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Correlation and comparative advantage of global value chain of China's manufacturing and service industries——Empirical research based on ADB database

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Abstract: *Based on the perspective of comparative advantage, This paper examines the impact of the correlation between China's manufacturing and service industries before and after the global value chain on their status.he results show that the advantages of China's primary industry and low - and medium-tech manufacturing industry have declined, and the correlation between China's high-end manufacturing industry and service industry has become closer and more obvious, which is conducive to the improvement of China's position in the global value chain. Therefore, we should give full play to the comparative advantages of the industry and provide strong empirical research for China's industrial transformation and upgrading.*

Keywords: *global value chain, comparative advantage theory, manufacturing, value chain position.*

1. Introduction

Based on the perspective of comparative advantage, This paper examines the impact of the correlation between China's manufacturing and service industries before and after the global value chain on their status. The results show that the advantages of China's primary industry and low - and medium-tech manufacturing industry have declined, and the correlation between China's high-end manufacturing industry and service industry has become closer and more obvious, which is conducive to the improvement of China's position in the global value chain. Therefore, we should give full play to the comparative advantages of the industry and provide strong empirical research for China's industrial transformation and upgrading

Today, the global value chain has attracted great attention from all parties (Chen Deming, 2018) [1]. At the same time, in the government work report in 2021, China's "optimizing and stabilizing the industrial chain supply chain" is one of the key tasks. The report of the 19th National Congress of the Communist Party of China clearly puts forward that "promoting China's industry to move towards the middle and high-end of the global value chain and cultivating several industrial clusters" is an important goal and task of building a modern industrial system. With the deepening of reform and opening up, China has become the world's largest trading country. In the past, relying on the demographic dividend and policy dividend, China continued to burst out huge advantages in the wave of 40 years of reform and achieved a very high economic growth rate. With the help of cheap labor, the trade of the whole industry has achieved explosive growth. However, since the financial crisis and the scientific and technological revolution, it has posed great challenges to China's traditional labor-intensive industries in the past, and the industrial profits at the low end of the manufacturing value chain have been continuously compressed. At the same time, with the appreciation of RMB, the export-oriented trade surplus environment has also been changed, Force China to develop to high-end technology industry, improve trade added value, and promote the high-end extension and development of China's manufacturing industry in the global value chain.

The process of global value chain is not only the process of commodity exchange, but also involves the status of value chain, value chain governance and control (Liu Yi, 2009) [2]. The division of labor in the value chain overcomes the traditional division of labor in trade. It makes the elements such as technology, capital and manpower flow freely between different regions, and penetrates the division of labor into the interior of products, not just limited to the division of labor between industries. In recent

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years, the division of labor model of global value chain has become an important way for countries to participate in the international division of labor in economic globalization. At the same time, the integration and innovation of global value chain has become an important goal for countries to enhance their international status (Tang Bi, 2012) [3]. Under the background of global production, the trade statistics method based on trade added value includes the specific situation of different participants in trade, We can scientifically calculate the flow in the international market (Chen Jiyong, Yu Gang, Ge Ming, 2016) [4]. At the same time, China's international division of labor has also changed from horizontal division of labor to vertical specialization division of labor. In addition, foreign scholars use the input-output model to realize the framework of value-added trade, Koopman et al. (2014) [5] This paper puts forward a comprehensive decomposition framework of trade value-added, which divides the export value into four parts: returned domestic value-added, export domestic value-added, external value-added and double calculation, which is used to correct the problem of double calculation of value-added under traditional trade methods. Wang et al. (2015) [6]

Scholars have conducted a lot of research on the topic of China's manufacturing trade competitiveness (Mao Risheng, 2006) [7], and found that the actual competitiveness of China's manufacturing industry is very different from that of foreign countries, and the competitiveness of low-tech and high-tech manufacturing industries with high professional competitiveness is not strong (Huang Xianhai, 2006） [8]. Based on the calculation of trade added value, the overall value chain status of China's manufacturing industry is still at the middle and low end (Qiao Xiaoyong, 2017) [9]. China must continuously increase its participation in the global value chain, and the global value chain status of China's manufacturing industry urgently needs to move towards the high end (Liu Zhibiao, 2017) [10]. Fan Gang et al. (2006) [11] It is found that China's export structure has transitioned from low-tech to medium and high-tech products, but high-tech products have not yet become the most important export. In the increasingly competitive market environment of international trade market, industrial agglomeration can help to accelerate the industrial integration of manufacturing industry and give full play to the competitive advantage in the market. Promote the development of manufacturing industry to the right side of the "smile curve" and realize the structural reorganization and upgrading of manufacturing value chain.

