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Analysis on the Evolution Characteristics of China's Manufacturing Industry Structure——Based on the Perspective of Global Value Chain

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Abstract. As the largest developing country, China has been the world's leading manufacturing country for eight consecutive years.However, with the deepening of the academic research on the competitiveness of manufacturing industry and the development of global value chain, the views on whether China's manufacturing industry is in the "low-locked" in the global value chain are different, mainly due to the differences in the measurement and evaluation methods of competitiveness.By constructing the global value chain index, this paper examines the global value chain potential and its changes in China from the perspective of macro industry, and provides a reference for the research model of the embedded potential and governance model selection in the global value chain of Chinese manufacturing industry.

1. Introduction

At present, China has become the world's largest manufacturing country, making important contributions to domestic economic and social development, as well as an important support of the world's economic growth. From the horizontal comparison between China's manufacturing industry and developed countries, China's manufacturing industry has developed rapidly,as shown in table1. In 2005, China's manufacturing industry accounted for 9.56% of the world's manufacturing industry in terms of current US dollars, ranking the third in the world.Five years later, China's global share of manufacturing value-added reached 18.39%, surpassing the United Statesasthe world's largest manufacturing country for the first time.In 2016, China's manufacturing added value share reached 26.2%, far exceeding that of Japan and Germany, which were ranked second and third respectively, and equivalent of the combined value of the United States and Japan. The growth rate of China's manufacturing industry was much higher than that of the developed countries in Europe and America in the same period. China has maintained the status of the world's largest manufacturing country for eight consecutive years, which has enhanced China's position in the international division of labor in the pattern of globalization.

Table 1The proportion of manufacturing added value of major countries in the world ranking

countries	1997			2005			2010			2016		
	Rank-ing	AV of manufacturing ($trillion)	Share (%)	Rank-ing	AV of manufacturing ($trillion)	Share (%)	Rank-ing	AV of manufacturing ($trillion)	Share （%）	Ran-king	AV of manufacturing ($trillion)	Share （%）
China	-	-	-	3	0.73	9.56	1	1.92	18.39	1	3.23	26.20
USA	1	1.38	23.21	1	1.69	22.02	2	1.81	17.28	2	2.16	17.55
Japan	2	1.03	17.40	2	1.03	13.42	3	1.19	11.35	3	1.04	8.46
Germany	3	0.45	7.58	4	0.58	7.58	4	0.68	6.52	4	0.72	5.83
South Korea	7	0.13	2.26	8	0.23	2.99	5	0.30	2.91	5	0.38	3.08
India	11	0.07	1.19	11	0.13	1.75	9	0.27	2.57	6	0.35	2.82
Italy	5	0.23	3.82	5	0.29	3.75	6	0.30	2.89	7	0.27	2.21
French	6	0.21	3.59	6	0.27	3.51	8	0.27	2.61	8	0.25	2.07
UK	4	0.24	3.99	7	0.25	3.28	10	0.22	2.08	9	0.24	1.94
Indonesia	12	0.06	0.97	15	0.08	1.02	13	0.17	1.59	10	0.19	1.55
Brazil	8	0.11	1.93	12	0.13	1.71	7	0.28	2.69	11	0.18	1.50
Mexico	9	0.10	1.70	10	0.14	1.80	14	0.16	1.57	12	0.18	1.47
Spain	10	0.10	1.65	9	0.16	2.13	12	0.17	1.66	13	0.16	1.29
Russia	-	-	-	13	0.12	1.56	11	0.20	1.87	14	0.15	1.25
Turkey	13	0.04	0.69	14	0.08	1.11	15	0.12	1.11	15	0.14	1.16

Note: data from the World Bank shows that manufacturing activity increased in current dollars.

However, as China enjoys the reputation of the world's largest manufacturing country, with further research on manufacturing competitiveness and the development of the global value chain, scholars have joined the debate about 'low-locked' of Chinese manufacturing,especially in the case of China's strategic transformation and upgrading.In addition, scholars also have different views on the status quo of China's manufacturing competitiveness. Until now, the findings of the study are still controversial on the international competitiveness of China's manufacturing industry.

At present, it is generally accepted that the international competitiveness of China's manufacturing industry is in the low value-added link of the global value chain, and enterprises in developed countries firmly control the high value-added link of the value chain (Yue Zhuo, Zhang Min, 2008[1], Bingzhan Shi ,2010[2]). While some scholars believed that the international competitiveness of China's manufacturing industry was becoming stronger and more advanced. Yu Juanjuan (2014)[3] found that the technical structure of China's export products under the division of global value chain showed a trend of continuous optimization. QiuBin et al. (2008)[4] showed that the global production network promoted the promotion of the division of labor in China's manufacturing industry from 2001 to 2009.

