A Study on the Transfer of China's Manufacturing under the Adjustment of Global Industrial Layout—An Analysis Based on the Multi-Regional Input-Output Model of China and the United States

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Based on the multi-regional input-output model and WIOD data in 2014, this paper quantitatively estimates the impact of manufacturing transfer on China's GDP and industrial structure from three technological categories of manufacturing, two stages and three channels. This paper finds that: (1) China's exports to the United States are mainly high-tech products, and high-tech manufacturing is greatly constrained by the United States, which requires close attention. (2) Manufacturing transfer has an impact through three channels, i.e. direct effect, correlation effect and spillover effect. Direct effect is the main channel of influence in the short term, but in the long term, spillover effect is the main factor causing inter-sector differences. (3) In the short run, the transfer of low-tech manufacturing has the greatest impact on China's GDP, while in the long run, the transfer of medium- and high-tech manufacturing will exert much stronger impact than that of low-tech manufacturing, and low-tech manufacturing is less helpful for the upgrading of China's industrial structure. In order to mitigate the impact of industrial transfer, this paper suggests that differentiated policies be adopted for different technological categories of manufacturing, with special focus on strengthening the dominance and irreplaceability of medium- and high-tech manufacturing in the industrial chain in China.

Keywords: industrial transfer, manufacturing transfer, GDP, industrial structure

1. Introduction

Today, the global industrial layout faces profound adjustments, and under the influence of multiple factors such as production cost, international market layout of enterprises, local industrial policies, and resource and environmental carrying capacity, industrial division among different regions keeps changing, causing some industries to transfer among regions. Industrial transfer among regions, as a normal fact amid economic globalization, is in nature the change and evolvement of global

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pattern of industrial division and a natural phenomenon in market economy. However, in some cases, outward industrial transfer as a result of external impact will disturb the pace of industrial upgrading in a region. Premature "de-industrialization" when industrialization is not fully realized may cause "industrial hollowing-out" in a country and thus lose the opportunity of ascending to the upper-stream industrial chains. While Chinese economy has entered the new stage of transformation and upgrading towards high-quality development and is undertaking the industries transferred from developed countries, it also faces the outward transfer of some medium- and low-end industries. According to data of National Bureau of Statistics, in 2017, net outward foreign direct investment (OFDI) of China's manufacturing reached 29507 million dollars, increased by 15.7 times over a decade, and this aroused concerns of some scholars on large-scale export of industrial capital possibly causing domestic industrial hollowing-out (Sang *et al*., 2016; Yang and Sheng, 2019). Especially now when China faces the overlapping short-term and long-term factors such as rising labor cost and trade frictions, export enterprises are under heavy operation pressure and high risks, so some labor-intensive industries may possibly transfer outwards to evade the direct impact of related factors. Since 2018, the global economic and trade frictions initiated by the United States have not only disturbed the established international order of trade and broken the ties of some China-US industrial chains, but also forced related industrial chains to adjust to some extent. Despite the continuing China-US trade frictions, China hasn't encountered large-scale industrial transfer yet. Only a few enterprises have chosen to transfer outwards to evade the influence of trade frictions,[1] with the influence remaining in the control. However, subject to the impact of the complex external environment, a few medium- and low-end enterprises will have stronger desire for outward transfer. Related research will help us take targeted measures for early prevention, thereby easing the impact of industrial transfer on Chinese economy.

Since industrial transfer among different regions is inevitable, we should pay attention and give thoughts to some questions. How will industrial transfer affect Chinese economy? What are the influencing approaches and mechanisms of industrial transfer? To this end, the paper will start with the adjustment of China-US economic and trade ties and discuss the possible influence of industrial transfer (mainly manufacturing transfer) on Chinese economy, so as to help evaluate losses and take countermeasures in advance, and provide insightful policy references for mitigating the impact of industrial transfer on Chinese economy.

[1] Deputy Director of NDRC Department of Policy Studies and NDRC Spokesperson Meng Wei: Is outward transfer happening with in China's industrial chain and supply chain? http://www.ndrc.gov.cn/zcfb/jd/201907/t20190723_942137.html.