In the existing literature, few literatures explain the relationship between China's domestic manufacturing industry and the division of labor in the global value chain through the comparative advantage theory. The contribution of this paper is to explain the relationship between different types of manufacturing industry and the world division of labor after the division of technology intensity in China's manufacturing industry. Based on the above analysis, this paper intends to make an empirical study on this issue from the perspective of global value chain based on the data of 2000 and 2007-2019.

2. Research methods

Global value chain location measurement. Hummels et al.[12]created the "vertical specialization index" and measured the vertical division of labor between OECD countries and emerging developing countries with Icio model. This paper also uses this method to measure the location of global value chain.

Industrial connection refers to the economic and technological connection between industries with various inputs and products as the connecting link, which is specifically divided into two types: one is the "backward linkage", which is the active demand for related industries caused by the change of final demand of products; The other is "forward linkage", that is, the active supply of related industries caused by the change of input (added value). They measure the correlation effect between industries from the perspective of supply and demand. When we analyze the relationship between domestic industries, we often use the input-output table at the national level.

The total output in the row direction is expressed as: X=BY, where B is the Leontief inverse matrix (complete demand coefficient matrix), and the sub element $b_q^{\alpha\beta}$ reflects β Impact of changes in terminal demand of China's Q industry α The impact of changes in the output of China's P industry, i.e β National Q industry pair α The backward correlation effect produced by China's P industry reflects the demand pull effect. By the column addition of Leontief inverse matrix β National Q industry and α Backward correlation of countries $BL_Q^{\alpha\beta} = \sum_p b_{qp}^{\alpha\beta}$

The total input in the column direction is: X= VaG, where G is the Ghosh inverse matrix (complete supply coefficient matrix), and the sub elements $g_{pq}^{\alpha\beta}$ reflect α The impact of changes in investment in China's P industry β. The impact of China's Q industry output, i.e α China's P industry β the forward correlation effect of China's Q industry reflects the supply promotion. The row direction sum of Ghosh

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inverse matrix can be obtained α China's P industry β Forward relevance of countries: $FL_p^{\alpha\beta} = \sum_q g_{pq}^{\alpha\beta}$.

The proportion of output of each industry in the total output is used as the weight to obtain the backward and forward correlation degree of industries in the country:

$$BL^{\alpha\beta} = \sum_q BL_q^{\alpha\beta} * \frac{Y_q^{\beta}}{Y_{total}^{\beta}},\ FL^{\alpha\beta} = \sum_p FL_p^{\alpha\beta} * \frac{Y_q^{\alpha}}{Y_{total}^{\alpha}}.$$

3. Data Description

The data used in this paper is the multi regional input-output table prepared by ADB. The data involves 35 industries in 62 countries. The database year is updated to 2017, and the World Bank Database stays in 2011. Therefore, this ADB database is selected, and the database can fully cover all categories of manufacturing industry, the main research object of this country. At the same time, the input-output industry classification of the database is slightly different from that published by the General Administration of Customs of China. This paper is calculated according to the industry classification method published by ADB.

