Measurement and Evaluation of the Collaborative Development of Three Industries in Sichuan

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The research is supported by the project of "Study on the Collaborative Development of Three Industries in Sichuan Based on the View of the Policy Guidance" of the Sichuan Provincial Philosophical and Social Science Planning Project of 2009 (No. SC08B032). (Sponsoring information)

Abstract

The input-output characteristics method is used to measure the collaboration of three industries in Sichuan, and the actuality of the collaboration of three industries is analyzed in this article. The result shows three industries develop collaboratively as a whole, and the compatibility is higher and higher. But comparing with other developed provinces, the actual final product rate and the compatibility are lower. Aiming at these problems, some polices are suggested in the article.

Keywords: Collaboration of three industries, Final product rate, Compatibility

1. Introduction

In recent years, with the durative push of west development, the reforming and opening, and the introduction of inviting investments policy, the economy of Sichuan has been developed flourishingly, and the total strength of economy is enhanced continually. However, comparing with developed costal regions, the economy of Sichuan is still lagged, and it still should be discussed that whether the development of three industries in Sichuan is collaborative and achieves the standard about the industrial structure adjustment, optimization, and updating. At present, most researches about the development of three industries in Sichuan were qualitative, and the content only included the development meaning and the strategic orientation of the collaborative development of three industries, and few of them could measure the development of three industries from the quantitative view. Though the present researches measured the collaboration of three industries by the association degree of the fixed asset investment, the industry structure, and the production value structure from the view of the grey correlation method, but this measurement still could not definitely analyze the compatibility and development tendency of three industries in Sichuan. The measurement of the collaboration of three industries should start from the input and output table of three industries of Sichuan by computing the technical economic structure, production structure and final product rate, and constructing the industry compatibility, and evaluate the development tendency, and provide policy suggestions to better promote the collaboration of three industries in Sichuan.

2. Brief introduction of the input-output table characteristic method

The input-output table characteristic method is to compute the middle investment, the final usage, and the total social products by the data of various industrial departments and the data in the input-output table.

According to the transverse direct consumption coefficient model in the input-output table,

The middle investment + the final usage = the total social products

$$\sum_{j=1}^{3} X_{ij} + Y_i = X_i \qquad i = 1, 2, 3 \qquad (1)$$

$r = Y / X$ is the final product rate, and $Y = (Y_1 + Y_2 + Y_3)$, $X = (X_1 + X_2 + X_3)$, and $x = (x_1, x_2, x_3)$ is the social production structure, and $x_1 = X_1 / X$, $x_2 = X_2 / X$, $x_3 = X_3 / X$, and $y = (y_1, y_2, y_3)$ is the final product structure, and $y_1 = Y_1 / Y$, $y_2 = Y_2 / Y$, $y_3 = Y_3 / Y$.

$A = \begin{bmatrix} a_{11} a_{12} a_{13} \\ a_{21} a_{22} a_{23} \\ a_{31} a_{32} a_{33} \end{bmatrix}$ is the technical economic structure (input-output coefficient matrix), and $a_{ij} = X_{ij} / X_j$, $i, j = 1, 2, 3$, and the formula (1) can be written as

