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Analysis of the Position of China Information Industry in the Global Value Chain

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Abstract: Identifying the division of labor position of China information industry in the global value chain is particularly important for optimizing the structure of China's information industry and improving its overall competitiveness. The article calculates the global value chain revenue generated by the participation of the information industry in the global value chain division of labor production in various countries, and then establishes a global value chain height index to analyze the global scale and development of China information industry; Analyze the degree of vertical specialization of the information industry through the decomposition of international trade flows, and finally calculate the global value chain status index of the information industry in different countries. The results indicate that: (1) the value chain height index of China's information manufacturing industry is continuously decreasing, at the level of middle and lower reaches; The telecommunications industry and computer programming industry in China information service industry are in an upstream position in the value chain. (2) There is an imbalance in bilateral trade between China and the United States in information manufacturing and information service industries. Compared to the United States, China information industry has a lower value chain position. The United States mainly engages in research and development, design, and other work, while China is more engaged in less value-added work such as assembly and reprocessing. (3) From the global value chain status index, China information manufacturing industry is at the middle and lower reaches of the world, with Japan firmly ranking first and the United States second. The ranking of other developed countries is basically in the top 20, fluctuating between the middle and upper reaches. The position of China's information service industry in the global value chain is at the mid to upper level. Russia, Japan, and the United States are among the top three countries in the global value chain of the information services industry, while developed countries such as the UK, France, and Germany are in the upper reaches of the information services industry.

Keywords: Global Value Chain, Information Industry, Global Value Chain Height Index, Global Value Chain Status Index.

1. Introduction

With the advancement of global economic globalization and the continuous deepening of international division of labor, global value chains are gradually forming. Among the various industries participating in the global value chain, the information industry, as a strategic, fundamental, and leading pillar industry in China, has high added value, high correlation, and obvious market-oriented characteristics. At the same time, foreign trade in the information industry is also an important component of China foreign economic and trade, with obvious advantages in latecomers. Exploring the current division of labor position of China information industry on the global value chain and pointing out the development situation of China information industry on the global value chain is particularly important for optimizing China information industry structure and improving the overall competitiveness of China information industry.

Domestic scholars' analysis of the status of various industries in the global value chain mainly focuses on the measurement and analysis of export value added by regions and industries in the global value chain. Jiang et al.(2018)used the world input-output data table to measure and compare the actual economic benefits and implicit carbon emissions that major economies have gained from the export of electronic information industries from China and the United States from the perspective of the global value chain.Starting from bilateral trade, Wang et al. (2015) decomposed exports into 16 sub items based on the sources of added value and the final absorption places. They comprehensively and meticulously decomposed the trade flows between paired regions, providing a path for understanding trade structure and understanding actual trade forms. On the basis of the bilateral trade decomposition method proposed by Wang et al., Yin (2016) constructed a vertical division of labor index and a global value chain status index. Ma et al.(2014) calculated the income of China manufacturing industry on the global value chain and found that developed countries have a higher contribution to added value, while China own service industry has a higher contribution to the added value of the manufacturing industry. Feng (2014) pointed out that developed countries rely on their control over core technologies and brands to occupy a higher position in the value chain, while developing countries rely on their labor costs and resource advantages to participate in the division of labor in the value chain mainly through assembly, reprocessing, and other methods, and are at a lower end .

Foreign scholars' research on the status of various regions and industries in the global value chain mainly focuses on the construction of quantitative research methods and models. Hummels et al.(2001) found a positive relationship between vertical specialization rate and participation in the global value chain by defining it and conducting empirical calculations. Meng et al.(2010) pointed out that the input-output model based on demand pull is relatively mature in measuring a country's vertical specialization rate and the degree of participation in the global value chain, but it is relatively one-sided. The Ghosh model based on supply driven can also reflect the degree of participation in the global value chain. Inomata (2017) applied Dietzenbacher et al.

(2007) input-output economic distance model to the Asian International input-output Table to measure the international scale of production and division of labor. Koopman (2010) proposed a conceptual framework that decomposes a country's total exports into added components by source, and defines the Global Value Chain Status Index to measure the position of a country's industry in the value chain. Timmer et al. (2013) first proposed measuring the income of countries on the global value chain from the perspective of income, and proposed a specific definition and accounting framework for global value chain income.

At present, there are the following shortcomings in identifying the position of the information industry in the global value chain: firstly, previous research only started from a single economic positioning or a single physical positioning, lacking a comprehensive exploration of the two; Secondly, the analysis of influencing factors mainly focuses on the internal factors of the Chinese industry, while neglecting international economic exchange factors and international background factors. There is less understanding and application of the international division of labor value chain theory.

To address the above shortcomings: firstly, calculate the global value chain revenue generated by the participation of the information industry in the global value chain division of labor production in various countries, and then establish an advantage ratio index to analyze the global scale and development of China information industry; Secondly, by decomposing international trade flows, we can more accurately measure the participation of China information industry in the global information value chain, analyze the development of vertical specialization in the information industry, and finally calculate the global value chain status of the information industry in different countries.