4. Experimental results and analysis

Table 1: Backward and Forward Linkages by Industry

Industry	2010		2017	
	Backward Linkages	Forward Linkages	Backward Linkages	Forward Linkages
Agriculture, Hunting, Forestry and Fishing	0.80	1.12	0.79	1.05
Mining and Quarrying	0.93	1.77	0.93	1.71
Food, Beverages and Tobacco	1.09	0.96	1.09	0.93
Textiles and Textile Products	1.29	0.98	1.28	1.01
Leather, Leather and Footwear	1.24	0.81	1.33	0.93
Wood and Products of Wood and Cork	1.20	1.31	1.22	1.31
Pulp, Paper, Paper, Printing and Publishing	1.18	1.47	1.20	1.43
Coke, Refined Petroleum and Nuclear Fuel	1.04	1.52	1.13	1.46
Chemicals and Chemical Products	1.19	1.36	1.26	1.35
Rubber and Plastics	1.26	1.32	1.30	1.32
Other Non-Metallic Mineral	1.13	1.03	1.18	1.01
Basic Metals and Fabricated Metal	1.21	1.28	1.28	1.28
Machinery, Neca	1.23	0.96	1.27	0.99
Electrical and Optical Equipment	1.22	0.95	1.30	1.01
Transport Equipment	1.34	0.90	1.37	0.89
Manufacturing, Nec; Recyclinga	1.03	0.78	1.05	0.77
Electricity, Gas and Water Supply	1.20	1.64	1.21	1.57
Construction	1.23	0.45	1.25	0.43
Sale, Maintenance and Repair	0.42	0.40	0.39	0.37
Wholesale Trade and Commission Trade	0.77	1.01	0.73	1.03
Retail Trade	0.77	1.01	0.73	1.03
Hotels and Restaurants	1.02	0.91	0.99	0.87
Inland Transport	0.91	1.19	0.88	1.17
Water Transport	1.00	1.03	0.96	1.17
Air Transport	1.12	0.83	1.13	0.98
Other Supporting and Auxiliary Transport Activities	0.99	1.29	0.97	1.37
Post and Telecommunications	0.77	0.96	0.74	0.90
Financial Intermediation	0.68	1.26	0.64	1.24
Real Estate Activities	0.56	0.70	0.52	0.68
Renting of M&Eqb and Other Business Activities	1.00	1.07	0.98	1.14
Public Admin and Defence; Compulsory Social Security	0.85	0.44	0.81	0.44
Education	0.82	0.49	0.75	0.46
Health and Social Work	1.12	0.47	1.09	0.41
Other Community, Social and Personal Services	0.95	0.93	0.87	0.90
Private Households with Employed Persons	0.42	0.40	0.39	0.37

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Referring to ADB's industry classification, 35 industries are divided into five categories: primary, low-tech manufacturing, medium to high-tech manufacturing, business services, personal and public services. The specific classification is as follows: firstly, we can obtain whether China's manufacturing industry has established a close industrial chain association under the integrated development through the above five classification methods. Therefore, we can first observe the overall industrial chain association degree of China. Table 1 shows us the forward and backward Association of China in 2010 and 2017. The closer the correlation is, the closer the value is to 1, and the country is in the more central position. On the contrary, the closer the value is to 0, the smaller the correlation is, and the more marginal the country is in the world.

Table 1 shows the pre (post) correlation between China's industries and other industries in 2010 and 2017. It shows two characteristics: first, from the trend, the front and rear correlation of primary is weakening, such as the front and rear correlation of agriculture, forestry, animal husbandry and fishery is weakening; The correlation of low-tech manufacturing has not changed significantly in general, with a slight increase, which is specifically reflected in the larger correlation coefficient of purchased products leather, leather and footwear, wood and wood and cork products, the stable correlation coefficient of textiles and textile products, purchased products pulp, paper, paper, printing and publishing, and the stable correlation coefficient of food The correlation coefficient between beverage and tobacco industry decreased; The overall relevance of medium to high-tech manufacturing shows an upward trend, with large increases in various chemical raw material departments and machinery manufacturing departments.

According to the above analysis, China's industrial sector production has an obvious trend towards specialization and technicalization, and China continues to develop towards medium to high-tech manufacturing. China as a whole has a strong foundation in industrial chain connection, which is a solid cornerstone for China to develop regional trade and build economic globalization. It can be seen that China has transformed from low-end manufacturing and labor-intensive industries to high-tech industries and service industries. Judging from the trend, China's position in the global economy and trade will continue to strengthen, the relationship will be closer, and a wider production network will appear between the industrial chains. Second, from multiple industries, the backward correlation of most industries in China is higher than the forward correlation, which means that China's role as a downstream producer is greater than that as an upstream supplier, which stems from the structure of China's production system. Taiwan, Japan and South Korea provide China with a large number of intermediate products, and China's main production is located in the downstream production links.

