

Study on the Correlation Effect of Education Industry in Chongqing-Analysis based on the Input-output Table of Chongqing from 2015 to 2017

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Keywords: Education industry in Chongqing, input, output, economic relation.

Abstract: Education is an important industry to promote economic development, which plays a very important role in promoting the improvement of productivity and economic growth. Based on the input-output extension table of Chongqing in 2015 and input-output table of Chongqing in 2017, the author estimates the education industry of Chongqing from the perspectives of input-output structure, economic connection and industrial association. It can be seen that education industry in Chongqing belongs to the “final demand-oriented basic industry”, which is mainly indirect with the industry in Chongqing, and is relatively weak in radiation ability and driving force of other industries in regional economy. Therefore, it is necessary to further improve the development of education industry in Chongqing and promote its influence on other industries, so as to promote the overall development of Chongqing's economy.

1. Introduction

Education is the foundation of a country and the foundation of a strong country. Human capital theory holds that education has functions such as personnel training, technological innovation, and social services. It plays a leading, overall, and basic position in economic development, and plays a very important role in promoting productivity and economic growth. Through a lot of theoretical research and empirical analysis, scholars at home and abroad have found that educational factors and institutional change factors play an important role in China's economic development. It is of great significance to study the education industry in Chongqing to promote its economic development. The author studies the status of education industry in Chongqing in Chongqing's national economy and its influence on other industries in the national economy from the perspective of input and output, so as to further promote the healthy and rapid development of Chongqing's economy.

2. An Analysis of the Input-Output Structure of Education Industry in Chongqing

Input-output analysis is an economic quantitative analysis method that studies the interdependence of inputs and outputs between various parts of the economic system. A mathematical model is established through the input-output table to analyze the distribution and consumption relationship among various sectors or industries of the national economy.

The author uses the Chongqing Input-Output Extension Table of 42 sectors in 2015 and the Chongqing Input-Output Table of 42 sectors in 2017 as the research objects. However, due to too many sectors, the characteristics of education industry in Chongqing can't be reflected. In order to better highlight the quantitative characteristics of the industrial relationship between education industry in Chongqing and the primary, secondary and tertiary industries. The study is based on the "Industrial classification for national economic activities", and combined with the "pure sector" principle, to reintegrate the industry categories of the input-output extension table studied, that is, to separate the education industry from the tertiary industry and constitute an input-output table of four sectors with only the primary industry, the secondary industry, the tertiary industry (excluding the education industry) and the education industry. Among them: The primary industry includes agriculture, forestry, animal husbandry and fishery products and services (services should not be classified as primary industry according to the "pure sector" principle, but due to the difficulty of data stripping and its little impact on the research results of this paper, service is still classified into the primary industry in the study of this paper). The secondary industry includes coal mining products, petroleum and natural gas mining products, metal mining products, non-metallic minerals and other mining products, food and tobacco, textiles, clothing, shoes, hats, leather and other down and their products, wood processing products and furniture, papermaking, printing, cultural, educational and sporting goods, petroleum coking products and nuclear fuel processing products, chemical products, non-metallic mineral products, metal smelting and rolling products, metal products, general equipment, special equipment, transportation equipment, electrical machinery and equipment, communication equipment, computers and other electronic equipment, instrumentation, other manufactured products and scraps, metal products, machinery and equipment repair services, production and supply of electricity and heat, production and supply of gas, production and supply of water, and buildings. The tertiary industry includes wholesale and retail, transportation, storage and post, accommodation and catering, information transmission, software and information technology services, finance, real estate, leasing and business services, research and experimental development, comprehensive technical services, water conservancy, environmental and public facility management, resident services, repairs and other services, health and social work, culture, sports and entertainment, public management, social security and social organizations. The education industry includes education. By studying the relationship between the education industry and the three major industries, the economic status of the education industry in Chongqing is revealed.

