manufacturing industry	B1	The third industry growth rate of GDP	A4	
	Research expenditure of R&D in pharmaceutical manufacturing industry	B2			
	Number of patent authorization in pharmaceutical manufacturing industry	B3			
	Government funds in Pharmaceutical manufacturing R&D research funding	E3			

TABLE 6 : Regional competitive advantage score and ranking of pharmaceutical manufacturing industries in 6 prefecture-level cities

Area	Complex rank	Complex score	F1	F2	F3	F4	F5
			Industry scale factor	Science and technology innovation factor	Industrial development environment factor	The medical infrastructure factor	Regional potential development factor
Bozhou	1	0.8729	0.3888	0.2457	0.1086	0.0116	0.0182
Bengbu	2	0.8032	0.2369	0.3911	0.0169	0.0550	0.0033
Fuyang	3	0.6683	0.0721	0.0843	0.4604	0.0455	0.0060
Huainan	4	0.4774	0.0592	0.0315	0.1613	0.1383	0.0729
Huaibei	5	0.4334	0.0569	0.0656	0.0893	0.1107	0.1190
Suzhou	6	0.3288	0.0525	0.0560	0.0849	0.0625	0.0871

CONCLUSIONS

In this paper, by means of collecting Pharmaceutical manufacturing industry related index of the 6 prefecture level city in Northern Anhui, to establish and operate the evaluation model, it gained some useful conclusions:

First, uneven development among regions is the basic situation of the pharmaceutical industry in northern region, according to industry development goals embodied in "The pharmaceutical industry Plan in the Twelfth Five Year of Anhui province", combined with the basic idea of the growth pole theory, the pharmaceutical manufacturing industry in northern Anhui should take a unbalanced development way "from point to surface", allow a part of area giving priority to the development of pharmaceutical economy characteristics, to form industrial growth pole, and then promote the development of surrounding areas, to achieve the overall increase of pharmaceutical industry.

Second, according to the quantitative results in this paper, the growth pole of pharmaceutical manufacturing industry in Northern Anhui should be considered in Bozhou, Bengbu two cities. There is a significant positive correlation between the

scale of industry, science and technology innovation, industry development environment and pharmaceutical industry competitiveness, and the government plays an important guiding role in these three aspects, therefore, the government should actively play the macro planning and regulation, formulate a series of preferential policies to promote the pharmaceutical enterprise agglomeration, increase the government investment in new drugs' research and technology innovation, strengthen hard and soft environment construction of pharmaceutical industry, starting from actual situations of each area, combined with regional resources endowment, economic development level, industry environment, market distribution and other factors, to promote the advantages of regional differences, cultivate characteristic industries, develop the characteristics of pharmaceutical economy.

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