The first part of the article introduces the model method used in this study; The second part uses the world input-output table to calculate the global value chain height index and global value chain status index, which are used to reflect the different positions of information industries in different countries in the global value chain; The third part is the conclusion.

2. Model Method

2.1. Multi Regional Input-output Table

In order to analyze the global value chain of the information industry, it is necessary to introduce an input-output model that includes multiple countries and industries, namely a multi region input-output table. Build an input-output table containing G countries, each with N industries. Table 1 presents a simplified model of the input-output table for multiple regions with four countries.

Table 1. Input-output table of the four countries

Output / Input		Intermediate use				End-use				Total output
		S	R	T	Q	S	R	T	Q	
Intermediate investment	S	Z^{SS}	Z^{SR}	Z^{ST}	Z^{SQ}	Y^{SS}	Y^{SR}	Y^{ST}	Y^{SQ}	X^S
	R	Z^{RS}	Z^{RR}	Z^{RT}	Z^{RQ}	Y^{RS}	Y^{RR}	Y^{RT}	Y^{RQ}	X^R
	T	Z^{TS}	Z^{TR}	Z^{TR}	Z^{TQ}	Y^{TS}	Y^{TR}	Y^{TR}	Y^{TQ}	X^T
	Q	Z^{TS}	Z^{TR}	Z^{TT}	Z^{TQ}	Y^{TS}	Y^{TR}	Y^{TT}	Y^{TQ}	X^Q
value added		V^S	V^R	V^T	V^Q					
Total investment		$(X^S)'$	$(X^R)'$	$(X^T)'$	$(X^Q)'$					

Similar to the structure of the domestic input-output table, the multi regional input-output table consists of three parts: the middle flow part, the final use part, and the initial input part. The difference is that in the final use section, each country's final use for its own country and other countries will be separately listed. Taking countries S and R as examples, intermediate input matrix Z^{SR} is $N \times N$ matrix， element z_{ij}^{SR} show intermediate investment of S country i industry to R country j industry，it is achieved through imports from country R； Y^{SR} is $N \times 1$ final use matrix，element y_{ij}^{SR} is production of final product consumption of R country j industry to S country i industry， achieved through imports from country R； X^S is total output of S country，is $N \times 1$ matrix. Looking vertically， V^S is initial investment of S country. It's also an added value，is $1 \times N$ matrix； $(X^S)'$is total input of S country，equal to the total output of country S. The input-output tables in multiple regions are also balanced horizontally and vertically.

2.2. Calculation Method of Global Value Chain Height Index

The Global Value Chain Height Index (GH) is proposed on the basis of global value chain revenue, which can characterize the division of labor status and changing trends of industries in the global value chain. Global value chain income refers to the value-added income allocated by a country to participate in the production of global final products, directly or indirectly. Starting from the final demand, the Leontief inverse model can be used to obtain the total output. Then, based on the condition that the total input is equal to the total output, the added value coefficient matrix is multiplied by the total input to obtain the added value.

$$V = \widehat{V_S} \cdot (I - A)^{-1} \cdot Y \tag{1}$$

V_S represents the coefficient of added value, which is the industrial added value$V$ divided by the total investment of the industry X .$\widehat{V_S} \cdot (I - A)^{-1}$ known as the value chain matrix, denoted as V^*， The model from the final demand to the added value is called the value chain. In the value chain, matrix elements $V^*{}_{ij}$ show share of revenue in the value chain from i industry in j final product.

The main idea of constructing a global value chain height index is to divide the ratio of a country's domestic industry to its own industry of the same type, compared to the ratio of a certain industry of the same type worldwide, similar to the idea of advantage ratio. Nie et al.(2016) divided industries into knowledge intensive manufacturing, non-knowledge intensive manufacturing, knowledge intensive service

industry, and non-knowledge intensive service industry, and conducted a global value chain height index analysis on knowledge intensive industries [12]. The research subject of this article is the information industry. Drawing on its ideas, we only consider the global value chain height index of the information industry, which is a comparative analysis of the global value chain height index between the information industry and the global information industry.

Corresponding to various industries in each country, GVC_v_{ir} show global value chain revenue from r country i industry. Value chain height index GH_{ir} The calculation formula is:

$$GH_{ir} = \frac{GVC\_v_{ir} / \sum_{\phi} GVC\_v_{ir}}{\sum_{r} GVC\_v_{ir} / \sum_{r} \sum_{\phi} GVC\_v_{ir}} \quad (2)$$

After calculating the global value chain height index (GH) of a certain industry, qualitative and quantitative analysis is required. If GH>1, it indicates that the income contribution rate of country r's i industry is relatively high compared to the rest of the world, and it can be inferred that country r's i industry is in a higher position on the global value chain; On the contrary, if GH<1, the income contribution rate is lower than the average level, it can be inferred that the industry in country r is in a lower position on the global value chain; When GH=1, it indicates that the income contribution rate is equal to the global income contribution rate and is in the middle of the global value chain.

