

A Study on the Influence Factors of Vertical Specialization of Manufacturing Industry

-- Taking CAFTA as An Example

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Abstract

This paper takes the vertical specialization of the manufacturing industry in CAFTA as the research object. By combining the two frameworks of standard international trade division theory and industrial organization theory, this paper calculates the vertical specialization share of China's manufacturing industry, and further subdivides China's manufacturing into 16 industries to calculate the ratio of vertical specialization of manufacturing industry between China and ASEAN countries to analyze the division and cooperation model and find that the degree of division of labor between the two sides is growing rapidly on the whole, but the process still needs to be further explored and strengthened. As for influencing factors, the empirical results show that market concentration, investment intensity of technical, industry cost profit margin and industry openness have positive effect on vertical specialization share in manufacturing, while input intensity of labor, total labor productivity and international industrial competitiveness has opposite effect.

Keywords

Vertical specialization; CAFTA; Manufacturing; influencing factor.

1. RESEARCH BACKGROUND

Since the beginning of reform and opening-up in 1978, relying on the advantages of abundant labor resources and low production costs, China has taken the initiative to integrate into the globalized division of labor system by undertaking the processing and manufacturing of labor-intensive products in developed countries. Today, China's manufacturing industry has gradually formed a complete and clear industrial system, which has become an important support for the development of the national economy and has made a strong contribution to the development of the global economy. However, it is undeniable that compared with the advanced manufacturing powers in the world, China's current manufacturing industry still lack of core competitiveness. How to build a manufacturing strategy that occupies an international competitive advantage, how to break through the bottleneck of upgrading so as to improve China's overall international industrial division status, the above-mentioned problems have become major issues that China urgently needs to explore. In addition, the rapid development of network information technology and the transformation of modern communication methods have also provided essential elements for the further deepening of the fragmentation and decomposition of the industrial organization structure. The manufacturing industry, especially the industrial chain of trade products, has been greatly expanded. This has promoted the rapid development of global trade in intermediate goods, and the international vertical specialization of labor has increasingly become an important form of industrial division of labor.

Under the background of the international industrial division of labor and the domestic industrial upgrading, China has continuously analyzed and used its own comparative advantages, actively participated in and integrated into the international vertical specialization system. On January 1st, 2010, the China-ASEAN Free Trade Area (CAFTA), one of the three major regional economic cooperation areas in the world, was formally established, and this area has also become a restructuring area for China, which is now in a deep-water zone of transformation. At the same time, the State Council officially issued "Made in China 2025" on May 19th, 2015. This is a major deployment made by the Chinese government from a high level of national strategy. Its purpose has always been to enhance the innovation capability of China's manufacturing industry. Therefore, research the current intra-product division of labor and related influencing factors in the important stage of the reshaping of the global industrial structure is of great value for China to break through the low-end value chain of international division of labor.

2. LITERATURE REVIEW

From the beginning of the theory of international division of labor to today, the international division of labor has undergone a detailed development from inter-industry division to intra-industry division and then to intra-product division of labor. Nowadays, the international division of labor has been deepened layer by layer, that is, the deeper integration of different industries, products, different processes and production links, and a multi-layer and three-dimensional international division of labor has been gradually constructed. Since the late 20th century, the rapid development of vertical specialization and trade in the international economic phenomenon has aroused extensive attention of scholars from all over the world, and the discussion and research literature on it have been constantly emerging at home and abroad, which has become one of the important research directions of the economic discipline. The following three aspects can roughly cover the existing theoretical research framework : (1) Analyze the motivation and basis of international vertical specialization and trade; (2) Conduct quantitative research on the participation of a country or industry in international vertical specialization and trade; (3) Discuss the international vertical specialization division of labor and the impact of trade on the country from the perspective of economic effect.

