Competitiveness Evaluation and Empirical Study of Producer Services in Liaoning

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Abstract. This study constructs the evaluation index system of comprehensive competitiveness of producer services in Liaoning, China. Principal component analysis (PCA), refined development, investment scale, agglomeration level 3 factors will be used as research methods. Moreover, this paper uses SPSS statistical analysis software, which is based on the analysis of the competitiveness evaluation model to evaluate. Finally, this study gives some suggestions to strengthen the competitiveness of producer services in Liaoning, China.

The Construction of Evaluation Index System of Producer Services Competitiveness in Liaoning

Zhong Yun and Yan Xiaopei (2005) argue that producer service is provided for production, business activities and management to the government, rather than directly to the services provided by the individual consumers. It is not directly involved in the production or material transformation. However, producer service is indispensable to any industrial production activities[1][2].

In order to objective and comprehensive evaluation on the producer services, a producer services index system of need to be established. According to international and Chinese industrial sector classification standard, based on the statistical data of China Statistical Yearbook 2016 and Liaoning statistical yearbook 2016, this paper will study in two aspects: economic scale and agglomeration level evaluation index. Besides, the competitiveness of producer services and transportation, warehousing and postal service, wholesale and retail trade, finance, real estate industry, accommodation and catering industry competitiveness comprehensive evaluation analysis will be studied[3]. Index system and index are shown in Table 1 and Table 2.

Table 1 The productive service industry competitiveness evaluation index system

Index 1	Index 2	Index Content
Economies of Scale	X1	Proportion of the number of on-the-job worker on-the-job worker number and city
	X2	On-the-job worker total wages
	X3	The added value accounted for the proportion of GDP
	X4	The added value accounted for the proportion of the added value of the third industry
Level of Aggregation	X5	Fixed assets accounted for the proportion of investment
	X6	Industrial total output value accounted for the proportion of GDP
	X7	Construction project investment
	X8	The proportion of the number of legal person units
	X9	The proportion of actual foreign direct investment

The Comprehensive Evaluation of Productive Service Industry Competitiveness in Liaonin

It can be found that a certain linear relationship exists between the indexes above. Therefore, the principal component analysis (PCA) will be analyzed for evaluation. The core of this method is that the M principal components are selected by using the principal component analysis. Then, all the

selected principal components weight for the variance contribution rates of the principal component, and construct the comprehensive evaluation function. Moreover, calculation of every industry on the principal component score should be done. Finally, a calculation for the comprehensive score of each industry should be done. After all the calculation, higher the score, higher the comprehensive competitiveness[4].

Table 2 Liaoning productive service industry competitiveness evaluation index

	X1	X2	X3	X4	X5	X6	X7	X8	X9
Transportation, warehousing and postal service	0.0608	2347969.4	0.0514	0.1401	0.0524	0.0514	0.0721	0.0279	0.0036
Wholesale and retail	0.0411	1133227.2	0.0882	0.2403	0.03	0.0882	0.0413	0.2454	0.0425
The financial sector	0.0326	1908771.1	0.034	0.0926	0.0034	0.0339	0.0048	0.0061	0.0111
The real estate industry	0.0216	643913.6	0.0394	0.1074	0.2866	0.0394	0.0182	0.0374	0.2874
The accommodation and catering industry	0.0111	244484.5	0.0196	0.0535	0.0181	0.0196	0.0249	0.0156	0.0040

This research uses SPSS statistical analysis software to analyze the raw data in Table 2. A problem is raised that all the indexes uses different unit. In order to compare these indexes, a normalized process is taken place. This study uses SPSS software to normalize the indexes. And the standardized data are shown in Table 3.

After the standardized data comes out, a statistical analysis takes place. By using SPSS, this study analyzes all the 10 original evaluation index in Table 2. The study uses 3 tables to display the outcomes of the analysis. Table 4-Table 6 display the correlation coefficient matrix, the variance between the various indicators of decomposition principal component extraction and analysis of data and the initial factor loading matrix. Table 4 shows that direct correlations can be found between the variables. This direct correlations prove the existence of overlapping information[2].

According to the principle of principal component number, the study firstly extract all the principal components which the Eigenvalue is greater than 1. Table 4 shows that the cumulative variance contribution rate of the three principal components is equal to 94.19%. This edicate that these 3 principal components can response 94.19% of the whole original variable information. The deviation is tolerable. Therefore, this paper chose these 3 principal components to replace the original 10 variables.