The previous analysis shows that China has the potential to develop to a higher stage of globalization. How can China further give play to its market advantages and factor advantages under the connection of various industries, and how will China use its comparative advantages to further obtain the market? Next, this paper will discuss the trend of China's manufacturing and producer services through five sector classification method and comparative advantage theory.

Table 2: Evolution of Revealed Comparative Advantage

	2000	2010	2011	2012	2013	2014	2015	2016	2017
Primary	1.5	0.9	0.9	0.8	0.9	1.0	1.0	1.1	1.1
Low-tech manufacturing	1.5	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1
Medium- to high-tech manufacturing	1.0	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2
Business services	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9
Personal and public services	0.7	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6

In order to further analyze China's industrial development trend and comparative advantage, according to the trade comparative advantage judgment method of (Wang, 2018), the situation of China's comparative advantage in trade in 2000, 2010 and 2017 is drawn,as shown in Table 2,which has distinct characteristics: first, the two-way correlation of medium to high-tech manufacturing industry is the highest, In 2000, China's primary and low-tech manufacturing had a huge comparative advantage in the division of labor in the global value chain, with a coefficient of 1.5, which is far greater than the benchmark standard of 1, which is in line with China's becoming the largest undertaking party of the world's industrial chain transfer and the world's processing plant at the beginning of the century. And make use of sufficient labor factors to make the primary industry develop rapidly. However, by 2017, the proportion decreased to 1.0, indicating that China's comparative advantage in primary industries represented by labor-intensive industries has been weakened. China's demographic dividend in recent two decades has been gradually consumed. At the same time, policy dividend has also been consumed a lot, and stocking low-level simple industries are no longer the dominant direction. The competitive advantages of medium tohigh-tech manufacturing and business and service industries have soared from

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1.0 and 0.7 in 2000 to 1.2 and 0.9. China is still in the primary stage of socialism. However, China is gradually transforming and upgrading to high-end technology and capital intensive industries, which is in line with China's plan and deployment of high-end manufacturing in 2025. The current conditions have laid the foundation and provided guarantee for the subsequent transformation and upgrading

5. Conclusions and policy implications

This paper analyzes the current situation and trend of China in the global value chain from the perspective of correlation and comparative advantage before and after the global value chain, and empirically analyzes the necessity of China's manufacturing industry in promoting the transformation and upgrading of the industrial chain and China's position in the global division of labor system by using the panel data of ADB database 2010-2017. Through the above analysis, the following conclusions are drawn: first, China has improved on the supply side and demand side of the global value chain in recent two decades, which means that China plays an increasingly important role in the global division of labor system. Second, the increasing two-way correlation of China's medium to high-tech industry means that China has more and more dominant power inmedium to high-tech manufacturing. Three, at the same time, in terms of the position of industrial division of labor, China is still in the position of relatively downstream division of labor, and is highly dependent on the supply of foreign intermediate goods. We must pay attention to the uneven spatial layout of the value chain, respect the heterogeneity of various industries, and form a relationship of complementary advantages and internal linkage.

The policy implications of this study: firstly, the government should continue to support the development of high-tech industries. The era of relying on labor-intensive industries in China has passed. Now, under the background of "double cycle" and "one belt and one road" strategy, enterprise should take the initiative to develop high-end technology as a transformation oriented capital intensive and knowledge intensive industry. On one hand, we should "bring in", learn from foreign advanced technology, integrate existing resources around the world, integrate foreign manufacturers into our own operation network, improve the governance and control ability of Chinese enterprises on the global value chain, increase the closeness of forward correlation, pay attention to the relationship with upstream suppliers and enhance their own integration ability; On the other hand, we should "go global", make full use of the comparative advantages of our own industries, further deepen market reform in advantageous industries, and accelerate the establishment of a unified and efficient domestic and international market system

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