The current research on the motivation and foundation of vertical specialization can be divided into two framework systems. In the research supported by the theory of division of labor in international trade, the factors such as comparative advantage, economies of scale, imperfect competition and trade environment are summarized as the motivation and basis for promoting vertical specialization and trade in international trade. The other research is based on the theoretical framework of industrial division of labor and industrial organization. It holds that industrial structure, factors of technology and labor productivity, openness of specific industries, and institutional factors are the basis of influencing international vertical specialization of labor. Zhaoling Hu (2007) believe that driven by cost reduction, enterprises will seek global division of labor and layout of production links through comparative advantages, so economies of scale are the decisive factor for international vertical specialization [1]. Wu Liping and Chai Lulu analyzed the panel data and believed that the industry market structure or market concentration was the most important factor, and the R&D investment and technology investment intensity and industry openness were also important factors influencing the vertical specialization of China-ASEAN manufacturing industry [2].

As for the quantitative research on international vertical specialization and trade, there are a lot of economic indicators used in the research and the calculation methods are different. In the international vertical specialization system of production, the volume of inter-country trade in intermediate goods increases with the expansion of the global distribution of the upstream and

downstream production links of a certain product, so the measurement of the degree of vertical specialization can be more effectively reflected by the scale of the trade in intermediate goods. In the actual research, taking the scale of intermediate goods trade as the measurement index has also become a frequent choice of scholars. Therefore, the scale of intermediate goods trade in a country or region largely reflects the extent of its participation in the international vertical specialization. However, due to the lack of direct statistical data of intermediate goods trade, some scholars often use relevant data to substitute direct statistical data of intermediate goods trade in their researches.

From the perspective of economic effect, different scholars hold different views at present. Some scholars believe that the deepening of countries' participation in the international vertical specialization mainly brings positive economic effects, which are mainly reflected in promoting the transformation, upgrading trade structure, improving labor productivity and international competitiveness [3]. However, many scholars are skeptical or even negative about the economic effect of vertical specialization. They concluded that participation in the vertical specialization of international division of labor is the decisive factor for a country to gain profits from it, and the division of labor is mainly manifested as its position in the international division of labor system [4].

To sum up, in the existing research, the analysis of international vertical specialization under the two frameworks has different focuses and is complementary to each other. On the basis of studying and summarizing the existing research, this paper uses the manufacturing data of CAFTA to conduct empirical research on the influencing factors of international vertical specialization, so as to provide certain policy suggestions for the optimized development of China's manufacturing industry.

3. THEORY BASIS

3.1. Basic Concepts and Theoretical Foundations of International Vertical Specialization

The concept of vertical specialization was first proposed by Balassa in 1967 to describe the deep fission of the internal value chain of enterprises on a global scale, and the further segmentation of production stages and steps [5]. In the 21st century, some famous American scholars such as Hummels clarified the concept of "vertical specialization" (2001). "Vertical specialization" is fundamentally a phenomenon that products are specialized in division of labor and trade. In the increasing trade of intermediate goods between countries in the world, the vertical trade chain spans multiple countries and continues to extend. Product production links are distributed in different countries in the world, and different countries are only in one or a few specialized production activities in each link. For dividable products, each production process is distributed in two or more countries, and each country produces in its comparatively advantageous production links, which provides added value to the product and the flow of finished products must be partly exported to the international market [6].

3.2. Basic Content of Industrial Competitiveness

The industrial competitiveness refers to the competitive advantage of a certain industry in a country in the international market. The essence of the concept is the comparative advantage and market realization ability of the industry in the international market, thereby bringing more satisfactory and lasting economic benefits to the country. To a certain extent, indicators such as market profit rate and market share can quantitatively measure a country's industrial international competitiveness. Professor Porter proposed the "Diamond Model", proposing that a country's current economic development stage, technological innovation and innovation capabilities, industrial resources possessed, industrial policies implemented, and market size

determine the country’s overall industry competitiveness. Table 1 details the meaning of each element.

