

Analysis of China-ASEAN Industrial Cooperation Based on GVC

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Abstract: The Regional Comprehensive Economic Partnership (RCEP) is currently the world's largest trade agreement, involving about one-half of the world's population and one-third of the world's gross product. ASEAN countries, as the initiating countries, also occupy the most seats, so the region's economic recovery in the post epidemic era is of vital significance not only to China but also to the world economy. There are some problems in economic cooperation between China and ASEAN countries. This paper intends to make a comparative analysis of the industrial subdivision of the three industries of China and ASEAN through the decomposition of the global value chain division data, so as to obtain the subdivision of the industrial cooperation space and provide certain references for the selection of industrial paths in the economic cooperation between China and ASEAN.

1. Introduction

The Regional Comprehensive Economic Partnership (RCEP) is currently the world's largest trade agreement, with 16 participating countries, covering about one-half of the world's population and one-third of the world's gross domestic product (GDP). The ASEAN countries are the main members of RCEP, with the largest number of seats and the closest geographic proximity to China, so the healthy development of the region's economy is particularly important for stimulating the recovery of the world economy. With RCEP officially coming into effect on January 2022, China will accelerate the process of embedding itself in the ASEAN industrial chain and supply chain, while economic cooperation with ASEAN countries will continue to strengthen.

In the following, this paper will empirically analyze the industrial linkages and industrial comparative advantages between China and ASEAN countries from the perspectives of GVC participation index, GVC upstream index, and explicit comparative index, so as to derive the path of industrial choice for China to carry out economic cooperation with ASEAN countries and finally put forward the suggestions for carrying out industrial cooperation.

2. Literature Review

Indicators of the international division of labor can be divided into four perspectives: the product technology perspective, the export value added perspective, the production length perspective, and the backward/forward participation perspective of the industrial chain. Hummels et al. (1999) pioneered the definition of the vertical specialization index, which measures the value of imported

intermediates in a country's export trade using the international input-output table, which is known as the HIY model, and it is the basis of the measurement of the state of the international division of labor [1]. Later Daudin et al. (2011) conducted an empirical analysis based on the HIY model using the GTAP database, describing the reasons for the international division of labor based on the sources of value added [2]. Subsequently Koopman et al. relaxed the HIY model assumptions [3] and developed a refined KWW model [4][5]. The subsequent measurement models went through the improvement of KWZ [6] and KWZ decomposition model [7], but finally it was Wang Zhi's production decomposition model (DTPM) established in 2017 that corrected the defects of the above models and dissolved the bias of upstream degree [8][9]. Finally, most of these scholars' measurement of the use of GVC index only stays in the analysis of the international division of labor only, and is less developed to analyze the correlation between the international division of labor in each industry and the international industrial cooperation house.

Taking the China-ASEAN production network as the research object, this paper measures the international division of labour in 10 countries and 26 sub-industries along the China-ASEAN economic belt from 2000 to 2019, based on the production decomposition model (DTPM) constructed by Wang Zhi (2017), starting from the indicators of the degree of forward, backward and upward participation in the global value chain, and finally adding the RCA indicator. The international division of labour theory is applied to analyse China-ASEAN industrial cooperation.

3. Research methodology

3.1 GVC index

Koopman (2010) and Antràs (2012) constructed the GVC participation indicator and the GVC upstreamness indicator to measure the degree of participation of an industry in a country in the global production network and the production division of labor segments. The formulas for these two important indicators are as follows:

$$\text{GVC_Participation}_{ir} = \frac{IV_{ir} + FV_{ir}}{E_{ir}}$$

Where IV_{ir} represents the indirect domestic value added embedded in the total exports of industry i in country r ;

FV_{ir} represents the indirect foreign value added embedded in the total exports of industry i in country r ;

E_{ir} Represents total exports of industry i in country r .

A larger indicator indicates that country r 's industry i is more embedded in the global production value chain network.

$$U_i = 1 + \sum_{j=1}^N \frac{d_{ij} Y_j}{Y_i} U_j$$

Where d_{ij} represents the input demand coefficient, i.e., the ratio of the portion of intermediate inputs flowing from industry i to industry j to the unit value of output produced in industry j ;

Y_i represents the total output of industry i , and similarly Y_j represents the total output of industry j ;

N indicates that there are N industries.