$$A x + r y = x \qquad (2)$$

The characteristic roots of the technical economic structure A are λ_1, λ_2 and λ_3, and λ_1 is the main characteristic root, and if $0 < \lambda_1 < 1$ and $\lambda_1 > |\lambda_i|$ ($i = 1, 2, 3$), the corresponding eigenvector R_1 is the main eigenvector of A, and other corresponding eigenvectors of λ_2 and λ_3 are R_2 and R_3 (Ji, 2008). R_1 is called as the technical economic structure. The characteristic roots of the technical economic structure A are λ_1, λ_2 and λ_3, and λ_1 is the main characteristic root, and if $0 < \lambda_1 < 1$ and $\lambda_1 > |\lambda_i|$ ($i = 1, 2, 3$), the corresponding eigenvector R_1 is the main eigenvector of A, and other corresponding eigenvectors of λ_2 and λ_3 are R_2 and R_3 (Ji, 2008). R_1 is called as the technical economic structure. When the social production structure x is consistent with the technical main characteristic R_1, $A x = \lambda_1 x$ and $r y = (1 - \lambda_1) x$. When $r = 1 - \lambda_1$, the social production structure, the final product structure, and the technical economic structure R_1 are completely consistent. Therefore, when $r = 1 - \lambda_1$, the industry structure is harmonious, and when $r > 1 - \lambda_1$, the industry structure is harmonious, and when $r < 1 - \lambda_1$, the industry structure is not harmonious (Kang, 2009). At the same time, to exactly compute the industry compatibility, the variable γ is introduced to compute the included angle α between the social production structure vector and the main eigenvector and the angle β of the region (harmonious region or unharmonious region) of the social production structure vector, and the proportion γ that the former occupy in the latter is the compatibility of the social production structure and the technical economic structure. When $0 < \gamma < 1$, the development of industries is harmonious, and it is bigger, the compatibility is higher, and when $-1 < \gamma < 0$, the development of industries is not harmonious, and it is smaller, the compatibility is lower (Ji, 2008).

3. Measurement of the compatibility of three industries in Sichuan

Since the new Century, three industries in Sichuan have been quickly developed.

According to the statistical yearbook and statistical bulletin of Sichuan in past years, the GDP of Sichuan in 2002 was 472.501 billion Yuan, and the production value of the first industry was 104.795 billion Yuan, 22.2% of the GDP, and the production value of the second industry was 306.723 billion Yuan, 41.5% of the GDP, and the production value of the third industry was 283.674 billion Yuan, 38.4% of the GDP.

The GDP of Sichuan in 2005 was 738.511 billion Yuan, and the production value of the first industry was 148.114 billion Yuan, 20.1% of the GDP, and the production value of the second industry was 306.723 billion Yuan, 41.5% of the GDP, and the production value of the third industry was 283.674 billion Yuan, 38.4% of the GDP.

The GDP of Sichuan in 2007 was 1050.53 billion Yuan, and the production value of the first industry was 203.2 billion Yuan, 19.3% of the GDP, and the production value of the second industry was 464.13 billion Yuan, 44.2% of the GDP, and the production value of the third industry was 383.2 billion Yuan, 36.5% of the GDP.

From the production grosses and the production value proportions of three industries in 2002, 2005, and 2007,

the output of total value expanded continually, and the total economic strength was enhanced quickly. In three industries, the proportion of the first industry descended continually, and the proportion of the second industry was enhanced year by year, but the proportion of the third industry descended a little. The changing tendency of the first industry and the second industry could accord with the principle about three industries in Petty-Clark Theorem. And it was reasonable that the proportion of the third industry descended a little, because the proportion of the third industry in the first year was higher, and it was normal that it would be lower in the development.

But from the input-output table of 2002, 2005, and 2007, the proportions of the outputs of three industries in the total outputs in 2002 respectively were 14.4%, 54.2%, and 31.4%, and these proportions in 2005 respectively were 14.4%, 55.2%, and 30.2%, and these proportions in 2007 respectively were 12.9%, 58.5%, and 28.7%. The proportion of the first industry was descending, and the proportion of the second industry was bigger and bigger, and the proportion of the third industry descended a little, which are consistent with the proportions of three industries.

To better judge the compatibility of three industries in Sichuan, the input-output table characteristic method is used to compute and obtain the characteristic roots, the eigenvectors, the final product structures, and the social production structures of the technical economy according to the division of three industries (seen in Table 1).

According to the formula, the final product rate r, the included angle α between the social production structure vector and the main eigenvector, the angle β of the region (harmonious region or unharmonious region) of the social production structure vector could be obtained, and the compatibility of three industries could be obtained according to $r = \alpha / \beta$ (seen in Table 2).

In addition, the actual final product rate, the maximum final product rate, and minimum final product rate are seen in Table 3.

