

Research on the Upgrade Path of Global Value Chain of Northeast Equipment Manufacturing Industry Based on Value-added Trade

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Abstract. The research on the upgrading of global value chain (GVC) mostly showed from the national perspective, there was little research on the Northeast China equipment manufacturing industry into GVC and upgrading. Based on the value-added trade, this paper creates analytical framework that reflects the participation and position of regional industries in GVC, which measures and analyses the four Northeast China equipment manufacturing sub-sectors, basic metals and metal products, machinery, electronic and optical equipment, transportation equipment. Upgrade path of the basic metal and metal products industry is proposed from process to product. Machinery realizes functional upgrading. Electronics and optical industry needs to upgrade from product to production process and then to function. Transportation equipment industry needs to build a national value chain (NVC) that interfaces with the GVC to achieve chain upgrade.

Introduction

Since the 1990s, the international division of labor according to GVC has become the new normal of countries participating in specialization under economic globalization. The manufacturing industry is the main industry participating in GVC, and the equipment manufacturing industry is the key development industry in China. The report of the 19th National Congress clearly pointed out that it is necessary to “Promoting China's industry to move towards medium-high end of GVC, and foster a number of world-class advanced manufacturing clusters.” On the basis of Koopman's value-added decomposition of a country's exports, Chinese and foreign scholars discuss the degree of GVC_participation and GVC_position, upgrade path which focuses on equipment manufacturing industry from a national perspective. However, studying at the national level obviously lacks guidance for regional industrial upgrading. In 2015, the “Opinions on Comprehensively Revitalizing the Old Industrial Bases in the Northeast” was proposed that the Northeast should become an internationally competitive advanced equipment manufacturing and a major technical equipment strategic base. Therefore, it cannot be an evaded epochal topic that the Northeast equipment manufacturing industry cultivate new advantages in GVC in the new round international specialization, and get rid of the constraints of the existing path to achieve industrial upgrading.

Literature Review

The value added trade measuring method can be traced back to the discussion of vertical specialization which is proposed by Hummel et al. (2001, HIY).Koopman(2014) decomposed a country's export into five parts and created the model of GVC_position and GVC_participation to measure the situation of a country's industry in GVC. Researches of domestic scholars on value-added trade mainly focus on the measurement of industrial position and division of labor participation.Liu Zhongli, Zhao Ying (2014), Fan Maoqing, Huang Wei (2014), concluded that Chinese industries have gradually improved their position in GVC. However, more domestic scholars believe that China's industry is still unable to get out of the dilemma of “low-end locking” and “vertical crushing” from developed countries. Qiao Xiaoyong(2017) used the GVC_position to estimate the international position of Chinese manufacturing industry,

concluded that Chinese manufacturing industry has a low position in GVC and presents an L-shaped evolution trend. To sum up, the above researches explored industrial upgrading from national perspective and lack of analysis of regional perspective. Therefore, the study of this paper create the position and participation index of a region in GVC. Moreover, empirical analysis on the position and participation of the sub-sectors of equipment manufacturing industry in northeast China in GVC. Finally, proposing the upgrading path based on different position and participation indices.

Models And Data

Model Creation.

According to position and participation of a country in GVC which are proposed by Koopman et al. This paper creates $GVC_position_{irj}$ and $GVC_participation_{irj}$ which indicate the position and participation index of sector i in region j of country r in GVC.

$$GVC_position_{irj} = \ln(1 + \frac{IV_{ir} \times \frac{N_{irj} \times Q_{ir}^{-1}}{E_j \times E^{-1}}}{E_{ir}}) - \ln(1 + \frac{FV_{ir} \times \frac{M_{irj} \times M_{ir}^{-1}}{E_j \times E^{-1}}}{E_{ir}}) \quad (1)$$

$$GVC_participation_{irj} = \frac{IV_{ir} \times \frac{N_{irj} \times Q_{ir}^{-1}}{E_j \times E^{-1}}}{E_{ir}} + \frac{FV_{ir} \times \frac{M_{irj} \times M_{ir}^{-1}}{E_j \times E^{-1}}}{E_{ir}} \quad (2)$$