It can be seen from Table 1 that the total output of the primary, secondary, tertiary and education industries in Chongqing in 2015 was 1738, 30625, 14225 and 591 respectively, accounting for 3.7%, 65.6%, 30.5% and 1.2%. The total output of the primary industry, the secondary industry, the tertiary industry and the education industry in Chongqing in 2017 was 1902, 35873, 17420 and 719 respectively, accounting for 3.4%, 64.1%, 31.2% and 1.3%. It can be seen that from 2015 to 2017, the contribution of education industry in Chongqing to Chongqing's total output has basically not changed, and the contribution rate is relatively low. In terms of added value, the education industry in Chongqing accounted for only 2.7% of the GDP in 2015. In 2017, the share dropped to 2.4%. Compared with other related research and analysis, these data are relatively small because the industry classification in input and output is classified according to "pure sector", that is, product

attributes. Therefore, the reliability of the data is higher than that in the statistical yearbook. In other words, the development level of education industry in Chongqing is not high, which is lower than the actual expected level.

Table 1: Chongqing Input-output Coefficient Table in 2015 and 2017.

2015								
Industry	Total output (RMB 100 million)		Value added (RMB 100 million)		Intermediate rate product %	Final product rate %	Intermediate investment rate %	Initial investment rate %
	Absolute value	Rate %	Absolute value	Rate %				
Primary industry	1738	3.7	1168	7.4	71.9	28.1	32.8	67.2
Secondary industry	30625	65.6	6852	43.6	70.9	29.1	77.6	22.4
Tertiary industry	14225	30.5	7266	46.3	54.9	45.1	46.7	53.3
Education industry	591	1.2	430	2.7	16.4	83.6	27.3	72.7
Total	46589	100	15716	100	66.3	33.7	66.3	33.7
2017								
Industry	Total output (RMB 100 million)		Value added (RMB 100 million)		Intermediate rate product %	Final product rate %	Intermediate investment rate %	Initial investment rate %
	Absolute value	Rate %	Absolute value	Rate %				
Primary industry	1902	3.4	1304	6.7	38.9	61.1	31.5	68.5
Secondary industry	35873	64.1	8583	44.2	71.0	29.0	76.1	23.9
Tertiary industry	17420	31.2	9076	46.7	58.6	41.4	47.9	52.1
Education industry	719	1.3	462	2.4	9.7	90.3	35.7	64.3
Total	55914	100	19425	100	65.3	34.7	65.3	34.7

From the perspective of the investment structure, the intermediate investment rate of education industry in Chongqing was 27.3%, and the initial investment rate was 72.7% in 2015; the intermediate investment rate was 35.7%, and the initial investment rate was 64.3% in 2017. This shows that education industry in Chongqing has increased its intermediate investment in 2017 compared with 2015, but it is still an industry with “high added value and low driving capacity”. The initial investment includes the structure of fixed assets, labor compensation, and net social income. The initial investment ratios of education industry in Chongqing in 2015 were 18.5%, 61.6%, and 19.9%; the initial investment ratios in 2017 were 20.4%, 57.9%, and 21.7%. No matter in 2015 or 2017, the labor remuneration accounted for a large proportion of the initial investment, indicating that the education industry is a labor-intensive industry, and the output profit directly

created is relatively low, but the output profit is increasing. The output profit in 2017 was 1.8% higher than that in 2015.

In terms of output structure, the intermediate product rate of education industry in Chongqing in 2015 was 16.4% and the final product rate was 83.6%; the intermediate product rate in 2017 was 9.7% and the final product rate was 90.3%. Therefore, it can be seen that education industry in Chongqing is not for production services, but for non-productive service industries.

According to the intermediate product rate and intermediate investment rate, economists such as Chinnery and Watanabe will divide the industry into four types (see Table 2). 50% is taken as the boundary between intermediate product rate and intermediate investment rate. In combination with the above research, it can be seen that the education industry in Chongqing belongs to the “basic industry with final demand”.

Table 2: Industry Group Classification Table.