It can be seen that different views on the improvement of competitiveness are mainly due to the differences in the measurement and evaluation methods of competitiveness. Analyzing the position of China's manufacturing industry in the global value chain is the key to find the industrial interaction and upgrading. By constructing index of global value chain, this paper examines the potential global value chain and its change from the macro industrial level to provide a reference for the research model of the embedded potential and governance model selection in the global value chain of Chinese manufacturing industry.

2. Global value chain index construction
The deepening division of labor in the global value chain promoted the rapid growth of global GDP and had a significant impact on international trade (Gereffi, 2016)[5]. With the development and improvement of the inter-country input-output database, it is increasingly important to analyze the value chain by using the foreign import and domestic input matrix in the input-output table.

The deep participation of developing countries in the global value chain will bring benefits to these countries and promote the transition to higher value-added economic activities in the value chain. China has become one of the three countries deeply involved in the global value chain (Dollar, 2017)[6]. The impact of participating in global value chain on developing countries with a lower participation rate and at the upper end of the value chain is higher than that of developed countries at the same level (sheng bin et al., 2016)[7]. Koopman (2010) comprehensively considered the two roles

of a country as the supplier and recipient of intermediate goods, covering indirect export of domestic added value and foreign added value in export, and proposed GVC-position index to calculate the international status of labor division [8]. Then, the introduction of the total trade accounting rules—through the global multi-sector input-output database, expands domestic value-added statistics from a single country to a regional or global scale, and systematically defines and measures the value-added and double-counting portions of official statistics in trade data—has become the mainstream research method of global value chain measurement.

To measure the degree and status of division of Chinese manufacturing industry in the global value chain, this section reference Koopman (2010) and Li Yan et al.(2018)[9]. By constructing the Global Value Chain Status Index and the Global Value Chain Participation Index, this paper examines the status of China's manufacturing global value chain status index and global value chain participation; Furthermore, this paper further explores the status of China's manufacturing industry segments and value-added trade exports, in order to improve the status in the global value chain, increase trade gains and provide empirical reference for improve the international status.

According to the decomposition method of Koopman (2010) on a country's total exports, the added value of exports can be divided into the following five parts. The specific decomposition formula is as follows:

$$E_r = V_r B_{rr} \sum_{s \neq r} Y_{rs} + V_r B_{rr} \sum_{s \neq r} A_{rs} X_{ss} + V_r B_{rr} \sum_{s \neq r} A_{rs} X_{st} + V_r B_{rr} \sum_{s \neq r} A_{rs} X_{sr} + FV_r \quad （1）$$

In this formula, the first polynomial represents the domestic value added of country r that is absorbed by the direct importing country in the export of final products and services. The second polynomial represents the domestic value added of country r, which is included in the export of intermediate products and used by the direct importing country to produce domestic demand products. The third polynomial represents the domestic value added of country r, that is, the indirect value-added exports of country r (CIV), which are included in the intermediate products and used by the direct importing country to produce products and export to the third country. The fourth polynomial represents the domestic value added in country r which is included in the intermediate products and used by the direct importing country to produce products for export and return to country r. The fifth polynomial represents the value added of exports abroad.

The global value chain (GVC) status index refers to the comparison between the export and import values of "intermediate goods" of one country's industry, that is, the difference between the logarithmic values of intermediate goods exported to another country and that of imported intermediated goods used in the exported products of the same industry. The specific formula of the GVC state index is:

$$GVC\_Position_{ir} = In(1 + IV_{ir}/E_{ir}) - In(1 + FV_{ir}/E_{ir}) \quad （2）$$

In this formula, $GVC\_Position_{ir}$ represents the position of global value chain division of industry i in country r; IV_{ir} Represents the added value of export trade of industry i in country r (IDC); FV_{ir} Represents the foreign added value (FVA) of the export products of industry i in country r; E_{ir} Represents the total amount of value added trade of industry i in country r. A high value of the global value chain division position index indicates that country r's industry i has a high GVC status, a dominant position in the global value chain and an international competitive advantage in the industry. If the index is small, country r is at a disadvantage of global value chain in industry i.

The global value chain (GVC) engagement index represents the degree to which an industry in a country participates in GVCS. The formula is as follows:

$$GVC\_Participation_{ir} = (IV_{ir} + FV_{ir}/E_{ir}) \quad （3）$$

A high value of the global value chain participation index indicates a high degree of participation in the global value chain of industry I in country r and vice versa.

3. Index analysis and conclusions

The relevant data used for the index measurement are all from the world input-output database (WIOD) in 2016. The database provides input and output data of intermediate products and source data of final product consumption in 44 major countries and regions in the world from 2000 to 2014, in 56 sectors (1-4 is the sector providing the means of production, 5-22 is the manufacturing sector, and 23-56 is the service sector). The biggest feature of this database is that it provides the input and output data for 20 consecutive years. Therefore, the analysis of the continuous time series can comprehensively reflect the dynamics of China's trade added value in the past 20 years, so as to accurately judge the real situation of China's manufacturing industry participating in the global value chain.

