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The Scale Benefit Analysis of Sugar Clusters in Resource-rich Area of Southwestern Guangxi

—A Case of Chongzuo City

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Abstract Based on the scope economic theory of "resource curse" and industrial clusters, the scale of sugar cluster is calculated by the output of sugarcane and sugar while the scale benefit of sugar cluster is measured by the productivity (rate of sugar production), sales output ratio, industrial output value as well as profit margin. Positive analysis of the scale merit of sugar clusters in resource-rich area of southwestern Guangxi is conducted according to related statistics of Chongzuo City. And the primary problems of sugar clusters are pointed out. The profit created by sugar for the sugar industry in Chongzuo City has already been near capacity. The sugar industry is big but not strong. With much governmental interference, there is no effective connections and inadequate competitive forces among subjects of the clusters. The extension of industrial chain is limited. Therefore, measures for developing sugar clusters in resource-rich area of southwestern Guangxi are proposed. Industrial structure is to be adjusted to improve the sugarcane cultivation techniques. The industrial chain should be extended to increase the economic benefits of sugar industry. Industrial support is to be strengthened and capital output for science and technology increased. Price regulation fund of grain sugar is to be established with coordination with the superior region. The transformation from savings to investment should be quickened to evade "resource curse".

Key words Resource-rich, Sugar clusters, Scale economy, Benefit, China

With the composition of so many opportunities, such as the new round West Development Strategy implemented in China, the coming operation of Guangxi Pingxiang Comprehensive Bonded Area and Sino-Vietnam Pingxiang—Tongdeng Transnational Economic Cooperation Region, Chongzuo City, situated in southwestern Guangxi, has growing featured advantages and has become the primary component of Beibu Gulf Economic Region which is a country-level economic region. Overland ASEAN Nanning—Chongzuo Economic Belt is a significant constituent of Nanxin Economic Corridor and will become the priori economic corridor undertaking the world economic transference as well as banded economic region space connecting the development of the pearl river delta and world factories, industrial belts and tourism belts of Vietnam in the two different eras. Depending on the coastal regional advantages and abundant natural resources, Chongzuo City was ranked into the list of major industrial production bases and was defined as resource-rich industrial base in the industrial developmental structure of being large, strong and excellent in Guangxi in 2010. Therefore, studying the scale benefits of industrial clusters in the border of resource-rich southwestern Guangxi has great significance in national defense, national reconciliation and thriving agriculture.

1 Scale economy of "resource curse" and industrial clusters

1.1 Conception of "resource curse" The proposition of "resource curse" which means resource-poor countries have manifestation in economic growth superior to that of resource-rich countries was proposed by economic scholars being represented by Auty, Sachs and Warner based on the comparison of economic indication of various countries^[1-2]. Larsen further explained the mechanism of "resource curse" in 2006. He claimed that natural resources crowd labor force, capital and technology out of machine building industry through crowd-out effect and attract labor force from machine building industry to extractive industry and resource processing industry through relatively high salaries in resources departments. Moreover, low output and low growth would be brought about with technology spillover much lower than tradable goods departments in machine building industry. Natural resources also transform substantial resource benefits into the added aggregate demand through expenditure effect to elevate the effective exchange rate and weaken the international competitive forces of the products of machine building industry^[3]. Besides, a closed vicious annular causal relationship among poverty, population growth and environmental deterioration often exists in resource-rich area and is called PPE (Poverty, Population, Environment) circle which is a theoretical model of explaining the poverty mechanism in underdeveloped areas^[4].

1.2 Connotation of industrial clusters in resource-rich area Curse can be effectively dispelled if clustering development can be achieved since industrial clusters can form industries with competitive advantages, drive regional economic development and improve national per capita income in that region.

