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Research On The Impact Of Producer Services Import On China's Manufacturing Industry's Climbing Global Value Chain

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Abstract: *Intermediate investment in producer services is an effective way to promote the manufacturing industry to climb the global value chain. This paper uses the export added value data of OECD-TiVA database to calculate the export technical complexity of 17 types of manufacturing industries in China, so as to measure the position of various industries in the value chain, and empirically test the impact of producer services import on the promotion of the position of China's manufacturing value chain. The results show that producer services import has a significant positive impact on the promotion of China's manufacturing value chain, and the promotion effect has industry heterogeneity. In the labor-intensive manufacturing industry, the import of producer services plays the strongest role in promoting the rise of its value chain, followed by the capital intensive manufacturing industry.*

Keywords: *Producer services, Manufacturing, Export technology complexity, Global value chain*

1. Introduction

Promoting the value chain of manufacturing industry is an important task for China to optimize its economic structure and promote high-quality economic development. With the deepening of trade globalization, China's manufacturing industry actively participates in the international division of labor. Compared with developed countries, China is mainly engaged in low value-added processing and assembly in the international division of labor. Under the dual dilemma of insignificant labor cost advantage and low-end of the value chain, China's manufacturing export is facing a double squeeze and urgently needs to be transformed and upgraded to the middle and high-end of the value chain.

In recent years, the development trend of China's producer service trade is good, and its proportion in service trade is becoming higher and higher. Producer service investment promotes the integration of service industry and manufacturing industry by introducing high-end production factors such as manpower and knowledge into manufacturing industry. It plays a more and more important role in enhancing China's independent innovation ability and promoting the upgrading of manufacturing industry. Accelerating the development of producer service trade should become an important path for China's manufacturing industry to cultivate new international competitive advantages and enhance the status of international division of labor.

The research on the position of manufacturing industry in the value chain is of certain significance to the research of international division theory. The research on the integration of producer services and manufacturing industry is also helpful to deeply understand the theory of industrial integration. It is also of great practical significance to analyze the mechanism of producer service input on the international division of manufacturing industry.

In view of this, this paper measures the global value chain status of China's manufacturing industry, and further explores the impact of producer service imports on the rise of China's manufacturing value chain, so as to provide theoretical and empirical basis for formulating policies to improve the status of manufacturing value chain.

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2. Journals Reviewed

The research of this paper is closely related to the following three literatures. The first is about the definition of producer services and the calculation of global value chain. Greenfield (1966) first put forward the concept of producer service industry in the research on the classification of service industry. He believes that this is a service industry separated from the manufacturing industry to meet intermediate demand and completely different from the final consumer service. There is no unified standard for the statistical classification of producer services at home and abroad, but many mathematicians include finance, transportation and computer information services (Qiu Ailian et al., 2014; Chen Qifei et al., 2014; Du Yunsu et al., 2019). The academic methods used to measure the status of global value chain mainly include the vertical specialization index proposed by Hummels et al. (2001) and GVC_Position index proposed by Koopman et al. (2010), industrial upstream index proposed by Antràs et al. (2012) and export technology complexity index proposed by Hausmann (2007).

The second literature is about the impact of producer services on manufacturing. The import of producer services can promote the production efficiency of manufacturing industry (Qiu Ailian et al., 2014). The investment in finance, computer and information services in the form of cross-border delivery is particularly conducive to the improvement of the production efficiency of China's manufacturing industry (Fan Xiufeng et al., 2012). Some scholars study the impact of producer service investment on manufacturing industry upgrading from different degrees. Producer service investment can promote the overall structural upgrading of China's manufacturing industry through the accumulation effect of capital such as knowledge and human resources (Zhao Jingfeng et al., 2019). To a certain extent, the import of producer services is conducive to the upgrading of manufacturing industry (Meng Pingli, 2017) and the upgrading of manufacturing products (Luo Jun, 2019). In addition, producer service inputs also have many effects on manufacturing exports. Producer service input has obvious heterogeneity in the promotion of manufacturing export value-added rate. Yang Ling (2016) found that the promotion process of producer services import on manufacturing value-added rate is different in different provinces. The Northwest has just begun to grow, the coast is in a transitional period, and the effect of northeast provinces is not obvious.