Antràs points out that a higher degree of upstreamness means that the industry is more dominated by intermediate inputs in the production of its products, i.e., it is more in the middle of the production

chain.

3.2 RCA Revealed Comparative Advantage (RCA) index

The Revealed Comparative Advantage (RCA) index is used to measure the extent of a country's comparative advantage in an industry. In view of data availability, the RCA based on the trade value added benchmark is selected for measurement here. The formula is as follows:

$$NRCA_i^r = \frac{dva_{f_i}^r / \sum_i^n dva_{f_i}^r}{\sum_r^G dva_{f_i}^r / \sum_r^G \sum_i^n dva_{f_i}^r}$$

Where $dva_{f_i}^r$ denotes the domestic value added of country r in industry i 's total exports over time;

$\sum_i^n dva_{f_i}^r$ denotes the domestic value added in total exports of all industries in country r over time;

$\sum_r^G dva_{f_i}^r$ denotes the domestic value added of total exports of industry i in the global market over time;

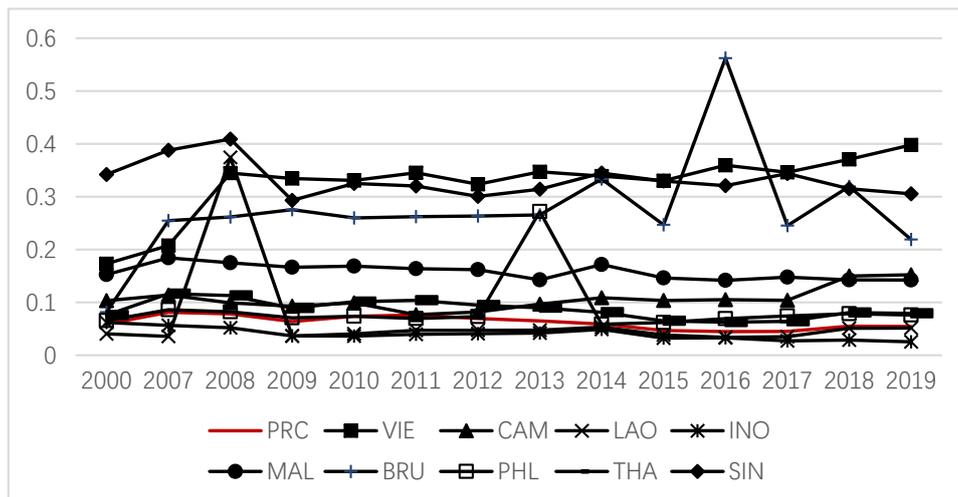
$\sum_r^G \sum_i^n dva_{f_i}^r$ represents the domestic value added of total exports of all industries in the global market over time.

The rules of judgment are $NRCA_i^r > 2.5$ indicates a very strong comparative advantage; $1.25 < NRCA_i^r < 2.5$ indicates a strong comparative advantage; $0.8 < NRCA_i^r < 1.25$ indicates a moderate comparative advantage, and $NRCA_i^r < 0.8$ indicates a weak comparative advantage.

4. Indicator analysis

4.1 Comparison of GVC indices by sector between China and ASEAN countries

4.1.1 Comparison of forward and backward participation in global value chains in the agricultural sector in China-ASEAN countries



Source: UIBE GVC Indicator database. Same as below

Figure 1: Forward GVC Participation in Agriculture, Forestry, Livestock and Fisheries in Key China-ASEAN Countries, 2000-2019

