Review and Prospect of Logistics Research Based on Input-Output Analysis

Aimin Deng, Yunfeng Li

Abstract— **Based on the brief analysis of the research background and input-output analysis of the logistics industry, this paper analyzes the domestic and foreign papers on the input-output analysis of the logistics industry. Logistics industry, logistics industry input-output analysis and logistics industry input-output analysis of the efficiency of the research status and progress are respectively compared. Then the situation of the domestic logistics industry input-output analysis are reviewed. Finally, as for the existing problems in the study, this paper makes a concise summary and forms some ideas for the future research directions.**

*Index Terms—***logistics industry; input-output analysis;review**

I. INTRODUCTION

In recent years, with the further development of China's reform and opening up, China's economic development pattern is undergoing major changes. For China's economic development, the logistics industry has gradually become a pillar industry and new economic growth point. In the "Eleventh Five-Year Plan", "to vigorously develop the modern logistics industry" was listed separately for the first time, marking the logistics industry in China entered a critical period of transition, modern logistics will become an important part of China's emerging service industry. As a result, the requirements for a multidisciplinary study of the related research and development of the logistics industry have become increasingly strong, but what is the relationship between logistics industry and economic growth in China? What kind of role does logistics industry play in China's national economy？Whether the logistics industry as a leading industry development is feasible and so on a series of issues still need further study. At present, there are many macro studies on the logistics industry at home and abroad, but most of them are qualitative analysis. Therefore, in order to understand the industrial characteristics of the logistics industry, the contribution to the national economy and the impact on other industries, how to use mathematical methods for quantitative calculation, and to analyze the input and output of the logistics industry from the perspective of industrial economy has become an urgent problem to be solved. However, due to the lack of relatively accurate data on the development of the logistics industry, the statistical

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department has brought a lot of inconvenience to the management and decision analysis of the logistics industry. Therefore, some other scientific methods need to be used to analyze the development of the logistics industry.

Input-output analysis method is an important method to study the logistics industry, so it is applied to the logistics industry research quite a lot. Input-output analysis is a kind of economic quantity analysis method. It refers to the theoretical system which reveals the interdependence quantity of each department of economic system from the point of view of production technology. First of all, the logistics industry is a multi-sectoral, cross-industry complex industry, the national logistics industry statistics published by the National Development and Reform Commission and the input and output table published by the National Bureau of Statistics provide an important clue for us to explore the logistics industry statistical caliber; Secondly, the input-output table establishes the input-output link among the various industries of the national economy, and provides an important basis for judging the role of the logistics industry in the operation of the national economy. Again, from the two aspects of industrial supply and market demand, input-output table can be used to analyze the status and problems of logistics industry development; Finally, the input-output analysis method can make suggestions on the development of the logistics industry from the macroscopic and industrial levels. Therefore, this article will review the relevant literature at home and abroad.

II. LITERATURE REVIEW

A. *Review and Comment on the Research on Logistics Industry*

（1）Summary of relevant literature at home and abroad

For the logistics industry research, Britain, the United States and Japan and other developed countries mainly focus on the micro-logistics enterprise level research, such as how to provide the overall logistics to optimize the strategy for the logistics enterprises, etc., the macro level of research is relatively small .On the contrary, the domestic research on the logistics industry mainly focused on the macro aspects of the study, such as the definition of the logistics industry, logistics and economic growth and the relationship between logistics and industrial structure and so on.

①Definition of logistics industry

Wang Zhitai (2005) [1] defines the logistics industry as a cluster of logistics services and logistics-related industries in its "Newly Modern Logistics", which he believes is not only engaged in logistics activities, but also requires enterprise

Organization and management structure. Wan Yunhong et al. (2005) [2] introduced the nature of the logistics and the contents covered by it in the "Logistics Industry Discrimination", and proposed that the logistics industry is a comprehensive service industry integrating logistics service and equipment production. Xu Shoubo put forward the theory of large logistics, and put forward, from the physical form, the whole social economy is composed of production, logistics and consumption of the three pillar industries. Wang Zuo proposed logistics enterprises can be defined as: the integration of such enterprises which provides logistics management services specifically for the market is the logistics industry.