The third literature is about the impact of producer services imports on the promotion of manufacturing's global value chain status. Producer services import contributes to the promotion of the international division of labor of manufacturing industry, and its influence channels have obvious industry heterogeneity. Zhang Hongxia et al. (2019) found that producer service investment plays the strongest role in promoting the GVC status of manufacturing industry with low technology content. Yang Renfa et al. (2019) believe that producer service investment plays a significant role in promoting the GVC status of manufacturing industry with high technology content. Zhou Dapeng (2015) empirical analysis also shows that the international division of labor status of China's high-tech manufacturing industry is most promoted by the import of producer services. In addition, some scholars have analyzed the impact of the complexity of producer services imports on the improvement of the international division of labor of manufacturing industry. The research results of Du Yunsu et al. (2019) show that the import complexity of producer services plays a greater role in promoting a country's manufacturing industry to realize the rise of the value chain in developed countries.

In general, many scholars have carried out research on the impact of producer services on the development of manufacturing industry and provided valuable research results. However, few studies have analyzed the impact of "producer service trade" on China's manufacturing value chain status, especially on the different types of manufacturing.

Based on this, this paper will empirically analyze the impact of producer services import on the status of China's manufacturing value chain, as well as the possible industry heterogeneity in this impact mechanism, so as to provide policy suggestions for realizing the rise of China's manufacturing value chain status.

3. Key Indices Measurement

3.1. Industry Classification Description

3.1.1. Classification of Producer Services

Based on《National economic industrial classification (2011)》and《The sixth edition of balance of

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payments and international investment position manual》(BPM6), this paper divides producer services into six categories: transportation, finance, insurance, intellectual property, communication, computer and information and other business services.

3.1.2. Classification of Manufacturing

Based on《National economic industrial classification (2011)》, combined with ISICRev.4 manufacturing classification provided by OECD-TiVA(Trade in Value Added)database, 17[①]manufacturing industries are selected as the research object. Referring to Dai Xiang et al. (2013), manufacturing is divided into labor-intensive, capital-intensive and technology intensive manufacturing according to factor intensity.

3.2. Measurement of Imports of Producer Services

In order to measure the input intensity of producer services in manufacturing export products, this paper uses the method of Zhang Hongxia et al. (2019) for reference to define the calculation formula of trade volume of producer services in a certain industry as:

$$Ser = \frac{Intermediate\ services\ imported\ by\ i\ industry}{Total\ output\ value\ of\ i\ industry} \times Export\ volume\ of\ i\ industry \quad (1)$$

Among them, the import intermediate service data of various manufacturing industries are from the WIOD China input-output table, and the total output value data and export volume data of various manufacturing industries are from《The statistical yearbook of China's industrial economy》over the years.

According to the calculation, in recent years, the import volume of producer services in various industries of China's manufacturing industry has shown an overall growth trend.

3.3. Measurement of Global Value Chain Position of Manufacturing Industry

The complexity of export technology can not only reflect the structural characteristics of a country's export commodities, but also reflect the technical content of the export industry and its position in the value chain. Some scholars have calculated the export technology complexity of various industries in China's manufacturing industry and measured the position of various industries in the value chain on this basis(Qiu bin et al., 2012).

This paper measures the position of China's manufacturing industries in the global value chain by calculating the export technology complexity proposed by Hausmann (2007), and constructs the export technology complexity (PRODY index) at the industry level:

$$PRODY_i = \sum_j \frac{x_{ij} \Big/ \sum_i x_{ij}}{\sum_j (x_{ij} \Big/ \sum_i x_{ij})} * Y_j \quad (2)$$

Where, i represents the subdivided manufacturing industry, j represents the country, X represents the export volume of the subdivided manufacturing industry of country j, and Y represents the real per capita income level of country j (expressed in per capita GDP). PRODY represents the export technology complexity of manufacturing industry I in country j. The higher this index is, the more advantageous a country's industry is in the value chain.