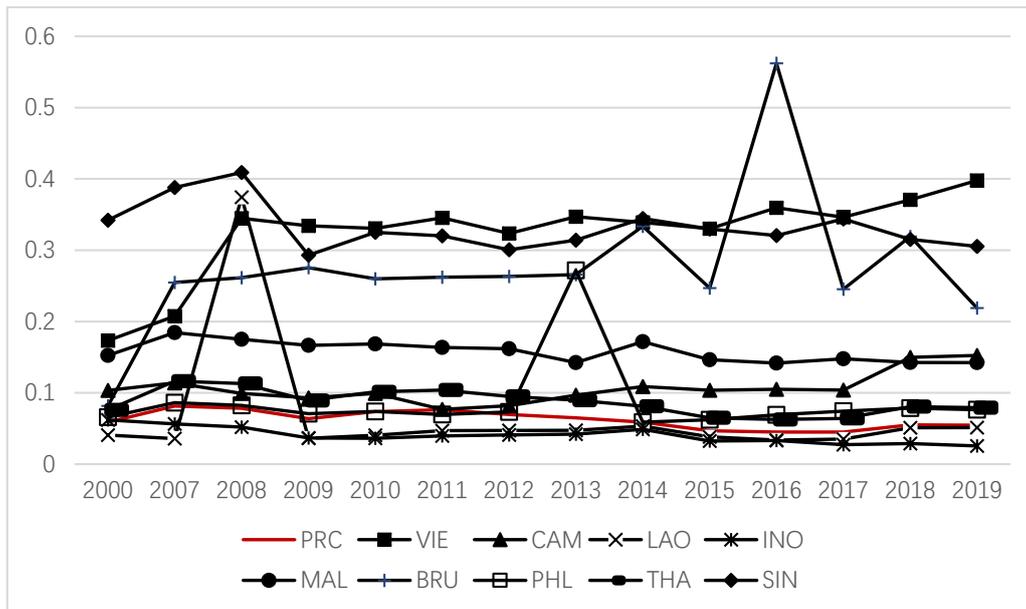


Figure 2: Backward GVC Participation in Agriculture, Forestry and Livestock Fisheries in Key China-ASEAN Countries, 2000-2019

Combining Figures 1, 2, and 3, there is little difference between backward and forward participation in China's agriculture, forestry, livestock and fisheries sector; whereas Vietnam, Brunei, and the Philippines have greater backward than forward participation in GVC, indicating that these three countries are more involved in downstream activities; and Singapore, Malaysia, Cambodia, Laos, Indonesia and Thailand have greater forward than backward participation in GVC, which suggests that these six countries are more involved in upstream activities.

The forward GVC index and the backward GVC index for agriculture, forestry and fisheries are plotted in the following scatterplot.

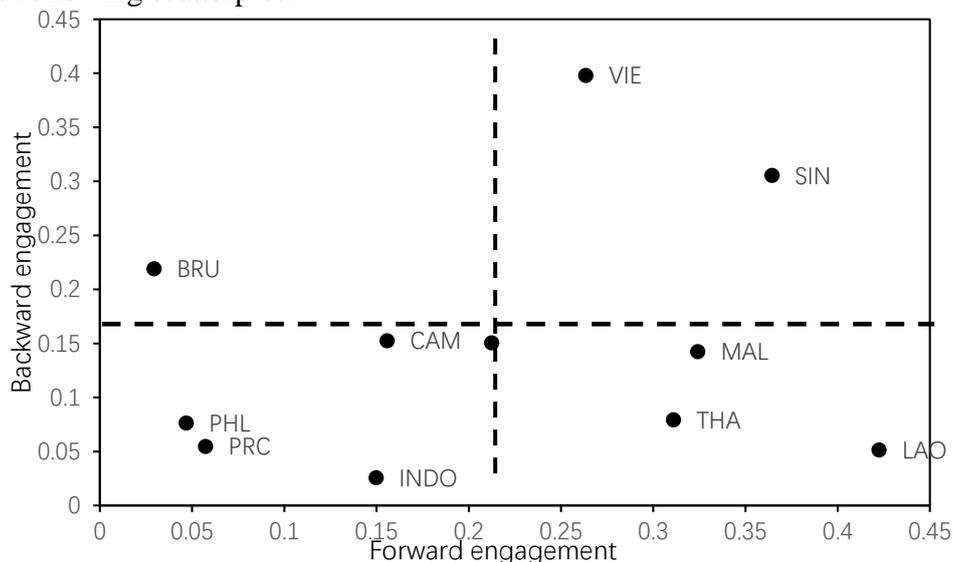


Figure 3: Forward/Backward GVC Participation in Agriculture, Forestry and Fisheries, 2019

The above analysis can show that in the agriculture, forestry, animal husbandry and fishery industries, China's degree of embeddedness in ASEAN's production network is much lower than the mean, and there is still a high upside in the future. At the same time, China's participation in both

upstream and downstream production activities is also lower than the mean value, and the ASEAN countries located in the first, second and fourth quadrants form a complementary division of labor in production, and industrial division of labor is precisely the basis of international industrial cooperation.