2.3. Bilateral Trade Export Decomposition Method

Wang et al. believe that in order to achieve a complete decomposition of the value flow of bilateral intermediate goods trade, it is necessary to decompose the value of intermediate goods based on their source and final destination, and record the value of different parts of the final product production used by different departments in each country. Wang Zhi et al. divided a country's exports into 16 parts in bilateral trade, and merged them into 8 parts according to different sources and destinations of value, as shown in Table 2.

Table 2. Breakdown of exports from country S to country R

classification	project	meaning
Domestic value added	(1) DVA-FIN	The domestic added value in the final products exported by country S.
	(2) DVA-INT	The added value of intermediate products imported by country R from country S and used for country R's production of its own final products.
	(3) DVA-INTrex	The added value of intermediate products imported by country R from country S, and ultimately absorbed by imports from countries other than country S.
	(4) RDV-G	The value-added of intermediate products exported from country S, but ultimately returned to country S.
Vertical Specialization	(5) DDC	Pure duplicate calculation in country S.
	(6) FVA-FIN	The added value from foreign countries in the final products exported by country S.
	(7) FVA-INT	The added value from foreign countries in the export of intermediate products from country S.
	(8)FDC	Pure duplicate calculations abroad.

Vertical specialization (VS) refers to the added value from foreign countries included in a country's total exports. This indicator is widely used in global value chain analysis to measure international production and division of labor. From the export breakdown table, it can be seen that vertical specialization includes four economic connotations. Based on the relative values of different parts, the role played by the country in participating in the global value chain division of labor production process can be analyzed. If a country finally exports contain a high proportion of foreign added value (FVA-FIN), it can be inferred that the country imports components, mainly undertakes production activities such as processing and assembly, and belongs to the lower end of cross-border division of labor production. The increase in the proportion of foreign value-added (FVA_INT) included in a country's intermediate goods exports indicates that in cross-border production, intermediate goods are repeatedly re-exported to third countries for final product production, indicating that the country may be upgrading its industrial structure and increasing its international position.

For the pure duplicate calculation part (FDC) in vertical specialization, although it includes pure duplicate calculations both domestically and internationally, its value can indicate the complexity of product value circulation worldwide and the deepening of international trade division. There is double counting in intermediate goods trade. The higher the proportion value obtained by dividing the pure double counting part (FDC) by vertical specialization (VS), the deeper the cross-border division of labor production. The more times intermediate goods cross border before becoming final goods.

2.4. Calculation Method of Global Value Chain Status Index

In order to compare the position of industries contained in various countries in the global value chain (GVC), Koopman et al. proposed the Global Value Chain Position Index. Its specific idea is to analyze the relative ratio of the export value of a country's corresponding industries as intermediate goods exported to other countries to the import intermediate value from other countries. Generally speaking, if a country is in an upstream position in the global value chain, it mainly participates in the division of labor production of the global value chain by providing raw materials or intermediate goods to other countries. Correspondingly, the decomposition results of bilateral trade indicate that the added value (IV) of

the country's exports to direct importing countries, which are then imported by third countries, should account for a high proportion of the country's total exports, compared to the country's exports, The proportion of foreign value added (FV) in exports, whether it is intermediate or final goods, is relatively large. On the contrary, if a country is located downstream of the global value chain and mainly participates in the global production division by reprocessing, assembling, and other processes of imported intermediate goods, then the proportion of foreign added value in the country's exports to the total exports will be relatively large compared to the proportion of domestic added value in exports. Based on the above analysis, construct a global value chain status index:

$$GVC\_position_{ir} = ln(1 + \frac{IV_{ir}}{E_{ir}}) - ln(\frac{FV_{ir}}{E_{ir}}) \quad (3)$$

$GVC\_position_{ir}$ measure status index of r country i industry, IV_{ir} shows the added value of intermediate goods from one's own country included in export E_{ir} to all other countries from r country i industry, FV_{ir} is value added in other countries included from E_{ir} ,which is r country i industry exports to all other countries.

Substitute the decomposed added value into formula (3) to obtain:

$$GVC\_position_{ir} = ln(1 + \frac{DVA\_REX_{ir}}{E_{ir}}) - ln(\frac{FVA\_FIN_{ir}+FVA\_INT_{ir}}{E_{ir}}) \quad (4)$$

$GVC\_position_{ir}$, from the meanings of each variable in the formula, it can be seen that in order to calculate this value, it is necessary to first decompose the paired exports of all countries in the world input−output table, and finally aggregate them to obtain the specific status index of that country.$GVC\_position_{ir}$ larger indicates that the country is located upstream of the global value chain, while conversely, it indicates that the economy is located downstream of the global value chain.