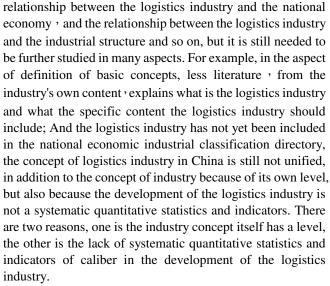②The relationship between the logistics industry and economic growth

In China, the logistics industry is a new classification of the industry, therefore, for the role that logistics industry plays in economic development，various economic schools have discussed, but in-depth study is still relatively small. Liu Xiaofeng [3] analyzes the role of the logistics industry in promoting the economic development from the microscopic, mesoscopic and macroscopic levels. Through the use of co-integration and Granger causality test and other methods, Bu Xiangzhi et al [4] analyzed the relationship between China's logistics industry development and economic growth. Si Linsheng [5] (2007) used the econometric modeling method to establish the model of China's logistics industry and economic growth, and obtained the quantitative relationship between China's logistics industry and national economic growth. From the perspective of industrial economics, Ling Youcheng et al [6] (2004) discussed the status and development of China's logistics industry, and believe that the logistics industry will have a positive impact on economic development. Li Li [7] (2006) used the VAR model to establish the empirical relationship among the logistics industry, the national economy and the energy price in China from 1996 to 2005.

③The relationship between logistics and industrial structure

Liu Yuguo et al. [8] (2003) pointed out that there is a relationship between the logistics industry and the industrial structure: by increasing the proportion of the tertiary industry in the national economy, the development of the logistics industry can achieve the role of industrial structure optimization; at the same time, the optimization of industrial structure can also bring more development opportunities for the logistics industry. He Xiaozhou et al. [9] (2007) studied the role of the development of logistics industry in Chongqing for its industrial structure optimization, and believed that the logistics industry in Chongqing played a role in promoting regional comprehensive economic strength；on the basis of this, it is proved that the relationship between regional logistics and regional economy is interdependent and promoted, and then the importance of logistics industry development to regional economic development is explained.

（2）Research review

The above research on the logistics industry mainly was focused on the connotation of the logistics industry, the

relationship between the logistics industry and the national economy，and the relationship between the logistics industry and the industrial structure and so on, but it is still needed to be further studied in many aspects. For example, in the aspect of definition of basic concepts, less literature，from the industry's own content，explains what is the logistics industry and what the specific content the logistics industry should include; And the logistics industry has not yet been included in the national economic industrial classification directory, the concept of logistics industry in China is still not unified, in addition to the concept of industry because of its own level, but also because the development of the logistics industry is not a systematic quantitative statistics and indicators. There are two reasons, one is the industry concept itself has a level, the other is the lack of systematic quantitative statistics and indicators of caliber in the development of the logistics industry.

In the research on the relationship between logistics industry and economic growth, most of them use econometric modeling to conclude the relationship between logistics and economic growth. There is no evaluation of the current performance of logistics industry in China, which makes the policy proposal often lack of relevance.

In the aspect of logistics industry and industrial structure optimization, the research results are mainly reflected in the fact that modern logistics industry itself is the product of industrial structure optimization. By improving the proportion of tertiary industry and promoting the development of secondary industry, it can achieve the optimization of industrial structure purpose; at the same time, the optimization of industrial structure can provide the opportunity for the development of modern logistics industry, but the specific industry positioning and its basis the in the national economy in is urgently needed to further clarify.