	Low intermediate product rate	High intermediate product rate
High intermediate investment rate	Final demand-oriented industry	Industry with intermediate product
Low intermediate investment rate	Basic industry with final demand	Basic industry with intermediate product

3. Economic Relation Analysis

3.1. Direct Economic Relation Analysis

Economic relation is divided into direct economic relation and complete economic relation. Direct economic relation is generally measured by the direct consumption coefficient a_{ij} , that is, the amount of output value of sector i directly consumed by per unit output value of sector j . The calculation formula is:

$$a_{ij} = \frac{x_{ij}}{X_j} \quad (i, j=1,2,\dots,n) \quad (1)$$

Generally, the larger a_{ij} is, the closer the direct links between departments (or products) are.

Table 3: Table of Direct Consumption Coefficient of Four Sectors in Chongqing.

2015				
	Primary Industry	Secondary Industry	Tertiary Industry	Education Industry
Primary Industry	0.1806	0.0233	0.0163	0.0000
Secondary Industry	0.1008	0.6138	0.1952	0.1289
Tertiary Industry	0.0463	0.1388	0.2497	0.1331
Education Industry	0.0000	0.0003	0.0059	0.0111
2017				
	Primary Industry	Secondary Industry	Tertiary Industry	Education Industry
Primary Industry	0.0726	0.0128	0.0082	0.0000
Secondary Industry	0.1329	0.6162	0.1737	0.1315
Tertiary Industry	0.1080	0.1312	0.2947	0.2174
Education Industry	0.0013	0.0006	0.0023	0.0080

Table 3 shows that for every RMB 10,000 of products or services produced by the education industry in Chongqing in 2015, the output values of the primary industry, the secondary industry, the tertiary industry and the education industry directly consumed were RMB0, RMB1,289, RMB1,331 and RMB111 respectively. In 2017, for every RMB 10,000 of products or services produced, the output value of the primary industry, the secondary industry, the tertiary industry and education industry directly consumed were RMB 0, RMB1,315, RMB2,174 and RMB80 respectively. It can be seen that the production of education industry products or services has the highest degree of direct dependence on the tertiary industry, followed by the secondary industry and education industry, and the dependence on agriculture is basically 0.

For every RMB10,000 of products or services produced by the primary, secondary, tertiary and education industries in Chongqing in 2015, the output values of the education industry directly consumed were RMB0, RMB3, RMB59 and RMB111, respectively. For every RMB 10,000 of products or services produced by the four industries in Chongqing in 2017, the output values of the education industry directly consumed were RMB13, RMB6, RMB23 and RMB80, respectively. It shows that the direct dependence of the three major industries in Chongqing on the education industry is generally low, and the primary and secondary industries have almost no dependence on the education industry.

3.2. Complete Economic Relation Analysis

The complete consumption coefficient is the complete consumption of a certain product by the final product of a production unit, including direct consumption and all indirect consumption. It is generally calculated using a matrix. The calculation formula is:

$$B = (I - A)^{-1} - I \quad (2)$$

From the perspective of complete consumption coefficient, the complete consumption of the primary industry, the secondary industry, the tertiary industry and education industry in 2015 was RMB 190, RMB4,793, RMB2,695 and RMB130 for every RMB 10,000 of products or services produced by the education industry in Chongqing. The complete consumption of the primary industry, the secondary industry, the tertiary industry and education industry in 2017 was RMB 111, RMB5,365, RMB4,126 and RMB94 for every RMB 10,000 of products or services produced by the education industry in Chongqing. For every RMB 10,000 of products and services produced by the four major industries, the complete consumption of the education industry in 2015 was RMB10, RMB41, RMB91, and RMB130; in 2017, the total consumption of the education industry was RMB23, RMB30, RMB41, and RMB94.

4. Dynamic Analysis of Industry Linkage

Industry linkage refers to the technical and economic ties between industries with input products and output products as the link. Among them, input refers to the raw materials, fuel, depreciation of fixed assets and input of labor needed for product production, while output refers to the total amount of products produced and the direction and quantity of distribution and use. Industry linkage analysis is to analyze the interdependence of input and output between subdivided industries, which is divided into forward linkage analysis and backward linkage analysis.