3. Empirical Analysis

3.1. Data Sources

This article selects the 2016 version of the World Input Output Database as the data source for empirical analysis. In the 56 industry categories of the 2016 World input-output Table, the information manufacturing industry code is r17 (computer, electronic, and optical product manufacturing), and the information services industry includes 4 categories, with codes r37 (publishing activities), r38 (film, video, television program production, recording, music publishing activities; program production, broadcasting activities), r39 (telecommunications), and r40 (computer programming, consulting and related activities, information service activities).

3.2. Global Value Chain Height Index of Chinese Information Industry and Its Comparison with Other Countries

According to the calculation method of the global value chain height index introduced in the first part of the article, the actual calculation of China's information industry is conducted, and Table 3 is obtained. The specific analysis is as follows:

Table 3. Global value chain height index of Chinese information industry

Time	Information manufacturing industry GHI	Information service industry GHI			
	Computer Electronics and Optical Equipment	Publishing activities	Movies, videos, TV programs, recording music activities	Telecommunication	Computer programming
2000	1.176	0.000	0.000	2.340	0.974
2001	1.228	0.000	0.000	2.344	0.952
2002	1.248	0.000	0.000	2.311	0.959
2003	1.217	0.000	0.000	2.304	1.010
2004	1.176	0.000	0.000	2.275	1.068
2005	1.199	0.000	0.000	2.245	1.104
2006	1.087	0.000	0.000	2.270	1.170
2007	1.014	0.000	0.000	2.254	1.231
2008	0.987	0.000	0.000	2.216	1.255
2009	0.945	0.000	0.000	2.251	1.298
2010	0.929	0.000	0.000	2.257	1.330
2011	0.901	0.000	0.000	2.262	1.338
2012	0.928	0.000	0.000	2.275	1.332
2013	0.865	0.000	0.000	2.305	1.352
2014	0.878	0.000	0.000	2.316	1.364

From Table 3, it can be seen that the global value chain height index of China's information manufacturing industry has gradually decreased from 1.176 in 2000 to 0.878 in 2014, and the global value chain height index has been decreasing year by year. Since 2008, China's information manufacturing industry has been in the middle and lower reaches of the global value chain.

For China's information service industry, the world input-output table shows that China's global value chain income for "publishing activities" and "film and video recording activities" is 0. Looking up the information industry export item in the domestic input-output table, it is found that there is export data. In theory, China has corresponding labor factor inputs, participates in global value chain division of labor, and obtains global value chain income. This is inconsistent with the data on the world input-output table, and the reason may be different from the statistical caliber of various industries in the information service industry. We can also observe that

India's global value chain revenue in "publishing activities" and "film and video recording activities" is also 0. From the perspective of the unified compilation of the 2016 edition of the World input-output Table, analyzing various industries around the world under a unified standard will not lose the comparability and authority of the results due to discrepancies with China's information industry statistics. So this article will not discuss the situation of China's information service industry in these two sub industries for the time being.

In China's information service industry, the global value chain height index of the telecommunications sub industry remains basically between 2.2 and 2.3, indicating that the telecommunications sub industry in China's information service industry has always been at a high position in the global value chain. The global value chain height of the computer programming sub industry has risen from the middle and downstream positions to the middle and upstream positions; From 2002 until 2014, there has been an upward trend, with a global value chain height index of 1.364 in 2014.

Looking at the global value chain height index of China's information industry alone, there is a lack of comparison. Comparing the global value chain height index of China with major developed and developing countries in the world can further understand the external development of China's information industry, as shown in Table 4.

Table 4. Global value chain height index of information industry in various countries in 2014

Country	Information manufacturing industry		Information service industry							
	Computer Electronics and Optical Equipment	sort	Publishing activities	sort	Movies, videos, TV programs, recording music activities	sort	telecommunication	sort	Computer programming	sort
China	0.878	8	0.000	9	0.000	9	2.316	2	1.364	2
Germany	1.140	3	0.994	5	1.214	1	0.719	10	1.012	6
France	1.138	4	1.115	3	0.992	6	0.745	8	1.063	4
Britain	1.075	5	1.072	4	1.029	4	0.874	7	0.989	7
India	0.790	10	0.000	9	0.000	9	1.928	3	1.800	1
Italy	1.067	6	0.851	6	1.017	5	0.996	5	1.060	5
Japan	0.969	7	0.823	7	0.951	7	1.134	4	1.069	3
South Korea	0.842	9	1.207	1	1.178	2	0.920	6	0.891	8
Russia	2.254	1	0.000	9	0.000	9	2.721	1	0.000	10
America	1.354	2	1.128	2	1.115	3	0.722	9	0.830	9

Table 4 shows the global value chain height index and income proportion of the information industry in 10 countries, including China, the United States, Japan, South Korea, and India, in 2014. China's information manufacturing industry ranks 8th out of ten countries, with Russia ranking first, the United States second, and Germany third. All three countries have significant advantages in manufacturing. In the information service industry, both China and India do not have statistical values for global value chain revenue in the industries of "publishing activities" and "film production and other activities", ranking last; Among the other eight countries, South Korea ranks first in the publishing industry, the United States second, France third, Germany first in the film production industry, South Korea second, and the United States third; Closely related to these two industries is culture, indicating that the cultural output of the top three countries is relatively strong compared to other countries. In the telecommunications industry, China ranks second, Russia ranks first, India ranks third, and France, the United States, and Germany rank last; In the computer programming industry, China ranks second, India first, Japan third, and South Korea, the United States, and Japan rank last.