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The so-called industrial cluster in resource-rich area refers to an ecological community where local residents, processing industries and other industries related to local resources established with the mining, processing and production of resources as the major industrial chain and resource production industries as the leading enterprises live closely together in region and space under the specific regional conditions of relatively abundant natural resources but underdeveloped economy and low per capita disposable income. As for China, the following reasons are significant in confining the development of industrial clusters in resource-rich area besides "resource curse" and PPE circle. Firstly, being far away from the market causes high costs in transportation and technology diffusion. Secondly, ecological environment is weak and pollution abatement ability is relatively poor. Thirdly, with the weak original economic foundation and shortage of capital as well as talents, the singular industrial structure and regional dual production system can be easily formed. Lastly, the exploitation of state-owned resources takes dominant position with low extent of local involvement. Local government takes GDP as the only guidance and emphasizes exploitation and utilization. Resource-intensive industries are marching forward and it is hard to find out an appropriate breakthrough point for the optimization of the whole industrial system as well as ecological protection^[5].

1.3 Study on scale economic theory of industrial clusters

Scale economy, also increasing returns to scale, which is a part of returns to scale means that the ratio of output growth surpasses that of input growth when the input is increasing^[6-7]. E. M. Hoover first introduced scale economy to the research of industrial cluster theory. And he classified the scale economy into three levels: firstly, economy determined by the scale of a single zone unit (factory, store and so on); secondly, economy determined by the scale of a single company (associated enterprises); thirdly, economy determined by the scale of an industrial aggregation within a certain zone which is understood as the colonization caused by the spatial aggregation of a large number of enterprises in pursuit of scale economy^[8]. Goodrich and Tecla point out that the industrial cluster refers to the geographical concentration of numerous middle and small-sized enterprises promoted by the performance and advantages created through the matching cooperation among each other^[9]. Krugman attributes the cause of scale economy benefit to the expansion of production scale led by regional concentration and professional production^[10]. Su Zengfu addresses that the economic scale is the primary source of the competitive force of an enterprise, industry or region and the economic scale is closely connected with the professional regional concentration. Once an industrial cluster is formed, the internal mechanism will be strengthened automatically and the cluster advantages would be more attractive to the external scale economy. And if the industrial cluster exists, enterprise benefits within the cluster will rise with the expansion of the industrial scale^[11]. Jia Wenyi also indicates that the industrial cluster promotes a growing number of enterprises mainly because of the scale benefit. The continuous development of current industries to the upstream and

downstream industry advances the unceasing expansion of market size^[12].

2 Positive scale benefit analysis of sugar clusters in Chongzuo City

2.1 Design of index system of the scale benefit Two specific indices are included in the measurement of the scale of sugar cluster, namely sugarcane output and sugar output which directly reflect the supply ability and production capacity of the sugar industry in Chongzuo City. The bigger the values of these indices are, the more possibility a cluster would be formed or the more space for developing the cluster scale.

The dynamic mechanism of the cluster lies in lessening production costs, achieving scale economy and obtaining the biggest benefits. And 4 indices are mainly used to measure the cluster size, namely productivity (rate of sugar production), sale output ratio, industrial output value and profit margin which mainly embody the scale of cluster benefit and comprehensively reflect the situation of cluster benefit. Productivity (rate of sugar production) is the ratio of input and output and mainly reflects the productive efficiency of the cluster. Sales output ratio chiefly embodies the marketability and benefit of the cluster since only products sold out can realize the appreciation of added value. A large amount of inventory suggests that the cluster development lacks sustainability, which would finally affect the enthusiasm for production of sugar industry. The output value is the total value achieved by a cluster and reflects the total scale benefit. Profit margin comprehensively reflects the economic benefit of a cluster and is the most significant index of developing the cluster and achieving total scale benefit.

2.2 Source of statistics This research studies the time from 2002 to 2007 and the statistics stem from the *Statistical Yearbook of Guangxi* from 2001 to 2008^[13] and the *Statistical Yearbook of Chongzuo City* from 2003 to 2008^[14] (Table 1, 2, Fig. 1). The 3 years from 2000 to 2002 was before the establishment of Chongzuo City and time from 2003 to 2007 was the 5th anniversary of the establishment of the city.

2.3 Result and analysis It is shown in Table 1 that the productivity of sugarcane and sugar in Chongzuo City from 2000 to 2007 was increasing and developing fastest especially during the 5 years after the establishment of the city with 2 indices nearly twice bigger than those before the establishment of the city. These 2 indices generally present a steady and fast growing trend and relatively speaking, the indices of the whole country in the corresponding period appear a relatively big fluctuation.