4.1.2 Comparison of forward and backward participation in manufacturing GVCs in China-ASEAN countries

In this paper, based on the WIOD database, and then combined with UIBE's GVC Indicator database, the data from 2000-2019 are measured to obtain the forward participation of China and ASEAN countries (except Myanmar) on 16 representative subsectors. Here, due to space constraints, the comparative results for 2019 are presented for the time being, as shown in Table 1.

Table 1: China and ASEAN Major Countries Segmented Forward Engagement, 2019

	PRC	VIE	CAM	LAO	INDO	MAL	BRU	PHL	THA	SIN
c2	0.14	0.46	0.13	0.46	0.41	0.76	0.87	0.43	0.40	NA
c3	0.05	0.16	0.10	0.11	0.13	0.33	0.14	0.03	0.16	0.20
c4	0.15	0.16	0.03	0.08	0.11	0.31	0.04	0.05	0.26	0.29
c5	0.08	0.12	NA	0.29	0.05	0.15	0.02	0.07	0.45	0.19
c6	0.09	0.26	0.34	0.34	0.67	0.63	0.27	0.56	0.97	0.67
c7	0.14	0.45	0.13	0.95	0.50	0.37	0.16	0.16	0.42	0.46
c8	0.13	0.28	0.95	0.10	0.12	0.56	0.24	0.16	0.27	0.75
c9	0.12	0.52	0.30	0.98	0.29	0.57	1.00	0.12	0.84	0.78
c10	0.14	0.57	0.29	0.27	0.17	0.40	0.04	0.21	0.59	0.69
c11	0.09	0.46	0.10	0.09	0.08	0.36	0.10	0.06	0.33	0.32
c12	0.18	0.39	0.58	0.31	0.27	0.65	0.97	0.96	0.99	0.78
c13	0.11	0.46	0.73	0.85	0.20	0.32	0.34	0.18	0.36	0.35
c14	0.16	0.16	0.79	0.56	0.47	0.53	0.36	0.23	0.34	0.41
c15	0.09	0.12	0.13	0.13	0.24	0.37	0.01	0.31	0.04	0.40

Data source: Calculated from WIOD database, UIBE GVC Indicator database. Same as below

Note: The industries and codes are thus mining (c2), food, beverages and tobacco (c3), textiles and textile products (c4), leather, leather products and footwear (c5), timber, wood products and cork (c6), pulp, paper, paper products, printing and publishing (c7), coke, refined gasoline and nuclear fuels (c8), chemicals and chemical products (c9), rubber and plastic products (c10), other non-metallic minerals (c11), base metals and metal products (c12), machinery and parts (c13), electrical and optical equipment (c14), transportation equipment (c15).

From the table 2 comparison, it is easy to see that the division of labor measurement between China and ASEAN countries varies in the production activities in these 14 areas. In the production of food and beverages and tobacco (c3), Vietnam's GVC forward participation is greater, which indicates that Vietnam measures upstream production activities in the production chain of this sector. The remaining 10 countries, including China, on the other hand, focus on downstream production activities in this sector. There is thus room for cooperation between China and Vietnam in the production of food and beverages and tobacco.

In the production of textiles and textile products (c4), China's production activities are concentrated in the upstream, while those of nine countries, including Vietnam, are concentrated in the downstream, and this division of labor likewise provides room for the growth of industrial cooperation in the textile industry between China and ASEAN countries. By the same token, China and ASEAN countries have the basis and space for cooperation in the remaining segments of the

industry.

Table 2: China's Backward Engagement with Major ASEAN Country Segments, 2019

	PRC	VIE	CAM	LAO	INO	MAL	BRU	PHL	THA	SIN
c2	0.10	0.05	0.08	0.15	0.37	0.37	0.21	0.17	0.17	NA
c3	0.08	0.08	0.24	0.12	0.23	0.49	0.23	0.38	0.38	0.40
c4	0.10	0.45	0.32	0.25	0.28	0.49	0.22	0.18	0.44	0.44
c5	0.12	0.46	0.25	0.29	0.24	0.42	0.19	0.25	NA	0.46
c6	0.13	0.09	0.23	0.16	0.21	0.42	0.15	0.37	0.23	0.35
c7	0.15	0.15	0.29	0.20	0.14	0.54	0.17	0.41	0.42	0.51
c8	0.22	0.09	0.24	0.61	0.75	0.43	0.29	0.11	0.73	0.57
c9	0.16	0.18	0.36	0.24	0.43	0.53	0.19	0.31	0.33	0.46
c10	0.17	0.23	0.46	0.32	0.22	0.59	0.34	0.45	0.61	0.30
c11	0.10	0.15	0.32	0.36	0.63	0.31	0.22	0.46	0.30	0.63
c12	0.20	0.17	0.47	0.53	0.52	0.63	0.50	0.40	0.35	0.50
c13	0.18	0.31	0.40	0.42	0.37	0.64	0.43	0.40	0.67	0.45
c14	0.25	0.29	0.52	0.50	0.37	0.66	0.22	0.41	0.40	0.54
c15	0.16	0.15	0.55	0.31	0.37	0.58	0.44	0.40	0.40	0.45