4.1. Forward Linkage Analysis

Forward linkage refers to the linkage between supply and other industries, which can be measured by sensitivity and sensitivity coefficient. The sensitivity is generally measured by the sum of the

row directions of the Leontief inverse matrix, and the sensitivity coefficient is the ratio of the sensitivity and the average sensitivity of the national economy. Its calculation formula is shown as follows:

$$E_i = \frac{\sum_{j=1}^n \bar{b}_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n \bar{b}_{ij}} \quad (3)$$

If the sensitivity coefficient > 1, it means that the industry has a high sensitivity, which is above the average level of all industries; if the sensitivity coefficient is < 1, it means that the industry has a low sensitivity and is below the average level of all industries.

Table 4: This caption has one line so it is centered.

2015				
	Primary Industry	Secondary Industry	Tertiary Industry	Education Industry
Sensitivity	0.3977	3.5298	1.4391	0.0271
Sensitivity coefficient	0.2949	2.6178	1.0673	0.0201
2017				
	Primary Industry	Secondary Industry	Tertiary Industry	Education Industry
Sensitivity	1.1664	4.6114	2.7681	1.0189
Sensitivity coefficient	0.4878	1.9285	1.1576	0.4261

As can be seen from the calculation results in Table 4, the sensitivity of education industry in Chongqing in 2015 was 0.0271, indicating that when each industrial sector in Chongqing increased by RMB 10,000, the driving value for the education industry was only RMB 271. In 2017, the sensitivity was improved to 1.0189, indicating that when each industrial sector in Chongqing increased by RMB 10,000, the driving value for the education industry was RMB 10,189. Although it is far lower than the sensitivity of other industries, from a vertical point of view, education industry in Chongqing is improving. From the perspective of sensitivity coefficient, the sensitivity coefficients of education industry in Chongqing were 0.0201 and 0.4261 in 2015 and 2017, respectively, which were less than 1, indicating that the sensitivity of education industry in Chongqing was below the average level of all industries. This is because other industries in Chongqing have relatively small intermediate demands for the products and services of the education industry in the production process, so the increase in the final demand of other industries does not have much impact on the education industry.

4.2. Backward Linkage Analysis

Backward linkage analysis refers to the linkage between one's own demand and other sectors, which can be measured by influence and influence coefficient. Influence is generally measured by the sum

of the column directions of Leontief inverse matrix, while influence coefficient is the ratio of influence to the average influence of national economy. Its calculation formula is shown as follows:

$$F_j = \frac{\sum_{i=1}^n \bar{b}_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n \bar{b}_{ij}} \quad (4)$$

If the influence coefficient is greater than 1, it indicates that the industry has a high influence, indicating that the influence of the j industry sector on other industry sectors of the national economy exceeds the average influence level of the industry sectors of the national economy. If the influence coefficient is less than 1, it means that the industry has a low influence, indicating that the influence of the j industry sector on other industrial sectors of the national economy is lower than the average influence level of the industry sectors of the national economy.

Table 5: Industrial Influence and Influence Coefficient of Chongqing.

2015				
	Primary Industry	Secondary Industry	Tertiary Industry	Education Industry
Influence	0.7842	2.5260	1.3028	0.7807
Influence Coefficient	0.5816	1.8733	0.9662	0.5790
2017				
	Primary Industry	Secondary Industry	Tertiary Industry	Education Industry
Influence	1.8436	3.4549	2.2968	1.9696
Influence Coefficient	0.7710	1.4448	0.9605	0.8237

From the calculation results in Table 5, it can be seen that the influence of education industry in Chongqing in 2015 was 0.7807, meaning that when education in Chongqing increased by RMB 10,000 in final products and services, all industrial sectors in Chongqing would be promoted to increase the final products and services by RMB 7,807. In 2017, the influence was 1.9696, indicating that when the education in Chongqing increased by RMB 10,000 in final products and services, all industrial sectors in Chongqing would be promoted to increase the final products and services by RMB 19,696. From the perspective of the influence coefficient, the influence coefficient of education industry in Chongqing was 0.5970 and 0.8237 in 2015 and 2017, respectively, which were less than 1, indicating that the driving force of the education industry to Chongqing's economy was lower than the city's average industry level. However, from a vertical perspective, from 2015 to 2017, education industry in Chongqing has continuously improved its driving force for Chongqing's economy.