Since the productivity of sugar industry in Chongzuo City takes a relatively big percentage in that of Guangxi, it exactly equaled the average value of Guangxi and is generally 1 percent higher than that of the country. The highest productivity which appeared in 2004 was 12.6% and the lowest one which appeared in 2001 was 3.6%. Though the productivity of Chongzuo City presents a relatively big fluctuation, it has no great connection with the technology of sugar manufacturing and the main reason is that both the rate of sugar production and the share of sugar industry have great dependence on nat-

ural conditions as well as soil sustained fertility.

It can be inferred from Table 2 that the sales output ratio of sugar industry in Chongzuo City from 2002 to 2007 also presented certain fluctuation. The fluctuation of domestic demand on sugar was another significant factor causing the fluctuation of sales output ratio of Chongzuo City apart from being closely related to the natural conditions. Although there was certain fluctuation in the sugar industry of Chongzuo City, the sales output ratios were all over 90% except for the year 2004 and 2007. And especially in 2005, it kept a good sales track and the sales ratio reached over 99%.

Picture 1 suggests that the output value of the sugar industry in Chongzuo City from 2000 to 2006 presented a growing trend and especially between 2005 and 2006, the output value doubled due to the "30 billion" project implemented by the municipal government of Chongzuo City, while it slightly decreased in 2007. The output value of the sugar industry in Chongzuo City basically took up nearly 50% of the total industrial output value except for a relatively small proportion in 2007, which indicated that the sugar clusters in Chongzuo City played a significant role in the total industrial output value and had become the

first pillar industry in Chongzuo City.

Table 2 displays that during the 5 years since the establishment of Chongzuo City, the total profit of sugar industry was increasing apart from a slight decrease in 2007 due to the continuous drop in soil fertility and sugarcane aging caused by the bumper crop in 2006. Yet relatively speaking, profit margin presented obvious fluctuation and the highest profit margin appeared in 2006 was three times bigger than the lowest one appeared in 2003. Both the sugar productivity and sales output ratio were not low in 2003, while there were reasons for the low profit margin. Firstly, one of the significant causes was the impact of external unpredictable factors. As is known to all, there was the "SARS" epidemic situation throughout the country in 2003, which caused a great impact on food processing industry. Secondly, under the influence of the supply-demand relationship of sugar throughout the country and the world, the price fluctuation of sugar was the key reason of the decreasing profit margin. Sugar price ranged from 2 000 yuan/t to 5 000 yuan/t, and this was why the profit margin of 2006 was three times that of 2003 and the main reason of the profit margin fluctuation in sugar industry from 2002 to 2007.

Table 1 Output and productivity of sugarcane and sugar

Year	The Country			Guangxi			Chongzuo City		
	Sugarcane ×10 ⁴ t	Sugar ×10 ⁴ t	Productivity//%	Sugarcane ×10 ⁴ t	Sugar ×10 ⁴ t	Productivity//%	Sugarcane ×10 ⁴ t	Sugar ×10 ⁴ t	Productivity//%
2000	6 828	700	10.3	2 799	276.00	9.9	592	71.62	12.1
2001	7 566	653	8.6	3 491	456.00	13.1	754	66.54	8.8
2002	9 011	926	10.3	5 359	564.00	10.5	1 087	120.27	11.1
2003	9 024	1 084	12.0	4 673	587.60	12.6	1 147	140.45	12.2
2004	8 985	1 034	11.5	4 817	531.00	11.0	1 217	152.69	12.6
2005	9 452	912	9.6	4 959	537.69	10.8	1 407	141.07	10.0
2006	10 010	949	9.5	5 925	566.02	9.6	1 713	188.44	11.0
2007	11 458	1 271	11.1	7 034	771.16	11.0	1 954	200.85	10.3

Table 2 Sales output ratio, profit and profit margin of sugar production industry in Chongzuo City from 2002 to 2007

Year	Total output value ×10 ⁴ yuan	Sales output value ×10 ⁴ yuan	Sales output ratio//%	Profit ×10 ⁴ yuan	Profit margin %
2002	282 580	263 627	93.292 87	35 256	13
2003	297 071	276 626	93.117 81	24 950	9
2004	350 635	303 815	86.647 08	52 902	17
2005	438 238	434 443	99.134 03	97 161	21
2006	792 315	761 173	96.069 49	213 360	27
2007	757 855	621 258	81.975 84	107 810	16