Overall, the global value chain of China's information manufacturing industry is at a mid to low level, ranking lower among the ten countries; In China's information service industry, only from the perspective of the "telecommunications" and "computer programming" industries, its global value chain is at an upper middle level, ranking second out of ten countries.

3.3. Decomposition of Bilateral Trade Between China and the United States in the Information Industry

As the second largest economy in the world, China explores its bilateral trade with developed countries (the United States), understands the bilateral trade structure, and analyzes the differences in the development of China's information industry with the United States by decomposing the different value directions of exports. This helps us identify breakthroughs in the global development of the information industry, as shown in Tables 5 and 6.

Table 5. Breakdown of Bilateral Trade between China and the US Information Manufacturing Industry (Computer Electronics and Optical Equipment Industry)

Project / Time	TEXP	TEXPF	TRXPI	DVA	DVA_FIN	DVA_INT	DVA_INTrex	RDV	MVA	OVA	PDC
	(1)	(2a)	(2b)	(3)	(3a)	(3b)	(3c)	(4)	(5)	(6)	(7)
China exports to the US information manufacturing industry											
2000	13302.54	10602.65	2700.99	9377.71	7501.35	1426.51	449.85	16.79	413.50	3270.59	223.95
	1.00	0.80	0.20	0.70	0.56	0.11	0.03	0.00	0.03	0.25	0.02
2005	52972.81	45839.90	7140.63	33184.73	28873.25	3499.93	811.55	52.98	1539.45	17506.27	689.37
	1.00	0.87	0.13	0.63	0.55	0.07	0.02	0.00	0.03	0.33	0.01
2010	85064.25	76012.75	9060.47	58076.42	52155.42	4947.25	973.74	83.11	1881.42	24287.77	735.52
	1.00	0.89	0.11	0.68	0.61	0.06	0.01	0.00	0.02	0.29	0.01
2013	101274.31	70106.73	31171.50	71568.69	50350.24	17647.35	3571.11	370.73	1657.91	25204.02	2472.96
	1.00	0.69	0.31	0.71	0.50	0.17	0.04	0.00	0.02	0.25	0.02
2014	107292.74	72920.59	34377.76	78571.43	54248.85	20156.82	4165.76	428.55	1617.25	24142.22	2533.29
	1.00	0.68	0.32	0.73	0.51	0.19	0.04	0.00	0.02	0.23	0.02
US exports to China's information manufacturing industry											
2000	3182.20	1962.83	1219.72	2644.51	1715.74	644.24	284.52	117.36	14.34	326.24	79.75
	1.00	0.62	0.38	0.83	0.54	0.20	0.09	0.04	0.00	0.10	0.03
2005	5752.10	2929.03	2823.81	4731.66	2632.60	986.94	1112.11	411.29	39.41	366.40	203.34
	1.00	0.51	0.49	0.82	0.46	0.17	0.19	0.07	0.01	0.06	0.04
2010	7624.52	3945.46	3680.17	6645.87	3674.43	1471.47	1499.97	435.07	50.18	326.42	166.98
	1.00	0.52	0.48	0.87	0.48	0.19	0.20	0.06	0.01	0.04	0.02
2013	7648.00	4983.78	2664.80	6696.22	4530.88	1251.03	914.32	236.40	113.55	461.67	140.16
	1.00	0.65	0.35	0.88	0.59	0.16	0.12	0.03	0.01	0.06	0.02
2014	8653.65	5198.41	3455.89	7502.98	4712.92	1598.31	1191.75	313.92	139.26	507.51	189.98
	1.00	0.60	0.40	0.87	0.54	0.18	0.14	0.04	0.02	0.06	0.02

Table 6. Bilateral Trade Breakdown of China and US Information Services Industry (Including Publishing Activities, Film Production and Other Activities)