Based on the world input-output data, the GVC index formula was used to calculate the degree and status of China's overall participation in GVC in export trade from 2000 to 2014.

Table 2 The status and extent of China's export trade participation in GVCS

	Overall GVC status index	Overall GVC participation index	Manufacturing GVC status index	Manufacturing GVC participation index
2000	-0.0101	0.2610	-0.0379	0.2663
2001	-0.0045	0.2544	-0.0329	0.2598
2002	-0.0146	0.2651	-0.0451	0.2731
2003	-0.0427	0.2844	-0.0709	0.2948
2004	-0.0600	0.3040	-0.0846	0.3155
2005	-0.0653	0.3022	-0.0891	0.3125
2006	-0.0604	0.3031	-0.0801	0.3140
2007	-0.0631	0.3022	-0.0831	0.3140
2008	-0.0442	0.2938	-0.0635	0.3071
2009	-0.0290	0.2571	-0.0483	0.2702
2010	-0.0354	0.2747	-0.0544	0.2894
2011	-0.0260	0.2769	-0.0443	0.2919
2012	-0.0216	0.2631	-0.0399	0.2781
2013	-0.0177	0.2614	-0.0320	0.2768
2014	-0.0013	0.2519	-0.0131	0.2665

In terms of the overall GVC index, although China has been widely involved in the global value chain division of labor system, the export status index is always less than 0 because the foreign added value contained in the export is higher than the indirect added value, indicating that China's overall export status is always not high. From the perspective of GVC index of the manufacturing industry, Chinese manufacturing industry is deeply involved in the global value chain, but its position in the global value chain is less than 0, which is still not high.

In order to further analyze the status and degree of different categories of manufacturing participating in GVCS, the manufacturing sector is subdivided into three industry categories of labor-intensive manufacturing, resource-intensive manufacturing and knowledge-intensive manufacturing to examine the specific conditions of different industries.

Table 3The status and degree of China's manufacturing sector's participation in GVCS

	Labor-intensive manufacturing		Resource-intensive manufacturing		Knowledge intensive manufacturing	
	status	participate	status	participate	status	participate
2000	-0.0788	0.1931	0.0500	0.2678	-0.0527	0.3166
2001	-0.0762	0.1893	0.0481	0.2525	-0.0426	0.3098
2002	-0.0798	0.2018	0.0418	0.2580	-0.0640	0.3206
2003	-0.0879	0.2118	0.0257	0.2780	-0.1011	0.3420

2004	-0.0905	0.2271	0.0169	0.3031	-0.1222	0.3558
2005	-0.0909	0.2145	0.0062	0.3004	-0.1227	0.3562
2006	-0.0829	0.2089	0.0207	0.3084	-0.1154	0.3568
2007	-0.0811	0.1985	0.0219	0.3097	-0.1196	0.3578
2008	-0.0655	0.1892	0.0302	0.3133	-0.0968	0.3426
2009	-0.0433	0.1602	0.0179	0.2638	-0.0736	0.3074
2010	-0.0516	0.1797	0.0035	0.2841	-0.0765	0.3197
2011	-0.0429	0.1860	0.0075	0.2957	-0.0665	0.3185
2012	-0.0338	0.1700	0.0068	0.2833	-0.0631	0.3055
2013	-0.0300	0.1705	0.0088	0.2790	-0.0529	0.3053
2014	-0.0177	0.1648	0.0263	0.2703	-0.0318	0.2922

As the table3 shown, in terms of the global value chain status index, Resource-intensive manufacturing has the highest position in the global value chain, labor-intensive manufacturing is inferior to resource-intensive manufacturing, and knowledge-intensive manufacturing has the lowest position in the global value chain. However,in terms of global value chain participation, knowledge intensive manufacturing industry has the highest degree of participation, followed by resource-intensive manufacturing industry, and labor-intensive manufacturing industry has the lowest degree of participation. From the perspective of the trend, the GVCS of the three categories of manufacturing industries show a fluctuating and rising trend, among which the knowledge-intensive manufacturing industry and labor-intensive manufacturing industry have shown an obvious rising trend in recent years. In addition, the degree of participation of the three categories of manufacturing industries in GVCS tends to rise first and then decline.The degree of global value chain participation is from high to low in order for knowledge intensive manufacturing, resource-intensive manufacturing and labor-intensive manufacturing. This shows that although knowledge-intensive manufacturing industry has a higher degree of participation in international division of labor, its position in global value chain is quite the opposite. Although China's knowledge-intensive manufacturing industry has entered the high-end industry, it is still engaged in the low-end production link that relies on the comparative advantage of labor force. China should promote the high-end layout of knowledge-intensive manufacturing industry, deeply integrate into the GVC system, give full play to the development advantages of China's manufacturing industry, provide sufficient jobs and drive economic growth.

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