3 Primary problems of sugar clusters in resource-rich area of Southwestern Guangxi

3.1 Sugar profit has already been near capacity With the growing sugar output in Chongzuo City, the sales output ratio of sugar was declining from 2005 to 2007 and began to drop sharply after reaching the peak in 2006, which indicated that the sugar market has already been saturated or near capacity and there would not be great improvement in sales volume as well as the profit. Although the output was greatly decreased in the grinding seasons in 2008 and 2009, with the influence of global financial crisis and continued macro-economic slowdown, the price increase of sugar caused by the decreased crop throughout the world was fairly limited and the future development is unpromising. It can be seen that the scale of sugar industry in Chongzuo City has already been near the re-

source limitation. Due to the law of diminishing returns of marginal economy, there is quite limited potential in pursuing scale benefits depending on indiscriminately expanding the scale while excavating scale benefits from the current scale is fairly promising. After future analysis, the writer found that sugar output in Chongzuo City should be kept within the reasonable level of 1.5 million to 1.8 million. Beyond this level, the industrial chain of sugar industry should be extended with further industry and finish machining or other products with sugarcane as the raw material in order to form an energetic sugar cluster with a large variety, which will achieve the scope economy and enlarge the profit margin of the sugar industry.

3.2 Large but weak industry Sugar clusters in Chongzuo City has formed enough scale, yet the division of labor in the leading industry is not complete and perfect with the lack of

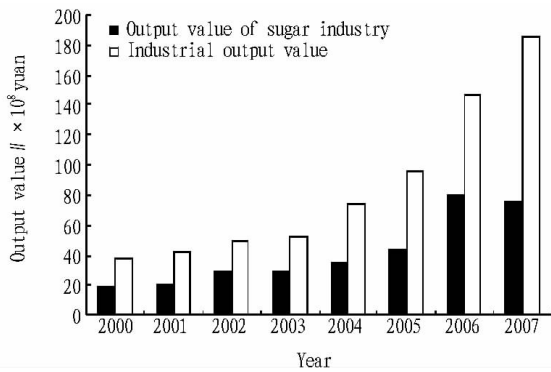


Fig. 1 Output value and total industrial value of sugar production industry in Chongzuo City from 2000 to 2007

high-end products and weak awareness of industrial outsourcing. The phenomenon of "big and complete, small and complement" still exists and overall "puffiness" is quite obvious. The scale of sugar industry mostly remains on the "assembling" of sugar manufacturing industry and the superposition of amount. And the scale economic benefit of competition caused by professional division and production does not appear.

3.3 Much governmental interference with the lack of effective connection and inadequate competitive forces among the cluster subjects There is inadequate interaction and communication between farmers and sugar manufacturing industries. And there are great homogeneity, small technical gap, weak complementarity and few cooperation opportunities of horizontal technology among enterprises without the motive power of knowledge spillover. The joint conference established under the governmental guidance smothered the necessary competition among each subject of the cluster and restraint the creative market mechanism. Sugar manufacturing industry, as the subject of innovation, has inadequate intention of innovation, thus it would be meaningless to talk about "innovation network", which causes a fall in the overall technical level.

3.4 Limited extension of the industrial chain Although the sugar industry of Chongzuo City has been in the top standard in our country, compared with other countries, problems of small scale, scattered sugarcane production, low extent of mechanization in sugarcane harvest, high production costs, inferior sugar variety, backward production technique and high costs of sugar manufacture in the sugar clusters of Chongzuo City have not been settled yet. There is leading enterprises but no body industries in the industrial chain. The impact has not been radiated out, causing the phenomenon of "short circuit" and resources of large amount of cane leaves, sugarcane bagasse, molasses and filter press mud have not been fully used. At present, the further processing and comprehensive utilization mainly include yeast, instant refined sugar, bagasse paper, compound fertilizer and so on. The output value takes up less than 10% of that of the sugar industry and the total industrial economic benefit is fairly low. There is big room for improvement compared with Guangxi Guitang (Group) Company Limited whose annual income of the comprehensive utilization of byproducts has already taken up more than 65% of the total business. Socialized service system like the government, colleges and universities, scientific researches, the market and in-

formation is not complete and perfect and support of related industries is far from being qualified for the scale development.