However, some scholars use the above formula to calculate that the export technical complexity of China's manufacturing industry is generally higher than that of countries with the same income level. They believe that under the "big in and big out" processing trade model of China's manufacturing industry at this stage, the total trade value data is no longer applicable to calculate and measure the

[①] Labor intensive: food, beverage and tobacco products industry, textile, clothing and fur manufacturing industry, wood processing and wood bamboo rattan, palm grass manufacturing industry, paper and paper products industry, printing industry and reproduction of recording media, furniture and other manufacturing industries; Capital intensive: petroleum processing, coking and nuclear fuel processing industry, rubber and plastic products industry, non-metallic mineral products industry, base metal manufacturing industry and metal products industry; Technology intensive: optical instrument manufacturing, electrical machinery and equipment manufacturing, mechanical equipment manufacturing, transportation equipment manufacturing.

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export technical level of China's manufacturing industry, It is difficult for the data of total trade value to truly show the trade benefits obtained by a country participating in international division of labor. The value-added trade data with export value-added as the statistical caliber can more accurately reflect a country's real export situation.

Therefore, this paper uses the export data of various countries provided by OECD-TiVA database with added value as the statistical caliber to re calculate the export technical complexity of China's manufacturing industry, that is, X in the above formula represents the export added value of various countries' manufacturing industry. The per capita GDP data of countries are from the world bank database.

Next, based on the latest data of OECD-TiVA database and using the export added value data of 17 types of manufacturing industries in 25 [②]countries from 2003 to 2014, this paper calculates the export technical complexity of 17 types of manufacturing industries in China, and arranges the ranking of each industry in the 25 countries, hoping to comprehensively analyze the position of China's manufacturing industry in the value chain from the perspective of export added value.The specific results are as follows:

China's food, beverage, paper products, petroleum processing, chemical products, basic metal products and transportation equipment have a low position in the global value chain. The labor productivity and industrial value-added rate of two types of labor-intensive manufacturing industries such as food, beverage and paper products are low. The two types of capital intensive manufacturing industries such as petroleum processing industry and basic metal products industry have the characteristics of high energy consumption, which are not conducive to industrial transformation and upgrading and the improvement of the status of international division. Although the chemical manufacturing industry is an important basic industry in China with a large output value, it ranks low in the international division. The main reason may be that the gross profit margin of the chemical industry has gradually decreased in recent years, and the formulation of relevant government environmental policies has also raised the entry threshold of high polluting enterprises. The main reason for the low status of global value chain in transportation equipment manufacturing industry is that China's enterprises producing transportation equipment are generally small in scale and low in technical level compared with developed countries, resulting in their weak international competitiveness.

Textile, clothing, furniture, computer, electronics and electrical machinery have a high position in the value chain. China has always been a large manufacturing country. Mechanical and electrical products are the most exported products in China in recent years, including mobile phones produced by Huawei and Xiaomi, and electrical appliances produced by state-owned enterprises such as Gree, Midea, Haier and TCL are well-known in the world, indicating that China is committed to improving the added value of technology intensive manufacturing industry in recent years. The global value chain status of the two types of labor-intensive manufacturing industries, textiles and furniture, has been in the upstream position for many years. Textiles and clothing have always been China's traditional advantageous products of "high quality and low price". They have strong international competitiveness and have also brought a lot of trade benefits to China. China has become the world's largest exporter of furniture, and its furniture manufacturing technology is the world's leading.

Although China has become a major manufacturing country in the world in terms of total trade volume, it is still at the low end of the global value chain in terms of added value, indicating that the current production mode of China's manufacturing industry is still dominated by processing and assembly, and the goal of upgrading the manufacturing industry to the high end of the value chain has not been achieved.

4. Econometric Model and Data Description

4.1. Model Building

Firstly, this paper establishes an ordinary least squares regression econometric model at the industry level-an empirical model between the export technology complexity of various industries of China's

[②] The 25 countries are Australia, Bulgaria, Brazil, Canada, Switzerland, China, Germany, France, the United Kingdom, Greece, Indonesia, India, Italy, Japan, South Korea, Mexico, Norway, Romania, Russia, Sweden, Turkey, the United States, Denmark, Austria and Spain. These 25 countries include both low-income and high-income countries, and cover many countries in the EU, ASEAN and NAFTA, so they are representative.

