

Study on the Mechanism and Path of Synergistic Development of Manufacturing and Service Industries in the Greater Bay Area of Guangdong, Hong Kong and Macao

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Abstract: The paper explores the level of synergistic agglomeration of the advanced manufacturing industry and logistics service industry in the Greater Bay Area from 2015 to 2018 through the spatial Gini coefficient and industrial agglomeration index. The results of the study show that the level of agglomeration and specialization of individual industries in some manufacturing industries in the Greater Bay Area is relatively high, and individual industries in the logistics industry have formed a certain scale of agglomeration, but there is still a certain gap compared with the manufacturing industry, and the level of agglomeration needs to be improved. Finally, it puts forward suggestions to promote the development of a synergistic agglomeration of the advanced manufacturing industry and logistics industry in the Greater Bay Area.

Keywords: Manufacturing, Services, Logistics Industrial Agglomeration, Industrial Synergy.

1. Introduction

The Outline of the Plan for the Development of the Guangdong-Hong Kong-Macao Greater Bay Area pointed out the need to build a modern and internationally competitive industrial system. Under the new development pattern, revealing the synergistic agglomeration of the service industry and the advanced manufacturing industry is an inevitable requirement to enhance the international competitiveness and added value of the manufacturing industry. Under the new development pattern, revealing the inherent law of synergistic agglomeration between logistics industry and advanced manufacturing industry is an inevitable requirement to enhance the international competitiveness and added value of the manufacturing industry, promote the synergistic and sustainable development of the secondary and tertiary industries, promote the optimization and upgrading of industrial structures, and enhance the competitiveness of regional industries.

Regarding the theory of synergistic industrial agglomeration, the neoclassical school of economics put forward the theory of industrial locality. The concept of "growth poles" and the theory of "cumulative circular causality" have been proposed by the school of industrial organization theory and the school of development economics theory, respectively. Davies and Lyons proposed to use the HHI index to measure the distribution of regional industrial organization[1]; Krugman used the Gini coefficient of location to measure the level of manufacturing industry agglomeration in the United States[2]; Ma et al. researched the conditions and scope of the formation and evolution of the logistics and manufacturing industries agglomeration through the endogenization of logistics costs[3]; Zhang and Wu studied the impact of manufacturing and logistics industries on the expansion of residents' consumption based on the spatial Durbin model[4]; Li and Wei measured the level of

collaborative agglomeration of manufacturing and logistics industries in Xinjiang, and analyzed the impact of industrial synergy in different cities and towns. Based on the spatial Durbin model, Zhang Hong and Wu studied the impact of manufacturing and logistics industries on the expansion of residents' consumption [4]; Li and Wei measured the level of collaborative agglomeration of the manufacturing industry and the logistics industry in Xinjiang and analyzed the level of collaborative industry agglomeration in different cities and municipalities, as well as the reasons for the inter-area differences[5]; Yan analyzed the spatial distribution and spatial correlation of the aggregation of the logistics industry and the manufacturing industry in the 31 provinces of China and studied the impacts of the Marshallian triad on the agglomeration of these two industries[6]. Song takes 284 cities in China as the research object and empirically analyzes the impact of logistics and manufacturing industries' agglomeration on the total factor productivity of the manufacturing industry[7]. Sang examined the spatial spillover effect of the integration of the distribution industry and manufacturing industry and verified the promotion effect of the integration of the two industries on the industry and regional economy [8].

Existing studies are mostly carried out from the perspectives of economics, management, and other perspectives, which basically form the research methodology system of industrial synergistic agglomeration, which provides useful theoretical and methodological guidance for this paper, but it lacks specific quantitative research on the synergistic agglomeration of advanced manufacturing industry and service industry. Therefore, this paper combines the regional factor endowment and the existing foundation of advanced manufacturing industry, explores the intrinsic mechanism and spatio-temporal evolution process of advanced manufacturing industry and logistics service industry agglomeration in the Greater Bay Area, and selects the industrial agglomeration index to calculate the level of the

development of the two industries' synergistic agglomeration and examine the impact of the synergistic agglomeration of the two industries on the upgrading of the manufacturing industry, so as to provide decision-making references for the promotion of the synergistic development of the industry and the optimization of industry between regions.