4 Developmental measures of sugar clusters in resource-rich area of Southwestern Guangxi

4.1 Adjusting the structure and improving sugar production technology Scientific production should be emphasized to improve the scientific level of sugar production. Each county (city, district) should build steady sugar production bases with high production, excellent quality and high efficiency with the wide utilization of 6 major advanced and practical techniques namely wide-row planting, plastic mulching, mechanical deep cultivating and softening technology, intellectualized construction, integrated pests management and chemical herbicide. Science and technology should be advanced to improve per unit yield and sugar content, reduce the costs of sugar production and enhance the benefit as well as competitive force of sugar production.

4.2 Extending the industrial chain and improving economic benefit of the sugar industry The 7 major circulating system of sugarcane field, sugar manufacturing, alcohol, paper making, monosodium glutamate, heat and power cogeneration as well as comprehensive environmental management. Moreover, 6 ecological chains are to be established, namely sugarcane—sugar manufacturing—making alcohol with waste molasses—making compound fertilizer with waste alcohol, sugar manufacturing—making alcohol with waste molasses—making compound fertilizer with waste alcohol, sugarcane—sugar manufacturing—making paper and fiberboard with sugarcane bagasse, sugarcane—sugar manufacturing—oligofructose and refined sugar, sugarcane—sugar manufacturing—biological fertilizer and sugarcane shoot—feedstuff.

4.3 Strengthening the industrial support and capital investment of science and technology Keystone industries are to be developed with the cooperation with major famous universities throughout the country to explore new technology and new products of the sugar industry, emphasize the production of sugarcane with high production and high sugar content and make great efforts on the comprehensive utilization in the sugar industry^[15]. Industrial management of the sugar industry is to be achieved with the methods of "sugar refinery + base + peasant", "sugar refinery + enterprise + peasant", "sugar refinery + specialized household" and farmer pooling.

4.4 Coordinating with the superior area and establishing the regulated fund of sugar price There is fluctuation in sugar price in both China and other countries and especially in recent years, the sugar price in China is rocketing and plumping with the highest of over 5 000 yuan/t and the lowest of only 2 000 yuan/t. The rocketing and plumping price is greatly detrimental to the development of sugar industry. It is suggested that the capital can be raised by the joint effort of sugar manufacturing enterprises, sugarcane farmers and the government to establish the regulated fund of sugar price which is used to perfect regional sugar provident system, regulate sugar price, avoid the cut-throat competition caused by mark-down sale of sugar refineries at the beginning of milling seasons and

keep the stability of sugar price^[16].

4.5 Quickening the transformation from savings to investment and evade "resource curse" High saving ratio is the primary economic condition for evading "resource curse". Obsession of "resource curse" and PPE circle can be ridded with relatively high saving ratio and especially the increase of saving ratio beyond resource benefit has great significance in evading "resource curse". Another key factor that can not be neglected is that the high-efficient transformation from saving to investment or transformation from resource benefit to production-oriented investment is the primary means of evading curse and achieving economic growth. The growing impact of human capital and continued ability of technical innovation are crucial obstacles in controlling "resource curse". Educational system in resource-rich area should be promoted to introduce resources into education and scientific research and establish excellent scientific research center. Besides, experts and scholars should be encouraged to conduct overseas mission and the cluster brand will be more stable once the education and research development investment and infrastructure are completed^[17].

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Henan should pay attention to optimization of structure and elevation of competitiveness in order to quicken the process of industrialization; focus on balanced development of regions so as to promote urbanization; focus on comprehensive rural reform so as to promote the agricultural modernization; focus on reform of resources price in order to promote social development; emphasize the guarantee of people's livelihood and construction of harmonious central plains of China in order to promote the government management system reform comprehensively and reform of social undertaking, and promote Henan's economy successfully to be at the stage of rise in the new economic cycle.

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