Project / Time	TEXP	TEXPF	TRXPI	DVA	DVA_FIN	DVA_INT	DVA_INTrex	RDV	MVA	OVA	PDC
	(1)	(2a)	(2b)	(3)	(3a)	(3b)	(3c)	(4)	(5)	(6)	(7)
China exports to the US information service industry											
2000	4.93	1.58	3.35	4.31	1.39	2.73	0.19	0.00	0.06	0.52	0.04
	1.00	0.32	0.68	0.87	0.32	0.63	0.04	0.00	0.01	0.11	0.01
2005	11.83	3.65	8.18	9.52	2.96	6.17	0.39	0.01	0.18	1.95	0.16
	1.00	0.31	0.69	0.81	0.31	0.65	0.04	0.00	0.01	0.17	0.01
2010	56.68	17.57	39.11	48.11	15.06	30.68	2.36	0.14	0.62	7.04	0.77
	1.00	0.31	0.69	0.85	0.31	0.64	0.05	0.00	0.01	0.12	0.01
2013	55.61	18.54	37.07	48.08	16.22	29.00	2.86	0.22	0.48	6.01	0.82
	1.00	0.33	0.67	0.86	0.34	0.60	0.06	0.00	0.01	0.11	0.01
2014	43.88	14.64	29.25	38.54	13.01	23.17	2.37	0.19	0.35	4.20	0.60
	1.00	0.33	0.67	0.88	0.34	0.60	0.06	0.00	0.01	0.10	0.01
US exports to China's information service industry											
2000	44.70	15.61	29.10	41.42	14.93	22.47	4.01	1.22	0.05	1.65	0.36
	1.00	0.35	0.65	0.93	0.36	0.54	0.10	0.03	0.00	0.04	0.01
2005	131.29	54.55	76.78	121.46	52.40	54.14	14.92	4.45	0.25	4.09	1.05
	1.00	0.42	0.58	0.93	0.43	0.45	0.12	0.03	0.00	0.03	0.01
2010	368.45	127.49	241.10	342.43	121.74	178.52	42.17	8.80	1.39	12.73	3.10
	1.00	0.35	0.65	0.93	0.36	0.52	0.12	0.02	0.00	0.03	0.01
2013	727.25	249.64	477.77	667.40	233.64	371.38	62.38	11.32	6.63	35.05	6.85
	1.00	0.34	0.66	0.92	0.35	0.56	0.09	0.02	0.01	0.05	0.01
2014	849.99	289.26	560.90	779.95	270.67	438.94	70.33	13.09	8.54	40.49	7.92
	1.00	0.34	0.66	0.92	0.35	0.56	0.09	0.02	0.01	0.05	0.01

Table 5 shows that China's information manufacturing industry to the United States mainly consists of exports of final products, with added value of final products . The proportion of DVA-FIN in total export TEXP fluctuates between 50% -60%, with a maximum of 61% in 2010; The proportion of intermediate product export value added to total output TEXP has experienced a process of first decreasing and then increasing; China added value in exports to the United States is absorbed by other countries , the proportion of DVA-INTrex in export TEXP is very small, not exceeding 5%.

Value added for final product exports in US exports to China information manufacturing industry_ DVA-FIN accounts for 50% of the total export TEXP, which is used for value-added of intermediate goods exports DVA-INT is between 15% and 20%, and the proportion absorbed by third countries is significantly higher than that of China, ranging from 10% to 20%. This indicates that China has a higher proportion of imported intermediate goods from the US manufacturing industry, which are processed and then exported to other countries. The global value chain height of China's information manufacturing industry is lower than that of the United States.

Table 6 shows that the trade export structure between China

and the United States is different, not only in terms of total volume, but also in terms of the proportion of each trade component. Compared to the information service industry in the United States, China is at a lower position in the global value chain. In terms of information service provision, the United States is in a high position in the value chain division of labor, mainly engaged in front-end service research and development design, while China is mainly engaged in back-end service configuration, etc.

3.4. Calculation of the Global Value Chain Status Index of the Information Industry

Based on the decomposition formula of bilateral trade exports, 44 countries and regions are grouped into paired ordered calculation units. After all traversal decomposition, the vertical professional structure and proportion of the global information industry are summed up. Based on the export decomposition formula, after completing the decomposition of bilateral information industry exports between all countries and regions, the foreign trade data of each country or region is summed up, and the corresponding global value chain status index is calculated using formula (4) of the global value chain status index. Table 7 shows the global value chain status index and world rankings of the information manufacturing industry in 10 major developed and developing countries, while Table 8 shows the global value chain status index and world rankings of the information service industry in 10 major developed and developing countries.