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manufacturing industry and various explanatory variables.

$$EXPY_{i,t} = \alpha_0 + \alpha_1 Ser_{i,t} + \alpha_2 RD_{i,t} + \alpha_3 HR_{i,t} + \alpha_4 SCALE_{i,t} + \alpha_5 CAPITAL_{i,t} + \alpha_6 InFDI_{i,t} + \mu_{i,t} + \varepsilon_{i,t} \quad (3)$$

EXPY represents the export technology complexity of the manufacturing industry segment, i represents the industry, and t represents the year. The core explanatory variable Ser is the import of producer services used by each manufacturing sector. Among them, α_0 is a fixed intercept item, $\alpha_1 \sim \alpha_6$ are the regression coefficients, $\mu_{i,t}$ represents the unobservable industry fixed effect , $\varepsilon_{i,t}$ is a random error term.

Since China issued a new version of《The classification and code of national economic industries》in 2003 and the latest TiVA database was updated to 2014, this paper selects the panel data of 17 sub industries of China's manufacturing industry from 2003 to 2014 for empirical analysis, a total of 204 observations, and N>T is the short panel model.

4.2. Variable Selection and Data Description

The explanatory variable is the export technology complexity (EXPY) of China's 17 types of manufacturing industries. The data required for calculation comes from TiVA database and World Bank Database. The core explanatory variable is the import volume of producer services (Ser), and the data are from WIOD's China input-output table and China industrial economy statistical yearbook.

Control variables, after referring to the existing research, this paper selects several variables that have an important impact on the transformation and upgrading of manufacturing industry:

R&D intensity (RD): expressed by the ratio of R&D project expenditure to main business income of manufacturing enterprises of scale and above.

Human capital (HR): expressed by the ratio of the number of R&D personnel employed to the average number of employees in various industries of the manufacturing industry.

Capital input intensity (CAPITAL): expressed by the ratio of the original price of fixed assets of each manufacturing industry to the average number of employees.

Industry scale (SCALE): expressed as the ratio of the total output value of each manufacturing industry to the number of enterprises.

Foreign direct investment (FDI): expressed by the sum of the paid in foreign capital and the capital of Hong Kong, Macao and Taiwan of each manufacturing industry (in the form of logarithmic FDI).

The data of control variables are from《The statistical yearbook of China's industrial economy》and《The statistical yearbook of China's science and technology》.

5. Empirical Results and Analysis

5.1. Benchmark Regression Results

This section uses industry panel data to test the impact of producer services import on the promotion of manufacturing value chain status.

Firstly, the F-test shows that the equation has significant individual effects. Secondly, the LM test results reject the original hypothesis that "there is no individual random effect", that is, we should choose "random effect". Finally, using Hausman test, it is found that the p value is 0.000, rejecting the original hypothesis, so the fixed effect model should be used. The overall sample regression results are shown in Table 5-1.

Table 5-1: Benchmark regression results.

Variable	Fixed effect		Random effect	
	Coefficient	t value	Coefficient	z value
Ser	0.002***	8.74	0.002***	9.19
RD	7.164***	2.66	6.447**	2.23

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HR	-0.155	-0.47	0.060	0.16
SCALE	0.011**	2.34	0.015***	3.03
CAPITAL	-10.544***	-2.81	-15.072***	-3.78
InFDI	0.047***	5.92	0.053***	6.48
Constant	-0.188***	-4.08	-0.229***	-4.56
R^2	0.682		0.678	
F test	0.0000		0.0000	

Note: * * *, * * and * are significant at the level of 1%, 5% and 10% respectively. The column on the right of the estimation coefficient is t / z statistics, and the last row is the P value of F test.

It can be seen from Table 5-1 that the core explanatory variables intermediate input in productive services, control variables R&D investment, industry scale and foreign direct investment all have a significant positive correlation with the global value chain status of China's manufacturing industry.