B. Review and comment on the input-output analysis in the logistics industry

（1）Summary of relevant research abroad

As an important tool for economic system analysis, input-output analysis technology is also being used in the development of the logistics industry analysis: Albinoa et al. [10] proposed regional and global logistics input-output models and made further studies. Seung-Jun Kwak [11] (2005) used input-output analysis to explore the impact of the maritime logistics industry in the national economy. He also analyzed the linkage effects of several industries, the induction of production, the employment induction effect and the impact of supply shortages and so on. Fukuishi [12] conducted an input-output analysis of Thailand's transport logistics industry. There are relatively few literatures on the use of input-output analysis and logistics industry in China. Many domestic scholars apply the input-output method to the tourism industry, real estate industry, wholesale and retail trade and finance and insurance industries, and analyze the impact of specific industries on industrial structure and the relationship among industry sectors.

（2）Summary of domestic research

The domestic input and output analysis of the logistics industry, was first seen in 2001, published by Li Guanlin [13]

in the "China Circulation Economy", through the use of input-output analysis of the ideological method or model, from the industry point of view, he analyzed the development level of China's logistics industry, its status in the national economy and so on. Then, from the perspective of purely transportation and freight industry, Zhong Shan and others wrote "the input and output analysis of the bottleneck problem of transportation and freight industry". They analyzed the present situation of various departments of transportation and freight industry and the relationship between them and national economy, and accordingly put forward the policy recommendations for the transport and freight industry. Based on the analysis method proposed by Li Guanlin, Ruan Jun et al. [14] of Fuzhou University has made input-output analysis of Fujian's modern logistics industry. By integrating the input and output tables of 122 departments in Fujian Province in 2002, the input-output table of four departments was independently set up to calculate the direct consumption coefficient of each department, the Leontief inverse, forward and backward correlation index, Influence and induction coefficient, production induced coefficient, he also analyzed the relationship between the logistics industry in Fujian and other industries, and put forward policy recommendations. Li Jiangfan (2001) applied the input-output theory to the tourism industry, and analyzed the industrial correlation degree and industry influence of the tourism industry in Guangdong Province. From the perspective of industrial association, Shao Yang et al. used the input-output analysis method to analyze the logistics industry in China, and pointed out the basis, bottleneck and the characteristics of the leading industry in China's logistics industry.

Through the use of input-output method, Huang Fuhua, Gu Hanfang (2005) [15] analyzed the industrial structure relationship and its related effect of China's modern logistics industry in the national economy. Feng Yun (2006) [16] used input-output method to analyze the relationship between logistics industry and various industrial sectors and its status and role in the national economy, and believed that China's logistics industry has made great contribution to the development of China's economy. Chu Yanfeng et al. [17] (2007) learned that China's logistics industry is in the transition from intermediate product base industry to complete intermediate product industry. Therefore, certain industrial policy support can promote the development of logistics industry. Zhang Jianghua et al. [18] (2010) argued that the industrialization of China's logistics industry has achieved initial results, it could significantly promote the industry, service industry and other industries, but there are still some problems, such as the degree of information is not high, life consumption is not enough to provide services and so on. In addition, some scholars have applied the input-output method to study the economic effects of regional logistics industry, such as Li Jinghui et al. (2005) [19], Cao Ying (2007) [20], Zhu Zhanfeng (2008) [21] Dan et al. (2010) [22]. Through the use of input-output method, they studied the industrial association of regional logistics industry in Guangdong, Fujian, Gansu and Central Plains respectively. The conclusion of the study was basically the same, that is, the influence of regional logistics industry was higher than that of induction, and there was unbalanced development in regional logistics.

(3) Research review

By summarizing the literature, the research on the input and output of the logistics industry at home and abroad can be summarized as follows.

①Foreign research is more limited to a department or a project, domestic research more confined to a province or only concentrated in the input or output of a certain aspect, there is no comprehensive consideration of input and output.

②The research method is mainly based on qualitative analysis. A small amount of quantitative analysis is only at the level of statistical data, which needs further analysis and excavation.