4.3. Category of Education Industry

According to the sensitivity coefficient and influence coefficient, the industries can be divided into the following four categories (see Table 6): The sensitivity coefficient and influence coefficient of category 1 industry are both greater than 1, which has a large demand for the economy and a large

supply driving force; The influence coefficient of category 2 industry is greater than 1, and the sensitivity coefficient is less than 1. Therefore, the demand for the economy is large, but the driving force for supply is small. The influence coefficient of category 3 industry is less than 1, and the sensitivity coefficient is greater than 1. Therefore, the demand for the economy is small, but the driving force for supply is large. The influence coefficient and sensitivity coefficient of category 4 industry are both less than 1, and the demand for the economy and driving force for supply are relatively small. Taking this as the standard, combined with the above research, it is found that the secondary industry in Chongqing belongs to the first category, which has a relatively large driving force for both demand and supply. That is to say, the secondary industry plays a decisive role in the economy of Chongqing, and will affect the overall quality of Chongqing's economy, so it should be supported. The sensitivity coefficient of the tertiary industry is greater than 1, and the influence coefficient is close to 1, indicating that the tertiary industry currently belongs to the second category, but it is moving closer to the first category, and the driving force of supply is gradually increasing, indicating that it has the nature of a leading industry, so it should be supported by policies; The primary industry belongs to the fourth category. It is not easy to drive the development of other industries, nor to be affected by the development of other industries. Education industry also belongs to the fourth category, but with the government's attention to education and the increasingly important status of education in the economy, it is now slowly approaching the second category, indicating that the demand for education in Chongqing is constantly improving.

Table 6: Industry category.

The first category	The second category	The third category	The fourth category
$F_i \geq 1 \quad E_i \geq 1$	$F_i \geq 1 \quad E_i < 1$	$F_i < 1 \quad E_i \geq 1$	$F_i < 1 \quad E_i < 1$
Large motive force for demand Large driving force for supply	Large motive force for demand Small driving force for supply	Small motive force for demand Large driving force for supply	Small motive force for demand Small driving force for supply

5. Conclusions

(1) The output of the education industry has a relatively low contribution rate to Chongqing's total output, accounting for only 1%. Due to relatively low intermediate investment rate and intermediate product rate, it belongs to the “final demand-based basic industry” sector. (2) The education industry in Chongqing is relatively closely related to the secondary and tertiary industries, and relatively little to the primary industry. In addition, the education industry is mainly indirectly connected with the primary and secondary industries, and is equivalent to the direct and indirect connections with the tertiary industry. It is directly connected with itself. (3) Through the analysis of the linkage analysis, it is found that the influence and sensitivity of education industry in Chongqing are relatively low, and its driving force and radiation ability to the economy are relatively weak, but vertically, its power to pull and radiate the economy is increasing.

It is necessary to develop education industry and promote economic development in Chongqing. Firstly, create education industry linkages, increase the connection and interaction between the education industry and other industries, integrate resources in upstream industries, realize resource agglomeration and utilization in midstream industries, and realize value-added services in downstream industries. Secondly, increase education investment, basic research funding and technology from both the government and enterprises, increase higher education enrollment

opportunities, and enhance the influence of the education industry in Chongqing's economy. Thirdly, strengthen school-enterprise cooperation, cultivate core professional abilities, enhance the knowledge competitiveness of workers, and further play the role of the education industry's indirect connection with other industries through the use of workers as a medium.

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