IV_{ir} is the domestic value added of sector i of country r after the export of the intermediate products then exported to the third country; N_{irj} represents the increase in the total output of sector i in region j of country r , and Q_{ir} represents the increase in the total output of sector i of country r . Then, $N_{irj} \times Q_{ir}^{-1}$ can be used to measure the contribution of the industry i of region j to the added value of the total domestic production of country r . Using this ratio to adjust the national indirect export value added to the region. FV_{ir} is the value added from abroad in the export of sector i of country r . M_{irj} is used to measure the amount of imported intermediate products in sector i in region j of country r .

Data Acquisition.

This paper matches customs HS2016 code of sub-sectors of equipment manufacturing industry with the OECD classification, determines four sub-sectors of manufacturing industry in northeastern China: basic metal and metal products, mechanical equipment, electronic and optical equipment, transportation equipment.

Empirical Results and Analyses

GVC_Participation and GVC_Position of Sub-Sectors Industry of Equipment Manufacturing Industry in Northeastern China.

From 2003 to 2011, the GVC_participation of the world basic metal and metal products averaged 0.408, and the average GVC_position was -0.309. Which indicated that the industry was involved in the upstream in GVC, and the proportion of imports in export products was smaller than the world average. The reason is that northeast China is rich in coal, petroleum and other resources. As known, basic metal and metal products belong to resource processing intermediates. The high value of the GVC_positions and the low level of GVC_participation mean that the basic metal and metal products industry in northeastern China play the role of resource provider in GVC. Behind it is environmental pollution and resource exploitation.

From 2003 to 2011, the GVC_participation of mechanical equipment in the world was 0.367, and the average position was -0.287. It indicated that there were a large number of foreign intermediate products imported in the exported machinery and equipment products in northeastern China. This shows that although there are various leading enterprises in the region, with outstanding scale advantages and industrial foundation, the intermediate products exported are mostly low-priced, low-tech parts, causing it difficult to participate in the deep GVC. The low-level operation of the position of GVC accompanied by

the high-level operation of the participation exposed that there was a lack of core technology advantages in sub-sector of mechanical equipment in northeastern China.

Table 1 GVC_Participation of Sub-Sectors of Equipment Industry in Northeast China

Sub-sectors	2003	2004	2005	2006	2007	2008	2009	2010	2011
Basic metal and metal	0.197	0.129	0.122	0.132	0.128	0.152	0.151	0.183	0.108
Mechanical equipment	0.574	0.687	0.715	0.621	0.659	0.623	0.719	0.645	0.664
Electronics and optical	1.079	1.063	0.911	0.876	0.858	0.799	0.886	0.869	0.939
Transport equipment	1.424	1.844	1.333	1.060	0.774	0.780	0.584	0.580	0.666

Data source: by calculation based on OECD-WTO (TiVA) database.

Table 2 GVC_Position of Sub-Sectors of Equipment Industry in Northeast China

Sub-sectors	2003	2004	2005	2006	2007	2008	2009	2010	2011
Basic metal and metal	-0.156	-0.101	-0.098	-0.099	-0.090	-0.114	-0.123	-0.082	-0.101
Mechanical equipment	-0.441	-0.471	-0.513	-0.449	-0.463	-0.432	-0.495	-0.451	-0.454
Electronics and optical	-0.664	-0.631	-0.543	-0.510	-0.481	-0.470	-0.539	-0.519	-0.557
Transport equipment	-0.830	-0.958	-0.758	-0.624	-0.483	-0.486	-0.393	-0.389	-0.433

Data source: by calculation based on OECD-WTO (TiVA) database

From 2003 to 2011, the GVC_participation of the world electronic appliances and optical equipment averaged 0.426, the average position was -0.288, there was a negative correlation between GVC_participation and GVC_position. For knowledge-intensive industries such as electronic appliances and optical equipment, the production is highly modular and has many production links. It is an industry with high degree of value chain division in the equipment manufacturing industry. The average backward linkage of electronic appliances and optical equipment in northeastern China reached 0.832. The high participation in GVC stemmed from foreign imports, and the lack of core technology had led to the dependence of key components and intermediate products, and the upstream industry chain of producer-driven equipment manufacturing. To this end, there was a high degree of deviation between value-added trade and total value trade. In the process of global value chain integration, there was a mismatch in the low value-added ability of high-tech industries.