At the same time, it is worth noting that most of the relevant literature is only based on an annual input-output table analysis in the framework of input-output analysis, in this way, it cannot accurately grasp the development law of a dynamic industry, and research tends to macro, there is no horizontal comparison of the subdivision area; and there is no empirical test of the proposed conclusion. In view of this, the future research direction can be committed to regarding the input and output table as the object, the whole economy is divided into four parts (agriculture, industry, service industry, logistics), so that there could be more in-depth and meticulous comparison between the logistics industry and three industries; In addition, through the use of input and output analysis of the nine indicators (the initial input structure coefficient, the middle of the input structure coefficient, the intermediate input rate, the use of structural factors, the middle of the demand, direct and complete consumption coefficient, influence coefficient, sensitivity coefficient), from the perspective of industrial correlation and industry impact, we can carry out all-round quantitative analysis and evaluation of China's logistics industry and so on.

C. Summary of the literature on the input-output efficiency of the logistics industry

In recent years, the input and output efficiency of the logistics industry has aroused the concern of many scholars at home and abroad. Through the input-output situation of China's logistics industry, it is clear that China's investment in the industry continues to increase and its output is gradually rich. However, whether the input of the logistics resources is fully utilized, whether the existing logistics industry has achieved maximum output and so on are the focus of government and logistics industry workers. Therefore, it is necessary to evaluate the efficiency of its input and output.

Based on the theory of economics and operational theory, the relevant scholars at home and abroad have established the efficiency measure model and method, which can be divided into frontier analysis method and non-front analysis method. The frontier analysis method can be further divided into parametric analysis method and nonparametric analysis method. The parameter analysis method determines the production frontier by estimating the parameters of the

production function and measures the technical efficiency. The commonly used parametric analysis method is the random frontier method (SFA). The nonparametric analysis method uses the linear programming method to determine the production frontier and determine the technical efficiency. A typical representation of the nonparametric analysis method is the Data Envelopment Analysis Method (DEA).

（1）Literature review of efficiency evaluation

From the literatures that have been collected, domestic scholars such as Liu Jian et al. [23] used DEA model to analyze the logistics input and output efficiency of 31 provinces, municipalities and autonomous regions in 2008. Wu Jinzhuo [24] applied data envelopment analysis to analyze the comprehensive efficiency of a number of logistics enterprises under a multinational logistics group, and pointed out the main problems in the input and output of logistics enterprises. Braglia et al. [25] analyzed the input-output efficiency of the five largest private steel mills in Italy by DEA. Min et al. [26] used the DEA method to evaluate the operational efficiency of international container ports. Wang Ying, Du Pengcheng and Wang Kaiqian tried to use the C2R model and C2GS2 model in data envelopment analysis to study the logistics industry, and established the evaluation system of logistics input and output efficiency in China. Zang Ruixue(2010) [27]proposed the index system of the efficiency of enterprise logistics evaluation, and used the structural equation model to verify the reliability, validity and confirmatory factor analysis model of this evaluation index system，which provides a way to improve the efficiency of enterprise logistics and improve the overall operation efficiency of enterprises. Based on the analysis of the characteristics of third-party logistics of shipbuilding, Yan Bin and Fei Xiaohui [28] (2009) analyzed the gray correlation degree between the ship's manufacturing process and the key characteristics of the third-party logistics, so that the ship enterprises can reasonably adjust and arrange the ship production process. Liu Manzhi et al. [29] (2009) introduced the data envelopment analysis method into the urban logistics efficiency evaluation, established the DEA-based urban logistics efficiency evaluation model and index system, and conducted a comparative analysis by applying the model to the urban logistics efficiency of 13 cities in Jiangsu Province in 2006. According to the relevant information and data of the logistics industry in the central provinces of China, Huang Yong, Xu Jinghao (2009) [30] used the data envelopment analysis method to analyze and evaluate the social logistics efficiency of the six provinces and made suggestions for improvement by establishing the logistics industry evaluation index system and related models. Gao teng (2008) [31] analyzed the logistics efficiency of our country through the use of DEA method, with regarding the 31 provinces of fixed assets investment and labor as input variables, passenger turnover and turnover of goods as a variable output. Based on the background of manufacturing enterprises, Chen Zhi, Shan Leiyuan, Gu Hengping [32] (2005) used DEA data envelopment analysis method to study the efficiency evaluation of supply logistics system of manufacturing enterprises. Based on the case

analysis, it is proved that the data envelopment analysis method has a good application value for the efficiency evaluation of the enterprise logistics system.