The regression coefficient of producer service intermediate input (Ser) is significantly positive at the level of 1%, indicating that producer service import plays a significant role in promoting the status of China's manufacturing industry in the global value chain, which is consistent with the academic conclusion that producer service import is conducive to the upgrading of a country's manufacturing industry and the promotion of the status of the value chain. The research of Zheng XiuXiu et al. (2018) also proves that China and other countries engaged in processing trade for a long time should improve the openness of importing intermediate goods of productive services from developed countries and improve the added value of manufacturing industry by investing high-quality productive services, so as to further participate in and benefit from international division of labor.

The regression coefficient of R&D investment (RD) is significantly positive at the level of 1%, indicating that R&D investment is also an important factor to promote the status of China's manufacturing industry in the global value chain, which means that strengthening scientific research expenditure is an important factor for enterprises to improve innovation ability and productivity.

The regression coefficient of industry scale (SCALE) is significantly positive at the level of 5%, indicating that the expansion of industry scale is conducive to the improvement of the status of China's manufacturing industry in the global value chain. As a "world factory", China has a huge production scale and high dependence on foreign trade. The comparative cost difference formed by external economies of scale further promotes China's manufacturing industry to participate in the value chain.

The regression coefficient of foreign direct investment (FDI) is significantly positive at the level of 1%, indicating that the increase of this investment is also conducive to the promotion of the international division of labor of China's manufacturing industry. The increase of foreign direct investment will produce knowledge and technology spillover, so as to stimulate technological progress and promote the rise of GVC status. The lack of funds for the development of China's manufacturing industry can be alleviated by foreign capital investment, and the international competitiveness of China's manufacturing industry can be improved by absorbing foreign advanced technology and management experience.

However, due to the lag effect of R&D achievements of manufacturing researchers, it is difficult to convert them into effective productivity in the short term. In addition, R&D personnel in the manufacturing industry have not promoted transformative technological innovation in recent years. A large amount of R&D investment costs loaded by R&D personnel in the manufacturing industry and the low efficiency of R&D personnel's technological innovation have caused a negative impact of human capital (HR) on the status of China's manufacturing in the global value chain, which is contrary to the prediction.

The regression coefficient of capital investment intensity (CAPITAL) is significantly negative at the level of 1%, indicating that excessive material capital investment has a negative impact on the promotion of the status of China's manufacturing industry, which is contrary to the prediction. Excessive capital investment is easy to cause overcapacity, which is not conducive to the improvement of resource allocation efficiency of manufacturing industry. In recent years, the investment in fixed assets of China's manufacturing industry has increased rapidly, but the total profit has increased slowly. The main reason may be that the fixed asset investment of some enterprises focuses on the construction and purchase of real estate and buildings, and the lack of introduction of advanced production machines and means of transportation, which is unfavorable to the improvement of production efficiency and industrial transformation and upgrading.

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5.2. Heterogeneity Analysis of the Impact of Producer Services Imports

For manufacturing industries with different factor intensity types, the impact of producer services import on their status in the global value chain should be different.

For this reason, this paper conducts heterogeneity analysis, and the specific results are shown in table 5-2.

Table 5-2: Regression results of grouped samples.

Variable	Labour-intensive	Capital-intensive	Technology-intensive
Ser	0.012***	0.002***	0.001***
	(7.53)	(2.78)	(6.37)
RD	0.002	5.748*	3.011
	(1.25)	(1.78)	(0.71)
HR	-0.579	-1.066**	-0.091
	(-1.04)	(-2.22)	(-0.19)
SCALE	0.028*	0.003	0.031***
	(1.73)	(0.43)	(3.85)
CAPITAL	-4.152	-7.223**	-6.656***
	(-0.74)	(-2.17)	(-2.54)
InFDI	0.006**	0.018	0.077***
	(2.02)	(1.10)	(4.23)
Constant	0.042	-0.048	-0.285***
	(1.43)	(-0.53)	(-2.50)
R^2	0.805	0.848	0.865
F test	0.0000	0.0000	0.0000

Note: * * *, * * and * are significant at the level of 1%, 5% and 10% respectively. Below the estimation coefficient is the t statistic, and the last row is the P value of F test.