2. Industry Definition and Data Sources

The advanced manufacturing industry is a manufacturing industry that adopts advanced information technology and digital technology, integrates high-precision technology with advanced manufacturing modes and management concepts, and is characterized by high value-added, low pollution, and strong competitiveness. According to the manufacturing industries involved in the 2017 National Economic Industry Classification (GB/T 4754-2017) and China High-Tech Industry Statistical Yearbook, this paper selects the pharmaceutical manufacturing industry, metal products industry, general equipment manufacturing industry, special equipment manufacturing industry, automobile manufacturing industry, railroad, shipbuilding, aerospace, and other transportation equipment manufacturing industry, computer communication and other electronic equipment manufacturing industry, electrical machinery and equipment manufacturing industry, instrumentation manufacturing industry, and the manufacturing industry. This paper selects 9 industries as advanced manufacturing industries, including pharmaceutical manufacturing industry, metal products manufacturing industry, general equipment manufacturing industry, special equipment manufacturing industry, automobile manufacturing industry, railway, shipbuilding, aerospace and other transportation equipment manufacturing industry, computer communication and other electronic equipment manufacturing industry, electrical machinery and equipment manufacturing industry, instrument manufacturing industry, and transportation, warehousing, and postal industry as logistics industry representatives.

The data for the measurements in this paper come from the Guangdong Statistical Yearbook, the Guangdong Statistical Bulletin, the China Statistical Yearbook, and the Guangdong Bureau of Statistics.

3. Analysis of the Intrinsic Mechanism of Synergistic Agglomeration in The Manufacturing and Service Industries

The formation of industrial synergistic agglomeration originates from the industrial integration formed by the deepening of the division of labor among different industries, and industrial integration provides a realistic basis for industrial synergistic agglomeration. On this basis, the specialized division of labor has led to the separation of logistics, design, and other services from the manufacturing industry. Against the background of the new normal economic development, China's industrial upgrading does not simply take the form of layout optimization and structural adjustment, but rather the interactive integration and agglomeration and penetration between industries. In particular, the agglomeration and synergy between manufacturing and

service industries is an important way to promote industrial innovation and development. Whether or not industrial synergy can be formed within a certain region is also one of the important criteria for judging the productivity improvement of a city.

4. Indicator Selection and Measurement of Agglomeration Levels

Commonly used measurement methods and indicators of industrial agglomeration include measuring industry concentration, Location entropy, H-index, spatial Gini coefficient, and so on. Considering the availability of data, this paper selects the spatial Gini coefficient and location entropy as the indicators for measuring the concentration of logistics and manufacturing industries. First, the spatial Gini coefficient is used to measure the overall degree of industrial concentration in Foshan City, and the closer the spatial Gini coefficient value is to 0, the more balanced the distribution of industries is in the region, and the closer it is to 1, the higher the degree of concentration of industries is. The location entropy index is used to measure the relative degree of concentration of an industry in the spatial distribution of a specific region, and the formula is: (a) the location entropy index is calculated as follows:

$$LQ_{ij} = \frac{Q_{ij}/Q_j}{Q_i/Q_t} \quad (1)$$

LQ_{ij} is the locational entropy of industry i in area j of GBA; Q_{ij} is the number of employees or GDP of industry i in area j ; and Q_j is the number of employees or GDP of all industries in area j ; Q_i is the number of employees or GDP of industry i in the whole country; and Q_t is the number of employees or GDP of all industries in the whole country. The larger the value of location entropy, the more obvious the advantage of industry i in region j in the whole country, the relative concentration of the industry, and the higher degree of specialization. If $LQ_{ij} > 1$, it means that industry i is relatively concentrated in region j , with an obvious tendency toward agglomeration and a high degree of specialization; on the contrary, if $LQ_{ij} < 1$, it means that industry i does not have an obvious tendency toward agglomeration and a low degree of specialization in region j . The spatial Gini coefficient is used to measure the number of employees/GDP of all industries in the country.

The spatial Gini coefficient is used to measure the degree of regional agglomeration of industries, and the formula is:

$$G = \sum_{i=1}^N (S_i - X_i)^2 \quad (2)$$

where G is the spatial Gini coefficient, S_i is the ratio of the number of employees in industry i in a certain region to the number of employees in that industry in the whole country, and X_i is the ratio of employees in a certain region to the number of employees in the whole country. The larger the value of $G \in (0, 1)$, the higher the degree of regional concentration of industry i in the region; on the contrary, the lower the degree of regional concentration of the industry.