4.1.3 Comparison of the upstream degree of service industry segments in China and ASEAN countries

In view of data availability considerations, the sale, maintenance and repair of motor vehicles and motorcycles in China and ASEAN; retail sale of fuel (c19), wholesale trade and commission trade, except motor vehicles and motorcycles (c20), retail trade, except motor vehicles and motorcycles; repair of household goods (c21), accommodation and catering (c22), inland transportation (c23), waterway transportation (c24), air transport (c25), other support and auxiliary transport activities; activities of travel agencies (c26), post and telecommunications (c27), financial intermediation (c28), and real estate (c29) upstream to make a side-by-side comparison. Due to space constraints, Table 3 tentatively presents a comparison of the upstreamness of China and ASEAN countries in 2020.

Table 3: Comparison of the upstream degree of service industry segments in China and ASEAN countries in 2020

	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29
PRC	1.00	3.35	3.12	2.73	3.42	3.60	3.17	3.95	2.69	3.51	2.04
CAM	1.00	1.67	2.33	2.03	2.35	1.00	1.00	1.00	1.67	1.43	1.40
LAP	1.73	1.73	1.71	1.31	2.12	2.53	2.57	2.48	1.39	1.71	1.14
VIE	1.70	2.80	1.00	1.68	2.20	2.64	2.20	3.58	2.04	3.04	2.21
PHL	3.17	1.51	2.03	1.61	1.87	3.33	2.32	2.17	1.95	1.76	1.66
RBU	1.33	1.18	1.18	2.67	3.04	1.68	2.93	2.88	2.40	2.41	1.16
INDO	1.87	1.85	1.81	1.44	2.09	2.27	1.57	2.28	2.29	2.31	1.52
SIN	2.97	2.85	2.00	1.92	2.67	3.58	2.87	3.49	2.99	2.86	2.52
MAL	3.16	3.09	2.60	1.85	3.30	3.28	2.98	3.43	2.75	3.62	3.42
THA	2.54	2.57	2.49	1.42	1.86	3.22	2.08	3.01	2.45	2.71	1.44

Source: UIBE GVC Indicator database

From the comparison in Table 3, it is easy to see that in the labor-intensive service industries, namely c19, c20, c21, c22, and c26, China's upstream degree is greater than 2 and basically higher than that of the other ASEAN countries, except in the sale of motor vehicles and motorcycles,

maintenance and repairs; and retail sale of fuels (c19), which has an upstream degree of 1 that is smaller than that of the majority of ASEAN countries. This suggests that China is more involved in the intermediate stages of these four labor-intensive industries. Looking at the capital-intensive industries c23, c24, c25, c27 and c29, China's upstreamness is also greater than most ASEAN countries. Similarly, China's degree of upstreamness is greater than most ASEAN countries in the GVC division of labor activities in the technology-intensive industry, i.e., financial intermediation (c28). From the comparison of the degree of upstreamness in the service industry segments, it can be concluded that China is more involved in the intermediate stages of the GVC division of labor in the service industry, but less involved in the production activities located at the two ends of the value chain. It is the difference in the position of China and ASEAN countries in the GVC production activities that provides a vast cooperation space for the upcoming industrial cooperation.