（2）Research review

Through the induction and analysis of relevant literature, the research on the efficiency of input and output of logistics industry at home and abroad can be summarized as follows.

① Research on the efficiency of research, domestic and foreign scholars have come to a series of results, not only related to the theory, methods, etc., but also practical results about effective measures. However, most of the efficiency evaluation only analyzes the validity and inefficiency of the decision-making unit. The conclusion of the whole comparison is more, while there is no comparison between the provinces and cities, so the analysis is not deep enough.

② Research on the input-output efficiency of the logistics industry, the complicated development situation of the logistics industry makes it difficult to define, quantify and count the efficiency of input and output. The evaluation method is mainly based on qualitative analysis.

III. CONCLUSION AND PROSPECTS

Strictly speaking, the domestic research on the input and output of the logistics industry has just started, the research results obtained is very limited, how to apply input-output analysis to the logistics industry and to strengthen the depth, breadth, the number of research is a question worth thinking about.By summarizing the current situation of domestic and foreign research related to the logistics industry, it does help to clarify the shortcomings of our country in the implementation of the industry. On the basis of drawing lessons from the advanced experience of the logistics industry in developed countries (such as Anglo-American), combining with the practice of logistics industry in China, we can formulate the feasible development plan of logistics industry in the future, so as to promote the rapid development of China's logistics industry and shorten the gap between China and developed countries. On the other hand, maximizing the output of the logistics industry is the basis for maximizing the efficiency of the logistics industry. Effective input and output of the logistics industry is the basis and an important guarantee for the realization of the maximization of efficiency. In the future, as for the logistics industry's input-output efficiency evaluation study，we should try to increase the research efforts on the logistics industry's input-output to promote the relevant efficiency research, so as to further promote the development of China's logistics industry. The existing literature provides some ideas for future research, but there are some areas worthy of improvement. Future studies need to be addressed in the following areas:

(A) As for the input-output analysis, the biggest difficulty is not to calculate the matrix of various coefficients, on the contrary, how to obtain accurate scientific data is the most important issue. At present, there is no "logistics industry" in the industrial classification system of national statistics. Even in the most advanced North American industrial classification system (NAICS), there is no industrial

classification of "logistics industry". Therefore, in the true sense, the "logistics industry" statistics cannot be accurately obtained. As a result of the data, the literature through the use of input-output method of the logistics industry for accurate quantitative calculation is relatively rare, from a system point of view, the research is also very little outward to expand the link between the logistics industry and the various sectors in the national economy. In the current situation, the detailed, full data could not be obtained is a problem plagued the majority of researchers. We have our hope in the national authority of the statistical agencies, at the same time, we should also actively improve the data processing methods and programs to obtain greater credibility.

(B) Most of the existing research is static analysis, and rarely involves dynamic analysis, so that they cannot reveal changes in the proportionality of the structure between the logistics industry and other industries. The subsequent research can try to start from the input and output data from the calendar year to start the comparative analysis of the economic effect of the logistics industry to reflect the logistics industry's industrial nature and industrial relations, which helps to formulate industrial policies for the government, adjust and revitalize the logistics industry and so on.

(C) It is necessary to continue to improve the design of the table, including the structure of the table, the various sections and their subdivision. Only scientific, serious and reasonable form can be used to analyze the input and output services of the logistics industry.

(D) We must strengthen the integration in the exchange, and track the latest foreign theoretical research, so that it is possible to make people who really understand the logistics and the input-output to bear this responsibility, and to avoid running on the surface.

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