In Table 5, the principal component load matrix is given. This table expresses the correlation coefficient of each variable and the principal components. Table 5 shows that the percentage of the added value of the X3 index in GDP has a high load on the first principal component. The same situation can be found in the percentage of the added value of the X4 index in GDP, and the percentage of the added value of the X6 index in GDP. That can be Interpreted as the first principal component mainly reflects this several indexes of information. It will be called a scale factor blew.

The second classification of index can be called as the investment factor. It contains both X5 and X9. These two indexes both have a higher load on the second principal components, which show that the second principal component mainly reflects the fixed assets investment and the actual foreign direct investment information.

Last classification of index can be called as the agglomeration level factor. It contains X1, X2, X5, X9. The character of this classification is that all of them have a higher load on the third principal component.

Table 3 Standardized index data

	ZX1	ZX2	ZX3	ZX4	ZX5	ZX6	ZX7	ZX8	ZX9
Transportation, warehousing and postal service	1.4864	1.2403	0.1881	0.1885	-0.2179	0.1888	1.5406	-0.3830	-0.5387
Wholesale and retail	0.3430	-0.1684	1.6063	1.6063	-0.4079	1.6063	0.3496	1.7763	-0.2218
The financial sector	-0.0475	0.7975	-0.4825	-0.4836	-0.6334	-0.4854	-1.0619	-0.5995	-0.4776
The real estate industry	-0.6872	-0.7766	-0.2744	-0.2742	1.7681	-0.2735	-0.5437	-0.2887	1.7736
The accommodation and catering industry	-1.0947	-1.093	-1.0375	-1.0369	-0.5088	-1.0362	-0.2846	-0.5051	-0.5355

Table 4 Correlation matrix

	X1	X2	X3	X4	X5	X6	X7	X8	X9
X1	1.000	0.869	0.544	0.544	-0.273	0.544	0.786	0.205	-0.372
X2	0.869	1.000	0.231	0.231	-0.381	0.230	0.435	-0.119	-0.451
X3	0.544	0.231	1.000	1.000	-0.087	1.000	0.452	0.918	-0.040
X4	0.544	0.231	1.000	1.000	-0.087	1.000	0.452	0.919	-0.039
X5	-0.273	-0.381	-0.087	-0.087	1.000	-0.086	-0.156	-0.129	0.980
X6	0.544	0.230	1.000	1.000	-0.086	1.000	0.453	0.919	-0.039
X7	0.786	0.435	0.452	0.452	-0.156	0.453	1.000	0.242	-0.303
X8	0.205	-0.119	0.918	0.919	-0.129	0.919	0.242	1.000	-0.036
X9	-0.372	-0.451	-0.040	-0.039	0.980	-0.039	-0.303	-0.036	1.000

The principal component index in Table 5 divide by the counterpart open square root of the characteristic values in Table 4, will equal to 10 in the three principal component index, eigenvectors corresponding coefficient, shown in Table 6.

Multiply the feature vector index in Table 6 with the standardized data, it can calculate scores of each service industry in the three principal component. And the formula is as follows:

$$F_{ji} = A_{i1} \times ZX_{j1} + A_{i2} \times ZX_{j2} + ... + A_{i9} \times ZX_{j9} \tag{1}$$

(i=1,2,3，represent the 3 principal component, j=1,2,3,4,5，represent the 5 producer services)

Take transportation, warehousing and postal service as example. On the first principal component, score calculationprocess is as follows:

F11=0.3533×1.4864 + 0.2208×1.2403 + 0.4332×0.1881 + 0.4332×0.1885 + 0.1427×0.2179 + 0.4332×0.1888 + 0.3025×1.5406 - 0.3626×0.3830 + 0.1427×0.5387 = 1.4791

By using this formula Eq.1, it can be calculate scores of the 5 producer services respectively on the 3 principal component. Firstly, the weight of each eigenvalue of the principal components need to be counted. Secondly, use the result to calculate comprehensive scores of the 3 principal component in each producer services. Eq.2 is a computing model to calculate the comprehensive score for each service, the results are shown in Table 7.

$$F_j = \frac{\lambda_1}{\lambda_1+\lambda_2+\lambda_3} F_{j1} + \frac{\lambda_2}{\lambda_1+\lambda_2+\lambda_3} F_{j2} + \frac{\lambda_3}{\lambda_1+\lambda_2+\lambda_3} F_{j3} \tag{2}$$

(λ_i, i=1,2,3, represents the eigenvalue of the 3 principal component in table 5.)