Table 1. Michael Porter diamond Model

Economic development stage	Determine the type of comparative advantage industry
Innovation capacity	Determine the rise and fall of an industry in the overall development
Disposable industrial resources	The degree of surplus and shortage of relevant resources determines the development order and path of competitive industries
National Industrial Policy	Different industrial policies affect and promote national industrial ownership or loss of competitiveness
Market share	Determine the ultimate competitive potential of the country’s industry

3.3. The Value Chain

Also known as the Global Value Chain, it was first proposed by Harvard University professor Michael Porter in his research "Comparative Advantage" in 1985 [7]. According to the research of Smith A, Rainnie and other scholars, the global value chain is a combination of all the activities of cross-international production throughout the product life cycle, and it focuses on the effective value-added of each link of the product. In the Industrial Development Report of 2002-2003 released by the United Nations Industrial Development Organization (UNIDO), Global value chain (GVC) is defined as the establishment of an international network of enterprises around the world through various economic activities in order to realize the value of goods or services through production, sales and other links, including all participants and organizations, as well as the distribution of value and profit. The "Smile Curve" in Figure 1 shows that the added value generated by different links varies. Higher added value can be created at both ends of the "smile curve", that is, in industrial links such as technology research and development and marketing. As the industry links move to the middle, they are gradually at the bottom of the "smile curve", with low added value created. At present, China is still at the lower end of the "smile curve" in the global industrial chain. It is an inevitable path for China to increase its added value and improve its position in the international division of labor by enhancing its industrial research capability and improving its independent innovation capability.

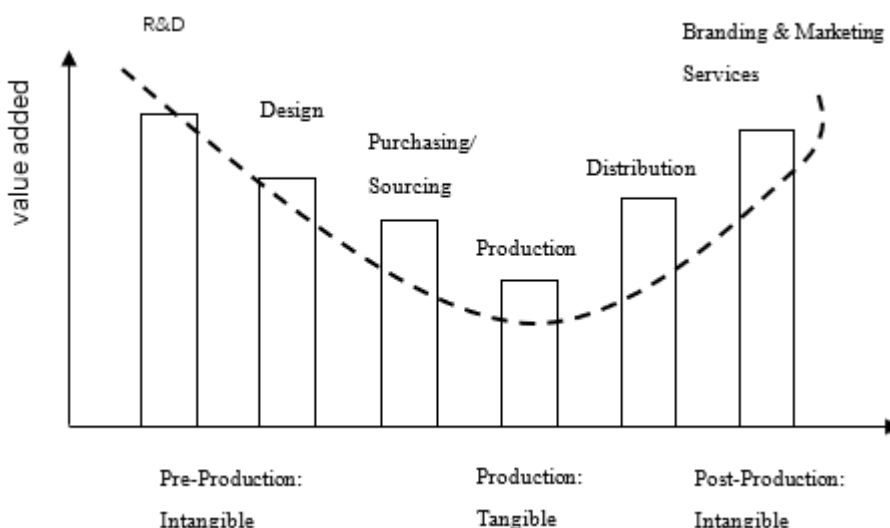


Figure 1. The Value Chain

4. THE EMPIRICAL FRAMEWORK

In the empirical analysis in this part, the VSS indicator of vertical specialization ratio is still used to define the vertical specialization level. Therefore, the explanatory variable Y of the model represents the vertical specialization ratio of the manufacturing industry in China-Asean countries. The establishment of each explanatory variable is shown in the following table: the vertical specialization ratio of the manufacturing industry in China-Asean countries. The establishment of each explanatory variable is shown in the following table:

Table 2. The description of Explanatory Variable

Variable	Meaning	Expected Sign of Variable
MKT	Market concentration	+
LIntensity	Labor factor input intensity	-
CIntensity	Capital factor input intensity	-
TIntensity	Investment intensity of technical factors	+
TLP	Total labor productivity	+
CPM	Cost profit margin	+
IIC	International industrial competitiveness	+
IO	Industrial openness	+