Table 1. Average value of advanced agglomeration index in GBA (2015 – 2018)

Serial number	Manufacturing Industry	Location Entropy	Spatial Gini Coefficient
1	Pharmaceutical Manufacturing	0.809	0.000001
2	Metal Products Industry	6.819	0.001393
3	General Equipment Manufacturing	2.879	0.000145
4	Specialty Equipment Manufacturing	2.688	0.000118
5	Automobile Manufacturing	1.808	0.000026
6	Railroad, Shipbuilding, Aerospace and Other Transportation Equipment Manufacturing Industry	0.992	0.000001
7	Electrical Machinery and Equipment Manufacturing	10.098	0.003352
8	Computer, Communications and Other Electronic Equipment Manufacturing	1.523	0.000015
9	Instrumentation Manufacturing	3.566	0.000268
10	Transportation Industry	1.3431	0.000001
11	Loading and Unloading Handling and Warehousing Industry	1.3806	0.000001
12	Mail Business Industry	1.6033	0.00003

Overall, during 2015-2018, the industries with a location entropy of manufacturing in the Greater Bay Area greater than 1 include electrical machinery and equipment manufacturing, metal products, instrument and meter manufacturing, general equipment manufacturing, special equipment manufacturing, automobile manufacturing, and computer, communication, and other electronic equipment manufacturing (Table 1), indicating that the manufacturing industry in the Greater Bay Area is relatively developed and that part of the advanced manufacturing industry has formed a considerable scale of agglomeration and the level of agglomeration and specialization is among the highest in the country. This shows that the manufacturing industry in the Greater Bay Area is relatively developed, and some advanced manufacturing industries have formed a considerable scale of agglomeration, and the level of agglomeration and specialization is among the highest in the country. The location entropy of the service industry is not obvious compared with that of the manufacturing industry. Although the location entropy is greater than 1, there is still a certain gap between the concentration level and that of the manufacturing industry (Table 1), indicating that the concentration level of the service industry in the Greater Bay Area is not high and the degree of specialization is not dominant.

5. Suggestions for Promoting Synergistic Clustering Development of Manufacturing and Logistics Industries in the Greater Bay Area

Formulate effective policies for synergistic industrial agglomerations based on the stage of development of regional industries and the factors affecting them. When formulating policies on industrial synergistic clustering, it is necessary to take into account all kinds of factors affecting industrial clustering according to the stages of development of different industries, follow the objective law of industrial development, and formulate policies on synergistic clustering in line with actual needs and industrial development planning.

Expanding domestic and foreign markets and embedding

them into global and domestic dual value chains. After the first stage of industrial division of labor, the advantage of economies of scale further reduces the cost of production link, and the manufacturing industry in the Greater Bay Area has been able to form a relatively complete supporting industry system around core enterprises in the cluster area at this stage of development. The scale of industrial clusters tends to stabilize, and there is an urgent need to improve the overall profitability of the industrial chain by embedding itself in the global value chain and the high level of the domestic value chain.

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References

- [1] Davies S, Lyons B. Industrial Organization in the European Union[M]. Oxford: Clarendon Press, 1996.^[1]
- [2] Krugman P R. Geography and Trade[M]. Cambridge. USA: MIT Press, 1991.^[1]
- [3] Ma Hongsheng, Zhao Fang, Yan Yusong. Research on the formation and evolution conditions of synergistic agglomeration of manufacturing industry and logistics industry[J]. Highway Transportation Science and Technology, 2022, 39(06): 169 -176.
- [4] Zhang Hong, Wu Shunli. The impact of synergistic agglomeration of logistics and manufacturing industries on the expansion of residents' consumption--an empirical analysis based on the dynamic spatial Durbin model[J]. Consumption Economy, 2022, 38(02):41 -56.

- [5] Li Guilong, Wei Hengshu. Measurement and analysis of synergistic agglomeration level of logistics and manufacturing industries in Xinjiang[J]. Science and Industry, 2021, 21 (12):102 -106.
- [6] YAN Fei.Spatial correlation and influencing factors of synergistic agglomeration of logistics industry and manufacturing industry[J]. Statistics and Decision Making, 2021, 37(07):113 -117.
- [7] Song Glimmerjun. Study on the impact of synergistic agglomeration of logistics industry and manufacturing industry on manufacturing industry's total factor productivity [D]. Hangzhou: Zhejiang Gongshang University, 2020.
- [8] Sang Jiajia. Analysis of the spatial spillover effect of the deep integration level of modern circulation industry and advanced manufacturing industry[J]. Business and Economic Research, 2022(12):173 -176.