Study on the transportation influences of the secondary industry

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ABSTRACT

National economy is closely related to the transportation structure, and the development of economic cause adjust of the transportation structure. Taking Chongqing as an example, we analyzed the influences of Chongqing secondary industry with transportation. Combined with gray relational theory, we can describe and analyze the detailed relationship between industrial structure and transport structure quantitatively.

KEYWORDS

Industrial structure; Transportation structure; Grey system relational model.

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INTRODUCTION

The national economy is closely related to the structure of transportation, and the development of economic cause the adjust of the structure of transportation. Because of different of economic and technical characteristics of various transportation, different industrial structure will be presented to the different transportation needs in the quantity and quality. Secondary industry is based on the economic theory of traditional industries division an industrial sector, is a industry sectors to provide processing product or raw materials for primary industry and itself, including manufacturing, electricity, gas and water production and supply industry, construction, etc. Secondary industry as the main initiator of goods transport demand for higher of transport. Although in recent years the government put forward changes in the economic development mode, secondary industry remains the backbone of the national economic growth. Chongqing city's GDP is 1.265669 trillion yuan in 2013 , the output value of the secondary industry is 639.792 billion yuan, accounting for 50.55%.

Zhang Lingling[1] use co-integration theory,VAR model and impulse response function to analysis causality and cointegration between secondary industry development and railway transport.Li Chongliang analysis impact on the evolution of the industrial structure of transportation with correlation analysis and gray relational analysis[2].Nie Zhengying[3] constructing the complete decomposition model to analysis the affect of the industrial structure and the transportation needs in the empirical analysis and forecasting analysis.Rong Chaohe[4] pointed out that industrial development is changing economic motives of the development of the transport sector needs. Patrick H. Buckley[5] think outline a three-region, five-sector operational ICGE model of the United States which has been calibrated from a 51 region, 124 sector public data base. JING Y[6] think that the internal structure of secondary industry changes progressively, especially new characteristics and new variation tendency has turned up inside the industrial departments. Fan G thinks the transformation of dual economic structure is a crucial point of the economic development in developing countries. In this paper, we will begin with the current situation of Chongqing industrial structure, combined with structural changes of transportation in recent years, and then use gray correlation theory to quantify the influences of Chongqing secondary industry on transportation .

THE INDUSTRIAL STRUCTURE ANALYSIS OF CHONGQING

The general characteristics of the three industries of Chongqing from 1978 to 2012 is that the proportion of primary industry continue to show a downward trend, the proportion of secondary industry output rose steadily, keep between 40% - 55%. The proportion of tertiary industry output is rising. From the current situation, the industrial structure in Chongqing also need to constantly adjust, as well as escalating space. As shown in figure 1.
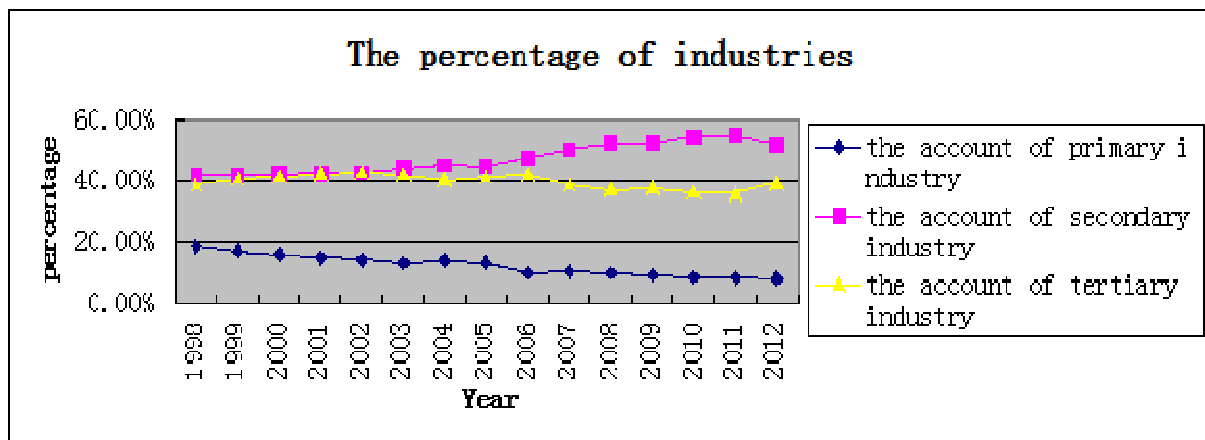

FIGURE 1 The percentage of three industries in Chongqing

Industrial structure evolution

Deviation of industrial structure is an asymmetric state between output structure and employment structure. It is calculated using the following formula:

$$p = \sum |L - C|$$

In this formula, P is deviation of industrial structure, L is the proportion of a particular industry employment, C is same proportion of output. the asymmetric of employment structure and value structure, the greater the deviation between them, the lower the efficiency of industrial structure.