4. Evaluation of the collaboration of three industries

From the measurement data, the compatibilities of three industries in Sichuan all are between 0 and 1, and positive, so the development of three industries in Sichuan was harmonious, but the compatibility increased continually, from 6.74 in 2002 to 10.48 in 2007, and the actual final product rate gradually increased, from 42.44 in 2002 to 44.53 in 2007. When three industries in Sichuan developed continually, the compatibility was higher and higher, but there were many problems in the development.

First, the actual final product rates of three industries were lower. The actual final product rates in 2002, 2005, and 2007 were all less than 50%, which were behind than the national average level, and the gap with the developed costal provinces was bigger. The reason that the actual final product rate was lower might be that the input-output efficiency of resources was lower. The infrastructure of the agriculture was relatively lagged, and the life style and plantation mode were still traditional, and the product added value of the agriculture was lower, and the use efficiency was not high, and the use rate of the scientific technology in the agriculture was lower, and the introduction, extension, and conversion efficiency of agricultural technology should be further enhanced. Thought the production value and output proportions of the industry and the building trade were largely enhanced in recent years, but that was because that the industry and the building trade continually increased the fixed asset investment, and the capitals and resources begun to incline to these industries. The output efficiency and the competitive force of these two industries were lower, and comparing with developed costal provinces, the total competitive force and the grasp degree of core technology were still lower than the national average level. The proportion of the third industry descended a little, which should be noticed. The development of the modern big service industry, the large wholesale and retail enterprises, and the modern finance industry including financial insurance and the securities investment, is still in the initial stage, and it should be further deepened and quickened.

Second, thought three industries were harmonious, but the compatibility was lower, and it was obviously lagged than the complete compatibility, which means the structure of three industries should be further optimized and the orientation of three industries should be further defined.

The first industry is not only the basic industry, but it could provide resources and consumption materials for the development of the second industry and the third industry. At the same time, the status of the first industry should be further enhanced, and its development should be further emphasized. The development of the second industry and the third industry should provide energy for the development of the first industry. The industry should reversely feed the agriculture, and provide better establishments, more advanced production equipments, and better production mode for the development of the agriculture. The modern service industry should increase

the added value and prolong the industry chain, and provide more marketing channels for the development of the first industry.

But the practice is not optimistic. The first industry was still in the weak status, and the binary economic gap between village and city is still obvious, and the rural economy is till weak, and rural young labors leave their native places, so the rural labor force is deficient. At the same time, the agriculture is lagged, and farmers' cultural quality is generally lower. Therefore, it is hard to enhance the agricultural productivity in short time and strengthen the first industry. The interaction between the second industry and the third industry is not ideal. The proportion of the third industry is descending, though the proportion of the second industry increased a little, but it is still not healthy and reasonable development. When developing the industry and the building trade, the relationship with the third industry and the modern service industry has not been harmonized well, and the development of the second industry needs more resources and capitals, and the third industry has not be strengthened with the development of the first industry.

Third, the big cause of the bad compatibility of three industries was the ignorance of the technology, human capitals, and management experience.

The development of the first industry needs more labor forces with knowledge, more technical talents, and more agricultural scientific technologies in the rural areas, but the practice is not so. Rural areas are still lagged and the production mode is still traditional, and talents are hard to be attracted in these areas. The development of the second industry also needs advanced technical resource to convert into actual labor force, and attract domestic and foreign excellent research and management talents. Comparing with developed costal provinces, the attractive force of Sichuan is still deficient. The development of the industry is still centralized in the labor-intensive and traditional industry. The technology and the management mode are lagged, and various encouragement measures are not completed, and there is not a set of effective mechanism in the technology innovation, R&D, and conversion. These problems seriously limit the quick and healthy development of the industry. The transportation, posts, telecommunications, and financial insurance in the third industry also have same problems with the development of the first industry and the second industry. The talent introduction and the technical result conversion are very difficult.

The existence of above problems restrains the harmonious development of three industries, so the compatibility of three industries in Sichuan is still on the lower level, and the actual final product rate is still lagged than the national rate, especially than the rate of those developed costal provinces.

5. Policy suggestions

Aiming at above problems, to better harmonize three industries in Sichuan, following policy advices are suggested.