From 2003 to 2011, the participation of the world's transportation equipment averaged 0.418, the average position was -0.306. It is worth mentioning that transportation equipment is the leading industry in Jilin Province. It was the main industry participating in the international vertical division of labor. However, the position of the transportation equipment industry in Jilin Province participating in GVC was -1.540, which was significantly lower than -0.122 in Liaoning Province and -0.103 in Heilongjiang Province. The reason is that behind the high output and export volume, it was relatively low value capture capability, and this comparative disadvantage was continuously accumulated and amplified in larger-scale exports, resulting in a very low position index of the transportation equipment industry in Jilin Province.

Path of Industry Upgrading

Industrial Upgrading Path for Basic Metal and Metal Products Industry.

To break through the constraints of static comparative advantage, upgrade the factor endowment structure, reduce the export of basic metal and primary processed metal products, and make proper import. In this upgrade path, companies should actively establish strategic partnerships with upstream foreign suppliers, highlight long-term cooperation, procure raw materials from resource-rich suppliers, reduce costs in GVC division to achieve economies of scale, and complete product and production process upgrades. The

specific upgrade path should increase GVC participation while reducing the position index in GVC, and reduce the high pollution, resource-consuming industrial layout in the country.

Industrial Upgrading Path for Mechanical Equipment Industry.

As a traditional advantaged industry in northeastern China, the mechanical equipment industry should establish industrial clusters, optimize the correlation model between local manufacturing enterprises and multinational corporations, give policy support in financing, taxation, R&D, etc., guide enterprises to establish industry cluster, expand the scale of enterprises, give full play to the positive effect of the aggregation effect and scope economy on improving the bargaining power of mechanical equipment enterprises in northeastern China, increase the value added of regional product exports, and increase the ability of independent innovation, drive the overall upgrading of enterprise technology within the industrial cluster, optimize the structure of upstream and downstream participation in specific industry value chains, and create more upstream value-added parts to achieve functional upgrades across GVC.

Industrial Upgrading Path for Electronic Appliances and Optical Equipment.

The electronic appliances and optical equipment industry, as an industry with neither industrial base nor growth advantage in northeastern China, one of its upgrade strategies is to build an industrial chain integration mechanism which is supported by government with leading enterprises as the core. Since the biggest problem in the upgrading of electronic appliances and optical equipment industry in northeastern China is “group innovation inertia”, it is necessary to build a core technology chain and core industry chain that support the upgrading of manufacturing industry, so as to reverse the “innovation inertia of group innovation” under the lock of low-end links. Therefore, the strategy is to create a new, long-term cooperation mechanism for production, education and research to maximize the use of innovative resources and research and development strengths of universities, and to complete conversion from low-end processing and assembly link to high value-added link of R&D of electronic appliances and optical equipment industry in northeastern China, to realize the upgrading of products and production processes, and to realize the development goals of achieving high-end knowledge-intensive equipment manufacturing and branding of advantageous industries.

Industrial Upgrading Path for Transportation Equipment Industry.

Transportation equipment is the most easily upgraded sub-sector among the three knowledge-intensive equipment industries in northeastern China. Since 2008, its position in the global value chain has entered an upward path. At present, the position and participation index in GVC are closest to the world average level, and the overall position index of transport equipment industry in China is slightly higher than the world average, in the global division of labor system, there is a balanced governance model with complementary proximity and technology sharing between the transportation equipment industry in northeastern China and the developed countries. Therefore, the transportation equipment industry in the northeast can absorb the various core technologies within the system by means of national policy support and industrial linkages and diffusion effects among various regions in the country. Based on this, more abundant and close economic and technological links will be launched in different regions of China, which will promote the connection between GVC and national value chain (NVC), and realize the reconstruction in GVC of the transportation equipment industry.

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