From table 1, we can see that from 1997 to 2012, Chongqing industrial structure deviation decreased only 5.9 percentage points. Description of this period the asymmetric state between output structure and employment structure in Chongqing has not been significantly improved. However, second industry negative deviation is 33.4 in 2012, rise 11.7 compared with 1997, primary industry's deviation in 2012 changes 4.5 compared with 1997. explain that tertiary industry structure evolution performance lagged.

TABLE 1: the Deviation of industrial structure of Chongqing 1998-2012(unit:%)

Year	Primary industry	Secondary industry	Tertiary industry	Absolute value of the total
1997	36.6	−21.7	−14.9	73.3
1998	37.7	−22.5	−15.1	75.3
1999	38.9	−24.3	−14.7	77.8
2000	38.3	−25.1	−13.3	76.6
2001	37.8	−24.8	−13.0	75.6
2002	37.1	−25.2	−11.9	74.3
2003	36.7	−26.1	−10.6	73.4
2004	34.8	−26.7	−8.0	69.5
2005	35.9	−26.2	−9.7	71.8
2006	38.5	−28.7	−9.8	77.0
2007	36.2	−30.6	−5.6	72.4
2008	35.5	−32.2	−3.2	71.0
2009	34.7	−31.5	−3.2	69.4
2010	33.6	−32.5	−2.7	68.8
2011	32.8	−33.0	−2.5	68.3
2012	32.1	−33.4	−1.9	67.4

Source: Chongqing Statistical Yearbook (2013)

Comparing chongqing industrial structure with standard structure

Standard structure is the comprehensive description of the advancement evolution of the country's industrial structure. Through statistical analysis method, summarized statistics the characteristics of national advanced industrial structure samples. Based on this, integrated characterization of a number of high-class indicators, as this stage of the evolution of industrial structure and representation standards. Kuznets, Chenery and Sell Quinn summarized the theory as the Standard structure. In this paper, use standard structure as reference to measure the industrial structure in Chongqing[8]. Chongqing per capita GDP is 38,914 yuan in 2012, based on the dollar exchange rate,this value is close to 4000 dollar of the standard structure in table 2.

TABLE 2 : The model of Chenery and Sell Quinn

industry	Baseline levels of per capita GNP（dollars of 1998）					
	Less than 300	300	500	1000	2000	4000
Primary industry	46.2	30.6	30.4	26.7	21.9	18.6
Secondary industry	13.5	19.6	23.1	25.5	29	31.4
Tertiary industry	40.1	44.4	46.5	47.8	49.2	50

TABLE 3 Compare of Chongqing industrial structure and standard structure

	Primary industry	Secondary industry	Tertiary industry
Standard structure	18.6	31.4	50
Chongqing	8.6	55	36.4
Difference	-10	23.6	-13.6

From table 3, compare of Chongqing industrial structure and standard structure, the secondary industry is high, 23.6 percentage points higher than the standard structure, the tertiary industry 13.6 percentage points lower. Chongqing at the intermediate stage of industrial development as well as the evolution stage. According to the internal resource-intensive ,secondary industry can be further divided into light industry, heavy industry and construction.This paper analysis that the relationships of the evolution within the industry and railway freight, road freight and sea freight transport.

MODEL AND CALCULATION

Grey system relational model

Grey system relational analysis is essentially the analysis of relation coefficient. First calculated relation coefficient of indicators for each dependent variable and the independent variables related indicators. Obtained correlation by the correlation coefficient, press the Size of correlation to sort and analyze, then draw conclusions. This method is superior to the classical exact mathematical methods, transform the intent, opinions and demands to the conceptualization and modeling, described and treated with quantitative and mathematical.

According to transportation structure and secondary industry have closely relationship, use grey system relational model to analysis them, to seek the inherent law between transportation and industrial structure.

Calculation gray correlation coefficient and correlation

Relevance is essentially the difference of the curve geometry,treat the difference between the size of the reference sequence and comparison of the number of columns as the measure of the degree of association.

(1) the calculated of gray correlation coefficient

$$\xi_i(k) = \frac{\min\limits_{i}\min\limits_{k}\left|x_o(k)\right| + p\max\limits_{i}\max\limits_{k}\left|x_o(k)-x_i(k)\right|}{\left|x_o(k)-x_i(k)\right| + p\max\limits_{i}\max\limits_{k}\left|x_o(k)-x_i(k)\right|} \tag{1}$$

(p is fesolution factor, p=0.5)

(2) calculated of correlation

By calculation, the correlation coefficient reference sequence and comparison of the number of columns. There is a lot of the correlation coefficient, the relation coefficient for each moment of focus to a value called the correlation.