The development of the first industry should be reoriented. Combining with the resource, environment, and location of Sichuan, the development of three industries in Sichuan should be oriented definitely. The first industry should be updated from the orientation provide traditional resources and raw materials, and the development status of the first industry needs to be enhanced. The development of the first industry is very important to ensure food safety, establish the new socialism village, construct the harmonious society, enhance farmers' income level, and reduce and change the binary gap between village and city. Villages should create conditions to attract and hold talents, and introduce more advanced equipments, and new agricultural scientific technology. The development of the first industry needs more agricultural leading enterprises, create more agricultural development modes, more cooperation with agricultural research colleges, institutions, and heading companies and bases, and convert new agricultural scientific results into new farm products and animal products. Farmers should cooperate with enterprises, companies, and bases, to construct the modern agriculture with ecology, recycle, and high efficiency.

The development of the second industry should emphasize the efficiency. Not only the development of the second industry needs capitals and fixed assets, but also existing traditional industry should be reformed, and those lagged industries with high energy consumption and heavy pollution should be eliminated. More new technology should be introduced, and more enterprises should be encouraged to invest more capitals in the independent R&D, and construct their own core and dominant industries. More preferential polices should be made to attract more investors to develop the industry with high technology, and the green industry, and the industry with low energy consumption. At the same time, the management mode should be emphasized, and the management experience should be accumulated, and the existing information technology should be fully utilized to guide and support the reform and development of the industry. The utilization rate and the conversion rate of the resource should be enhanced, and the pollution should be reduced, and the unit energy consumption output

 ISSN 1833-3850 E-ISSN 1833-8119

should be enhanced.

The big development potential of the third industry needs to be dug continually. To better develop the economy of Sichuan, the development potential of the third industry must be dug, and the development of the modern service industry is the necessary choice. The third industry contains wide range, and provides more labor posts, and extends the existing industrial chain. The beautiful view of Sichuan should be fully utilized to construct the strong tourism province by virtue of its abundant tourism resource. At the same time, the development of the tourism industry could drive the development of many industries such as the transportation, the post and telecommunications, the eating and drinking, the wholesale and retail industry. Various industries should be developed collaboratively and achieve mutual benefit and win-win result.

Three industries should develop collaboratively and orderly in the entire allocation. The development of three industries should be promoted each other, and three industries should have their own characters and advantages, and at the same time, they could survive and compensate each other as a whole.

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Table 1. Characteristic roots, eigenvectors, final product structures, and social production structures of the technical economy in 2002, 2005, and 2007

Year	Characteristic root			Eigenvector			Final product structure	Social production structure
	λ_1	λ_2	λ_3	R_1	R_2	R_3		
2002	0.623	0.208	0.242	0.124	0.729	0.662	0.19331	0.14402
				0.634	-0.408	-0.325	0.49348	0.54232
				0.242	0.729	0.662	0.31322	0.31366
2005	0.628	0.241	0.252	0.104	0.505	0.582	0.17767	0.14354
				0.682	0.842	0.027	0.50363	0.55159
				0.214	-0.348	0.394	0.31870	0.30487
2007	0.632	0.243	0.274	0.085	0.675	0.796	0.15766	0.12867
				0.726	-0.35	-0.229	0.52074	0.58463
				0.189	0.675	0.433	0.32160	0.28670

Table 2. Analysis of the compatibilities of three industries in 2002, 2005, and 2007

Year	λ_1	R_1	x_i	α	β	γ
2002	0.623	0.124	0.14402	46.24	6.86	6.74
		0.634	0.54232			
		0.242	0.31366			
2005	0.628	0.104	0.14354	57.85	6.60	8.76
		0.682	0.55159			
		0.214	0.30487			
2007	0.632	0.085	0.12867	64.76	6.17	10.48
		0.726	0.58463			
		0.189	0.28670			

Table 3. Final product rates and compatibilities of three industries of Sichuan in 2002, 2005, and 2007

Year	Compatibility	Actual final product rate
2002	6.74	42.44
2005	8.76	43.14
2007	10.48	44.53

ISSN 1833-3850 E-ISSN 1833-8119