Table 7. Global value chain status index and world ranking of information manufacturing industry of 10 countries

Time	China	Germany	France	Britain	India	Italy	Japan	South Korea	Russia	America
2000	-0.0964 (21)	-0.0245 (13)	-0.0309 (15)	-0.0693 (20)	0.0791 (4)	0.0152 (9)	0.1723 (1)	-0.0199 (12)	0.0539 (5)	0.0995 (3)
2001	-0.0849 (21)	-0.0410 (15)	-0.0188 (10)	-0.0563 (17)	0.0631 (4)	0.0179 (7)	0.1643 (1)	-0.0321 (12)	-0.0302 (11)	0.0995 (2)
2002	-0.1120 (25)	-0.0243 (15)	-0.0011 (11)	-0.0184 (13)	0.0166 (9)	0.0387 (6)	0.1613 (1)	-0.0156 (12)	-0.0008 (10)	0.1266 (2)
2003	-0.1490 (30)	-0.0187 (12)	0.0138 (8)	-0.0471 (16)	0.0067 (9)	0.0489 (4)	0.1662 (1)	-0.0242 (13)	0.0259 (7)	0.1317 (2)
2004	-0.1696 (33)	-0.0104 (12)	0.0233 (9)	-0.0243 (15)	-0.0134 (13)	0.0364 (6)	0.1730 (1)	-0.0019 (11)	0.0475 (4)	0.1281 (2)
2005	-0.1729 (33)	-0.0203 (15)	0.0214 (7)	-0.0017 (11)	-0.0376 (20)	0.0305 (4)	0.1588 (1)	0.0107 (9)	0.0229 (6)	0.1223 (3)
2006	-0.1660 (31)	-0.0237 (17)	0.0349 (4)	0.0163 (14)	-0.0577 (20)	0.0304 (6)	0.1748 (1)	0.0294 (7)	0.0431 (3)	0.1340 (2)
2007	-0.1825 (34)	-0.0347 (18)	0.0413 (5)	0.0238 (11)	-0.0526 (19)	0.0383 (7)	0.1844 (1)	0.0602 (3)	0.0409 (6)	0.1317 (2)
2008	-0.1595 (29)	-0.0306 (15)	0.0376 (5)	-0.0155 (14)	-0.0539 (17)	0.0320 (7)	0.1657 (1)	0.0075 (9)	0.0446 (3)	0.1308 (2)
2009	-0.1209 (26)	-0.0286 (15)	0.0182 (8)	-0.0206 (12)	-0.1073 (22)	0.0050 (10)	0.1743 (1)	-0.0289 (16)	0.0448 (5)	0.1393 (2)
2010	-0.1164 (23)	-0.0145 (11)	-0.0037 (10)	-0.0922 (20)	-0.0735 (18)	-0.0502 (15)	0.1832 (1)	-0.0223 (13)	0.0368 (3)	0.1434 (2)
2011	-0.1076 (22)	-0.0238 (13)	-0.0063 (10)	-0.1130 (23)	-0.0974 (20)	-0.0458 (16)	0.1690 (1)	-0.0664 (18)	0.0304 (5)	0.1337 (2)
2012	-0.1073 (23)	-0.0243 (12)	0.0020 (9)	-0.0973 (20)	-0.1052 (22)	-0.0238 (11)	0.1507 (1)	-0.0532 (15)	0.0069 (7)	0.1277 (2)
2013	-0.0931 (25)	-0.0083 (12)	0.0048 (9)	-0.0783 (18)	-0.0799 (20)	-0.0143 (13)	0.1325 (1)	-0.0280 (15)	0.0027 (10)	0.1085 (2)
2014	-0.0739 (20)	0.0032 (7)	-0.0042 (8)	-0.0600 (18)	-0.0164 (10)	-0.0286 (14)	0.1053 (1)	-0.0191 (12)	-0.0178 (11)	0.1053 (2)

Table 7 shows the estimated global value chain status index of the information manufacturing industry in 10 countries, with the values in parentheses indicating the ranking of the country's information manufacturing industry among 44 countries or regions during that year. China is basically in the middle and lower reaches of the world. Japan firmly ranks first in the world, the United States second, and the rest of the developed countries are generally ranked below 20, at the mid to upper level. It is worth pointing out that India ranked fourth in the global value chain of information manufacturing in 2000, but has been fluctuating and declining since then. In 2014, it once again climbed to 10th place and regained its position at the middle and upper reaches of the world.

Table 8. Global value chain status index and world ranking of the information service industry of 10 countries