Here is the calculated of correlation.

$$r_i = \frac{1}{N}\sum\limits_{k-1}^{N}\xi_i(k) \tag{2}$$

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Establish reference series and compare series

Based on step of gray correlation analysis, firstly establish the reference number of columns and compare the number of columns, freight by rail, road freight and air freight were used as reference series. $\{C^*\} = \lfloor C_1^*, C_2^*,...C_n^* \rfloor$.Light industry, heavy industry and construction as compare few columns respectively. $\{C\} = \lfloor C_1^i, C_2^i,...C_n^i \rfloor$.

Normalized the data

Because of different indicators of various types of data,use equation (1) transform the reference number of columns and compare the number of columns dimensionless to the normalized data.As shown in table 4.

Grey correlation coefficient between reference sequence and comparison sequence

Based on the data in table 4, use equation (1) to calculated gray correlation coefficient by rail freight, road freight and sea freight for reference sequence, heavy industry, light industry and construction for omparison sequence. As shown in table 5.use equation (2) to calculate the correlation Chongqing passenger and cargo traffic and industrial structure. As shown in table 6

From table 6, the correlation of railway freight from big to small is construction, light industry,and heavy industry. The correlation of road freight from big to small is construction, light industry,and heavy industry. The correlation of sea freight from big to small is heavy industry, construction and light industry.

TABLE 4 :2003-2012 Chongqing above-scale industrial and construction value added and transportation processing standardization

Year	above-scale industrial value added	Light industry(million yuan)	Heavy industry(million yuan)	Building industry(million yuan)	Freight (million tonnes)	Railway freight	Road freight	Sea freight	Passenger volume (million people)	Railway passenger traffic	Highway passenger traffic	Air passenger traffic
2003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.05	0.00
2004	0.00	0.00	0.03	0.08	0.03	0.00	0.03	0.02	0.04	0.16	0.05	0.1
2005	0.02	0.05	0.01	0.17	0.11	0.15	0.08	0.07	0.00	0.33	0.00	0.09
2006	0.07	0.08	0.06	0.24	0.26	0.31	0.22	0.13	0.01	0.05	0.03	0.11
2007	0.15	0.09	0.16	0.36	0.65	0.43	0.68	0.28	0.15	0.38	0.16	0.23
2008	0.26	0.16	0.28	0.48	0.80	0.53	0.83	0.46	0.22	0.33	0.23	0.30
2009	0.45	0.27	0.49	0.53	1.00	0.80	1.00	0.69	0.33	0.47	0.34	0.49
2010	0.66	0.41	0.71	0.59	0.73	0.90	0.62	0.76	0.43	0.77	0.41	0.59
2011	0.94	0.66	1.00	0.77	0.97	1.00	0.88	1.00	0.51	0.87	0.49	0.64
2012	1.00	1.00	0.99	1.00	0.89	0.93	0.81	1.00	1.00	1.00	1.00	1.00

TABLE 5 2003-2012 Chongqing above-scale industrial and construction value added and the freight of rail, road freight and sea processing standardization

Year	Railway freight			Road freight			Sea freight		
	Light industy	Heavy industy	Buildig industy	Light industy	Heavy industy	Buildig industry	Light industy	Heavy industy	Buildig industry
2003	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2004	1.00	1.00	0.66	0.92	0.90	0.82	0.91	0.83	0.66
2005	0.73	0.49	0.89	0.92	0.80	0.72	0.91	0.63	0.53
2006	0.54	0.35	0.69	0.72	0.63	0.92	0.81	0.59	0.51
2007	0.44	0.33	0.69	0.38	0.35	0.42	0.53	0.45	0.59
2008	0.42	0.35	0.76	0.35	0.33	0.40	0.41	0.36	0.85
2009	0.33	0.30	0.36	0.33	0.35	0.33	0.33	0.33	0.42
2010	0.35	0.42	0.33	0.63	0.75	0.89	0.38	0.67	0.40
2011	0.44	1.00	0.40	0.62	0.70	0.68	0.38	1.00	0.33
2012	0.79	0.69	0.69	0.66	0.60	0.55	1.00	0.91	1.00

TABLE 6 2003-2012 Chongqing gray correlation of the second industry and railways, highways, waterways freight

correlation	Railway freight	Road freight	Sea freight
_Light industry	0.60	0.65	0.52
Heavy industry	0.59	0.64	0.68
Building industry	0.65	0.67	0.63

CONCLUSION

Chongqing freight has the maximum correlation with secondary industry. Road freight and railway freight have the maximum correlation with building industry in the same time. Sea freight has the maximum correlation with heavy industry.

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