According to the regression results in table 5-2, the following basic conclusions can be drawn:

First, for these three types of manufacturing industries, the inclusion of various control variables does not change the regression coefficient symbol and significance of the core explanatory variable of producer service import, indicating that the impact of producer service import on the promotion of the status of China's manufacturing industry in the global value chain is relatively stable.

Second, the import of producer services plays the strongest role in promoting the rise of the status of labor-intensive manufacturing industry, followed by capital intensive manufacturing industry. This is consistent with the current development stage of China's service industry. At present, more than half of China's intermediate investment in producer services are traditional service industries such as transportation and warehousing. Labor-intensive manufacturing industry has a high degree of participation in the global value chain, a high degree of dependence on traditional producer services such as transportation and warehousing, and an increase in investment in producer services such as transportation and warehousing, It helps to improve the output efficiency and value-added level of this kind of manufacturing industry. Capital intensive manufacturing industries such as rubber, plastic and metal manufacturing have obvious economies of scale, and their storage and transportation capacity is efficient enough to reduce inventory in time and further production. Producer services with intensive knowledge input, such as scientific research and technical services, account for a relatively low proportion in the production link. Compared with a large amount of capital and labor input, the export of technology intensive manufacturing industry depends more on this kind of scientific and technological input. Therefore, the import of producer services plays a relatively weak role in improving the global value chain status of technology intensive manufacturing industry.

6. Conclusions and Recommendations

6.1. Research Conclusion

Firstly, using the export added value data of 25 major countries, this paper calculates the export technical complexity of 17 types of manufacturing industries in China, so as to measure the position of each industry in the value chain. Secondly, it empirically tests the impact of producer services import on the promotion of China's manufacturing value chain, and draws the following main conclusions:

The import of producer services has significantly promoted the status of China's manufacturing industry in the global value chain. The import of producer services promotes China's manufacturing

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industry to climb to the high value-added link of the value chain through the effects of knowledge, technology accumulation and economies of scale. R&D investment and foreign direct investment will also promote the rise of the manufacturing value chain through the spillover of knowledge and technology. The expansion of industry scale further promotes the manufacturing industry to participate in the international division through the comparative cost difference formed by the external economies of scale. However, due to the lag effect of researchers' R&D results, excessive capital investment is easy to cause overcapacity, resulting in the negative impact of human and capital investment on the rise of China's manufacturing value chain. Further study found that producer services import has the strongest promotion effect on the rise of labor-intensive manufacturing value chain, followed by capital intensive manufacturing.

6.2. Recommendations

On the basis of summarizing the previous research conclusions, the following reference suggestions are provided:

1. Relax the restrictions on the import of service trade and improve the structure of productive service import trade. First, encourage China's manufacturing industry to actively import foreign advanced productive services and give full play to its positive role in improving manufacturing productivity. Second, continuously improve the existing trade structure of producer services imports, increase the proportion of high-end producer services imports such as finance, computer and information services, make up for the defects of domestic service factors, and provide more high-quality service inputs for manufacturing production and final product export.

2. Increase subsidies for enterprise R & D and innovation, pay attention to the quantity of human capital, and strive to improve the quality of human capital. R & D investment is an important factor to promote the status of China's manufacturing industry in the global value chain. Increasing R & D investment can further encourage enterprise reform and innovation, so as to improve production efficiency. At this stage, only by improving human resource endowment can we realize the promotion of human capital investment on the division of labor in China's manufacturing global value chain as soon as possible. The government should introduce and cultivate high-quality and high-tech talents to provide power support for improving the status of the value chain.

3. Break through the constraints of comparative cost advantage and guide China's manufacturing industry to climb to high value-added links. The government should strengthen the coordination of industrial, education and science and technology policies, strengthen the training of high-tech talents, enhance China's attraction to the core technology links of the value chain, and guide China's manufacturing industry to climb to high value-added links.

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