Time	China	Germany	France	Britain	India	Italy	Japan	South Korea	Russia	America
2000	0.0115(25)	0.0312(17)	0.0164(22)	0.0388(14)	0.078(5)	0.0505(10)	0.1438(1)	0.0536(8)	0.1004(3)	0.067(7)
2001	0.0115(25)	0.0335(18)	0.0234(20)	0.0417(16)	0.0807(7)	0.0578(10)	0.1376(1)	0.0619(9)	0.1008(2)	0.0811(6)
2002	-0.0077(33)	0.047(16)	0.0341(20)	0.0488(15)	0.0781(7)	0.0607(11)	0.1324(1)	0.0686(8)	0.0945(3)	0.0861(5)
2003	-0.0119(36)	0.0481(14)	0.0419(18)	0.0472(15)	0.0589(12)	0.0751(7)	0.1415(1)	0.0723(10)	0.106(3)	0.0884(5)
2004	-0.0209(35)	0.0554(12)	0.049(13)	0.0462(14)	0.066(10)	0.0734(9)	0.1503(1)	0.074(8)	0.1158(2)	0.0869(5)
2005	-0.0177(34)	0.0506(15)	0.0566(11)	0.045(17)	0.056(12)	0.0759(6)	0.1169(2)	0.0768(5)	0.1175(1)	0.0874(4)
2006	0.0032(30)	0.0504(15)	0.0617(10)	0.0439(16)	0.0671(8)	0.0704(6)	0.1103(2)	0.0598(11)	0.1147(1)	0.081(4)
2007	0.0117(32)	0.054(15)	0.0498(16)	0.0432(20)	0.0746(7)	0.0983(4)	0.1234(2)	0.0559(14)	0.1255(1)	0.0921(5)
2008	0.0184(30)	0.0468(16)	0.0425(19)	0.0436(18)	0.0847(5)	0.079(6)	0.1093(2)	0.0322(24)	0.1252(1)	0.0939(4)
2009	0.0273(26)	0.0512(14)	0.0359(22)	0.0259(28)	0.083(6)	0.0699(8)	0.1255(2)	0.0181(29)	0.1259(1)	0.0958(4)
2010	0.0216(28)	0.0549(15)	0.0546(16)	0.0318(25)	0.0754(6)	0.0604(11)	0.1332(1)	-0.0001(34)	0.1242(2)	0.1025(3)
2011	0.0286(24)	0.058(10)	0.048(16)	0.0272(25)	0.0177(27)	0.0666(7)	0.1186(1)	-0.0353(37)	0.1115(2)	0.0984(3)
2012	0.0323(22)	0.0601(10)	0.0549(14)	0.0237(26)	0.0216(27)	0.0674(9)	0.1398(1)	-0.0428(38)	0.1003(2)	0.098(3)
2013	0.0298(28)	0.0674(11)	0.0604(13)	0.0335(27)	0.0504(21)	0.0793(7)	0.1473(1)	-0.036(36)	0.1292(2)	0.0968(3)
2014	0.0437(18)	0.0658(8)	0.0464(17)	0.0401(20)	0.0508(13)	0.0701(7)	0.143(1)	-0.0398(36)	0.1123(2)	0.0998(3)

Table 8 shows the global value chain status index and ranking of the information service industry in 10 countries. The global value chain status index of China's information service industry rose to 18th in 2014, ranking among the middle and upper reaches. Russia, Japan, and the United States are among the top three in the global value chain of the information services industry. Developed countries such as the UK, France, and Germany are located at the upstream of the global value chain in the information services industry. The global value chain status index of India's information services industry quickly rose to 13th in 2014, at the mid to upper level. South Korea is basically on a downward trend, falling to 36th in 2014, at the downstream level.

Although China's exports of both information manufacturing and information services industries are among the top in the world, according to the global value chain status index, China's information industry is basically at the global average level and the trend of moving towards the middle and upper reaches is relatively slow.

4. Conclusion

From the perspective of the participation of the information industry in the global value chain division of labor, the value chain height index of China's information manufacturing industry has been continuously decreasing, from 1.176 in 2000 to 0.878 in 2014, which is at the middle and downstream level; On the other hand, in the information service industry,

the telecommunications industry maintains a relatively high value chain height of 2.3, while the computer programming industry slowly rose from 0.974 in 2000 to 1.364 in 2014, ranking in the middle and upper reaches. From the ranking of the global value chain revenue share of the information industry in the 10 selected countries in 2014, the United States ranked first with a proportion of 3.00%. The proportion of major developed countries ranked high, while China and India ranked low with a proportion of 1.173% and 1.891%, respectively, ranking 9th and 8th.

From the decomposition results of bilateral trade between the information industry and other countries, it can be seen that there is an imbalance in bilateral trade between China and the United States in information manufacturing and information service industries. In Sino US trade, the main focus is on intermediate goods. China exports about 80% of intermediate goods, while the United States exports about 60% of intermediate goods. The proportion of added value from foreign countries included in China's exports is relatively high, and the height of China's own value chain is lower than that of the United States. Compared to the United States, China's information industry has a lower value chain position. The United States mainly engages in research and development, design, and other work, while China is more engaged in less value-added work such as assembly and reprocessing.

From the Global Value Chain Status Index, China's information manufacturing industry ranked 212.34 in 2000 and 34.34 in 2007, and gradually rebounded. In 2014, it ranked back to 20, ranking at the middle and lower reaches of the world. Japan firmly ranks first in the world, the United States second, and the rest of the developed countries are basically ranked in the top 20, fluctuating up and down in the middle and upper reaches. The global value chain status index of China's information service industry ranked 25th in 2000, decreased to 35th in 2003, and began to fluctuate and rise. In 2014, it rose to 18th, ranking in the middle and upper reaches. Russia, Japan, and the United States are among the top three countries in the global value chain of the information services industry, while developed countries such as the UK, France, and Germany are in the upper reaches of the information services industry.

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