Table 3. The Division Standard of Manufacturing

Type	The Specific Division	Code
Technology intensive	Communication equipment and computer and other electronic equipment manufacturing	INDUSTRY1
	General and special equipment manufacturing industry	INDUSTRY2
	Transportation equipment manufacturing industry	INDUSTRY3
	Crafts and other manufacturing industries (including waste products)	INDUSTRY4
	Instrument and meter and cultural office machinery manufacturing industry	INDUSTRY5
	Electrical machinery and equipment manufacturing industry	INDUSTRY6
Capital intensive	Metal smelting and rolling processing industries	INDUSTRY7
	The chemical industry	INDUSTRY8
	Petroleum processing and coking and nuclear fuel processing industries	INDUSTRY9
	Metal products industry	INDUSTRY10
	Nonmetallic mineral products industry	INDUSTRY11
Labor intensive	Textile industry	INDUSTRY12
	Food manufacturing and tobacco processing industries	INDUSTRY13
	Textile, clothing, shoes, hats, leather, down and its products	INDUSTRY14
	Paper printing and cultural and educational sports goods manufacturing	INDUSTRY15
	Wood processing and furniture manufacturing	INDUSTRY16

The measurement index data of the explained variable VSS are obtained by processing and integrating the data in the International Statistical Yearbook, China Input-Output Table and UN

Comtrade database. In view of the current industry classification standards implemented by China and the United Nations are different, the industry classification needs to be adjusted in the process of data integration. So, this paper uses the methods of Sheng Bin [8]. Based on the variables mentioned above, the empirical model is constructed as follows:

$$Y = \beta_0 + \beta_1 \text{MKT} + \beta_2 \text{LIntensity} + \beta_3 \text{CIntensity} + \beta_4 \text{TIntensity} + \beta_5 \text{TLP} + \beta_6 \text{CPM} + \beta_7 \text{IIC} + \beta_8 \text{IO} + U \quad (1)$$

The classification and data in this part are shown in the Table 3 and Table 4 below.

Table 4. The Manufacturing Vertical Specialization Division Ratio of China and ASEAN

Unit: Percentage

YEAR INDUSTRY	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average Growth
INDUSTRY1	3.51	4.43	4.80	5.62	5.02	4.36	4.04	3.33	5.35	4.10	4.51	2.53
INDUSTRY2	1.59	1.77	1.85	1.96	1.74	1.99	1.60	1.22	2.08	1.76	1.84	1.47
INDUSTRY3	1.36	1.49	1.54	1.65	1.49	1.96	1.58	1.26	2.08	1.78	1.86	3.23
INDUSTRY4	0.97	0.99	1.02	1.05	0.97	1.29	1.08	0.89	2.75	2.31	2.47	9.78
INDUSTRY5	3.22	3.62	3.73	4.17	3.81	4.44	3.87	3.08	5.22	4.06	4.52	3.46
INDUSTRY6	2.30	2.57	2.70	3.12	2.83	3.25	2.56	1.96	3.13	2.77	2.89	2.30
INDUSTRY7	0.73	0.82	0.82	0.83	0.71	0.71	0.62	0.49	0.93	0.75	0.84	1.38
INDUSTRY8	1.55	1.62	1.69	1.71	1.64	1.65	1.42	1.19	2.38	1.94	2.03	2.72
INDUSTRY9	0.32	0.36	0.38	0.47	0.45	0.28	0.27	0.21	0.43	0.33	0.37	1.31
INDUSTRY10	0.83	0.93	0.93	0.94	0.79	0.99	0.82	0.64	1.34	1.10	1.18	3.57
INDUSTRY11	0.79	0.82	0.85	0.91	0.85	0.79	0.68	0.54	1.28	1.06	1.46	6.27
INDUSTRY12	0.96	0.97	1.00	1.02	0.95	1.01	0.85	0.74	1.40	1.09	1.15	1.80
INDUSTRY13	0.41	0.43	0.46	0.47	0.46	0.53	0.48	0.37	0.67	0.34	0.57	3.49
INDUSTRY14	0.93	0.94	0.97	0.96	0.89	0.98	0.86	0.73	1.46	1.08	1.20	2.61
INDUSTRY15	1.45	1.35	1.37	1.68	1.61	1.78	1.47	1.18	2.13	1.74	1.77	2.02
INDUSTRY16	1.01	1.04	1.04	1.07	0.92	0.88	0.73	0.59	1.31	1.05	1.14	12.27

5. EMPIRICAL RESULTS AND ANALYSIS

Table 5 shows the regression results of the empirical model.