Table 5 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Eigenvalue	Variance Contribution Rate%	Cumulative Variance Contribution Rate%	Eigenvalue	Variance Contribution Rate%	Cumulative Variance Contribution Rate%
1	4.688	52.086	52.086	4.688	52.086	52.086
2	2.478	27.530	79.617	2.478	27.530	79.617
3	1.312	14.573	94.190	1.312	14.573	94.190
4	.523	5.810	100.000			
5	3.410E-16	3.789E-15	100.000			
6	7.500E-17	8.333E-16	100.000			
7	-9.841E-17	-1.093E-15	100.000			
8	-3.044E-16	-3.383E-15	100.000			
9	-6.080E-16	-6.755E-15	100.000			

Table 6 Component matrix

	Component		
	1	2	3
X1	0.765	-0.445	0.462
X2	0.478	-0.664	0.408
X3	0.938	0.334	-0.060
X4	0.938	0.334	-0.060
X5	-0.309	0.722	0.618
X6	0.938	0.335	-0.060
X7	0.655	-0.288	0.399
X8	0.785	0.486	-0.384
X9	-0.309	0.814	0.481

Table 7 can represent the competitiveness of this five producer services in Liaoning, China. The analysis shows the scores and rankings of the 3 principal component of producer services in Liaoning, China. The higher the score, the more competitive of this producer services area. Positive score shows that the competitiveness of this producer services area is higher than average, and negative score shows that the competitiveness of this producer services area is lower than average. Therefore, it can be sum up in table 8 that the producer services in 'wholesale and retail sale trade' ,financial industry ' and 'transportation, warehousing and postal service' area in Liaoning is competitive. However, the producer services in 'real estate' and 'Accommodation and Restaurants' area in Liaoning needs to strengthen some policy support.

Table 7 Index in 3 principal components of the coefficient

	feature vector		
	A1	A2	A3
X1	0.3533	-0.2827	0.4033
X2	0.2208	-0.4218	0.3562
X3	0.4332	0.2122	-0.0524
X4	0.4332	0.2122	-0.0524
X5	-0.1427	0.4587	0.5395
X6	0.4332	0.2128	-0.0524
X7	0.3025	-0.1830	0.3483
X8	0.3626	0.3088	-0.3353
X9	-0.1427	0.5171	0.4199

Suggestions for Producer Services in Liaoning, China

Relying on the Regional Industry Base and Improve the International Competitiveness. The revitalization and development of producer services in Liaoning should be based on the overall economic strength enhancement and promote the development of manufacturing and the fusion of producer services.

The equipment manufacturing industry in Liaoning has a good reputation around the world, this can advertise LIaoning. Besides, liaoning should strengthen cooperation with international enterprises, to improve the efficiency of the use of international capital and level. Moreover, Liaoning should focus on system innovation, technology innovation and management innovation to improve the competitiveness of producer services in the international market.

Foster the Development of Industrial Clusters and Improve Industrial Concentration. On the spatial distribution, a regulation can be found that high technology producer services and

manufacturing industry usually merge each other. Therefore, producer services in Liaoning should rely on manufacturing, constructing a relatively perfect system of producer services.

Take Dalian as example. Dalian port is one of the biggest port in north of China. Therefore, equipment and manufacturing industry clusters should be established in there to develop a public comprehensive port and the modern logistics industry. Moreover, LIaoning should pay attention to the overall layout of Dalian's equipment and manufacturing industry clusters, impetus the relocation of the large enterprise transformation.

Build Brand for Liaoning Producer Services. The final product of producer services is intangible service. Therefore, a good reputation and a reliable brand will leave new users concerns few concern.

For example, accommodation and restaurant industry is one of the economic benefits and outstanding achievement in Liaoning province. While, if Liaoning province implement the brand strategy, the situation should be better. Therefore, Liaoning government should create a market environment conducive to the development of brand cultivation and the legal environment. Finally, some of the Liaoning's accommodation and restaurants will formed with Liaoning characteristics, strong market competitiveness, high value-added products and service brand.

Speeding up the construction of enterprise informatization in service industry. The competition of modern enterprises is the competition of core technology, resource and informatization. The sustainable development of enterprises cannot do without informatization. Liaoning should strengthen the construction of service enterprise informatization demonstration project, through the use of various forms of training for enterprise information management professionals. Leaders and decision makers of each enterprise should renew the concept, change the advanced thought of enterprise informatization, improve the utilization rate of enterprise information system, promote enterprise development and improve the competitiveness of enterprises.

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