4.2 Analysis of China's explicit comparative advantage indices by industry segments

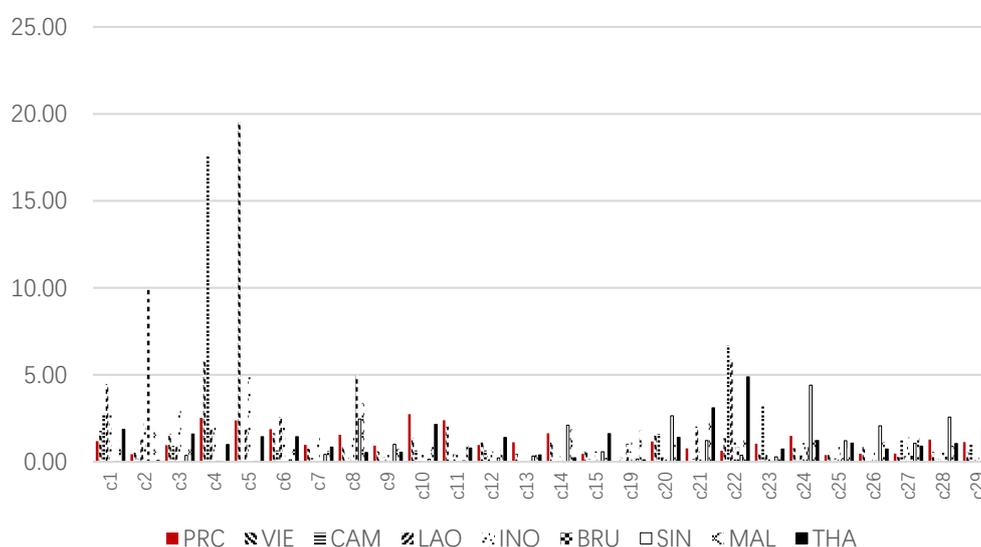


Figure 4: Comparison of RCA indices for the three industry segments in China and ASEAN countries, 2019

Through the comparative analysis of Figure 4, it is easy to see that China and ASEAN countries have their own strengths in the three sub-sectors, most ASEAN countries have a relatively leading comparative advantage in agriculture, forestry, animal husbandry and fishery (c1); China has a leading comparative advantage over other ASEAN countries in the two sectors of rubber and plastics manufacturing (c10), other non-metallic minerals (c11), and machinery and parts (c13).

Due to the different comparative advantages of countries, driven by the maximization of economic profits, countries spontaneously carry out industrial division of labor, thus providing a living ground for industrial cooperation.

5. Conclusions and Recommendations

5.1 China-ASEAN still has huge space for industrial cooperation

In terms of primary products, China's participation in the global value division of labor is relatively low, and a large number of our primary products depend on imported raw materials and intermediate products. However, ASEAN countries have a higher degree of participation and are rich in natural resources, so there is a vast space for cooperation between China and ASEAN in agricultural products,

seafood, timber and other primary products.

In terms of manufacturing and service industries, whether in labor-intensive, medium- and low-technology industries or high-technology industries, China and ASEAN countries have different levels of division of labor, and China can find countries in ASEAN countries that are in the upstream or downstream of the industrial chain, and this mismatch arrangement provides a deep foundation for China-ASEAN cooperation. For example, it can cooperate with Cambodia and Vietnam in the textile and footwear industries, with Brunei in the mining and coke and refined petroleum industries, and with Singapore in the manufacturing of electrical and optoelectronic equipment.

5.2 Accelerating the embedding of production networks in the ASEAN region

By way of comparison, it is easy to see that China's participation in the global value division of labor is still relatively low, especially in the agriculture, forestry, animal husbandry and fishery industries. A large part of the reason is that the industrial chain of China's primary agricultural products is too short, the agriculture, forestry, animal husbandry and fishery industries are too simple and elementary, and the downstream of the industrial chain is not closely integrated with the service industry to provide more value-added value. Therefore, in the future opening up, China should extend the industry chain of agriculture, forestry, animal husbandry and fishery, and strengthen the combination of this industry with the service industry, such as creating agro-tourism, etc., so as to increase the added value of this industry, and participate in the ASEAN region's value division of labor in a more proactive manner.

5.3 Strengthening innovation chain extension and complementary chains

It is not difficult to see through the analysis of the whole article that most of China's manufacturing and service industries are in the middle of the "smile curve", and are more responsible for the production of intermediate goods and the provision of intermediate services with insufficient innovation, and the added value of this part of the division of labor is much lower than that of the design and R&D located at the two ends of the curve. However, the current international environment is deteriorating rapidly, and China is facing many sanctions from Europe and the United States, so it is all the more important for China to strengthen the chain of innovation and supplement the chain, in order to enhance the industry's ability to cope with external shocks.

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