As we can see in the table, it can be concluded that: The coefficient value of explanatory variable MKT is the largest, indicating that market concentration plays an important role in the degree of vertical specialization of the manufacturing industry between China and ASEAN, and it is the most important factor among all variables set in this model. The more concentrated the manufacturing market is, the higher the degree of vertical specialization of manufacturing industry will be between China and ASEAN countries. as for LIntensity, the coefficient is -1.13, indicating that the ratio of vertical specialization in manufacturing is inversely correlated with the input intensity of labor factors. For every 1 percentage point change in labor input intensity, the ratio of vertical specialization decreases by 1.13 percentage points. This also means that China and ASEAN countries are at the lower end of the "smile curve" in the global value chain due to their greater competitiveness in labor-intensive production links, so there is a negative correlation between labor factor input and vertical specialization degree of both sides. The coefficient of explanatory variable CIntensity is small and does not play a significant role in the model. Because of China's capital competitiveness in the manufacturing industry still lags behind some of ASEAN countries, such as Singapore, the contribution of capital factor input

intensity in promoting the vertical specialization of the manufacturing industry is relatively small. As for TIntensity, Every 1 percentage point change in technical factor input intensity results in an average variation of 1.43 percentage points of the VSS, which plays a certain role in the promotion of vertical specialization between the two sides. The total labor productivity and the international industrial competitiveness both have reverse effect on the degree of vertical specialization in manufacturing between China and ASEAN, which is contrary to the expected impact before regression. Every percentage change in total labor productivity and international industrial competitiveness will lead to reverse changes in the vertical specialization degree of manufacturing industries in both sides. However, the cost profit margin and industry openness of each industry have a positive effect on the vertical specialization of the manufacturing industry, which means that it is necessary for both sides to improve the openness of the manufacturing industry and the cost profit margin to promote the vertical specialization cooperation.

Table 5. Empirical Results

VARIABLES	OLS	REM
MKT	22.1744*** (9.07)	19.0248*** (10.57)
LIntensity	-1.1303*** (6.42)	-1.0404*** (9.17)
CIntensity	-0.8234 (-2.58)	-0.7356 (-1.43)
TIntensity	-0.6133*** (5.51)	-0.6714*** (6.80)
TLP	1.4343*** (11.51)	1.0357*** (5.32)
CPM	11.5402*** (-3.62)	12.0164*** (-4.18)
IIC	-0.3540** (-2.76)	-0.4235* (-1.89)
IO	-2.8120*** (0.10)	-1.5704*** (1.77)
Constant	32.6107*** (9.07)	27.1693*** (7.91)
Observations	1,656	1,656
R-squared	0.6157	0.4531

Note: The value of t is reported in parentheses. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

6. CONCLUSIONS AND RECOMMENDATIONS

We will make greater efforts to build industrial clusters of vertical specialization and division of labor in the manufacturing industry in the China-ASEAN region, so as to create a better development environment for deepening vertical specialization and cooperation in the region. Today, as China's third largest trade partner, ASEAN country has become China's important breakthrough point of industrial structure optimization. Therefore, in the new era, it is

necessary for China to actively build a dominant division of production network, export excess capacity and optimize and upgrade the subdivision of the internal industry structure of China's manufacturing industry.

At present, the ASEAN countries' status of international division of labor is similar to China. In the same value range, the degree of market concentration affects the necessity of vertical division of labor in the industry. As we all know, large mature enterprises tend to have more active control and stronger guiding ability for technology, production and sales, so they are more capable of decomposing and distributing each production link and creating a larger scale effect. Therefore, the cultivation of core enterprises in the manufacturing industry is bound to provide a more powerful support for the deepening of international vertical specialization, so as to promote the benign interactive cycle mechanism of vertical specialization division and industrial structure optimization.

It is also necessary to pay more attention to the innovation ability and technology level, and to establish a new position in high-end value chain links. China has a certain degree of advantage in technology and science and technology. so, it's time to use advantage actively to enhance investment in high technology and high-quality human capital. Besides, building new industrial division of labor cooperation network and promoting the optimization of industrial structure.

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