2. Literature Review

According to the research content and background of the paper, one pertinent topic of literature is industrial transfer and outward transfer. Outward industrial transfer is a key feature of globalization, and spatial distribution characteristics of different products among and within industries and different working procedures within same products are of critical significance for the global economic pattern (Jones *et al*., 2005; Zhang and Liu, 2009). Currently, China is not only experiencing the internal transfer of coastal industries to middle and western regions (Liu and Hu, 2011), but also seeing many industries starting to transfer to other developing countries (Li, 2013) and even reversely to developed countries (Su and Zheng, 2019). Some developing countries are enhancing their industrial cooperation with China with the hope to attract greater capital and industrial inflows (Innwon and Soonchan, 2008). Liu and Nie (2015) studied the outward industrial transfer mechanism of OFDI and found that China's down-gradient OFDI was mainly for seeking resources and a counter-gradient OFDI for seeking technologies, with the former being more likely to cause the transfer of primary industrial production chains. Peng (2018) analyzed the foundation and conditions of industrial transfer between China and countries along the "Silk Road Economic Belt" and discovered that China enjoyed enormous space of outward industrial transfer. Currently, China's outward industrial transfer, with its limited size and insufficient data that is available, hasn't become the focus of academic discussions.

Another pertinent topic of literature is adjustment of China-US trade relationship and especially the impact of trade frictions on global industrial and trade patterns. According to related studies, such measures as anti-dumping and increasing tariffs will cause trade relationships and even industrial division to change and adjust, resulting in the re-distribution of regional or global industrial chains. Other studies believed that though increase of tariffs will generate enormous after-tax profit difference, China enjoys noticeable advantages in supporting industries and consumer market, and thus the influence of trade frictions on industrial transfer should be controllable (Pan, 2019). But some signs and researches indicated that a few multinationals are planning to cut their investment in China and some industries in the country have started to transfer part of capacity to ASEAN countries, so as to realize circuitous export to the United States (Li *et al*., 2019; Luo, 2019). The experience of Japan can be taken as reference. During the US-Japan trade frictions in the 1980s, Japan undertook heavy cost for transfer and consequently, some industries in the country were transferred to other East Asian countries (Lei, 2018). Wang *et al*. (2017) completely decomposed China's total trade flows, finding that foreign anti-dumping measures will lead to decrease in China's GDP and pose significantly negative influence on the global value chain (GVC) position of related industries. Li *et al*. (2019) held that China-US trade frictions are

directly affecting the global industrial layout of multinationals, posing apparent impact on China's imported supply chain and foreign-funded embedded supply chain, and driving related industrial chains to transfer to ASEAN countries. Yang and Lin (2019) studied if the increase of tariffs by the United States has caused China's export trade to transfer and found that the increase resulted in clear slowdown in growth of China's export to the United States, but a small growth of export to other trade partners. Huang *et al*. (2019) discovered that the trade frictions didn't thoroughly restrict China's export of value chain commodities to the United States, but indirectly extended the China-US value chain ties through intervention of EU, Japan, Mexico and other value chain countries, and thus indirectly benefited other countries. Benguria (2019) analyzed the impact of China-US trade frictions on enterprises and the result showed that the impact was heavier for China's export enterprises and China's exports to the United States, especially in sectors subject to additional tariffs imposed by the United States, were more vulnerable to export substitution by other countries. In general, all related researches show that trade frictions will cause changes in the global trade system, but quantitative ones among them are mostly based on the current industrial status, with little consideration given to outward industrial transfer or re-distribution of industrial chains, which is exactly the focus of study in this paper.

Compared with existing researches, the paper mainly contributes in the following two aspects. First, by constructing the international input-output model, it estimates the negative impact of outward transfer of manufacturing on China's GDP and industrial structure, filling part of the gap in related domestic quantitative researches to some extent. Second, it estimates in details and analyzes the influence channels and severity of manufacturing transfer on China's GDP and industrial structure from three technological categories of manufacturing, two stages and three channels, clearly reflecting the differences in the influence of outward industrial transfer at different stages, in different sectors and under different circumstances. Hopefully, the paper will be able to offer theoretical foundations and serve as policy references for coping with the outward industrial transfer.

3. Model and Data Source

The paper takes the adjustment in China-US economic and trade relationships as an example and supposes that some of China's export industries to the United States are transferred to a third country under the influence of cost, tariff and other factors, causing part of the bilateral trade relationship between China and the United States to evolve into the trilateral trade pattern among China, the United States and the third country. The industries that have been transferred will re-distribute their industrial chains according to local supporting conditions, which will weaken their industrial ties with China, thereby leading to a reduction in output of China's connected industries

and posing negative impact on Chinese economy. To this end, the paper constructs a three-regional input-output model covering China and the United States to study the influence of outward industrial transfer on Chinese economy.

In the row vector of the input-output table, total output of a sector is taken as intermediate input to participate in production or as end products to be consumed, invested and exported, hence the following equilibrium relationship:

$$X = AX + Y$$

A is a direct consumption coefficient matrix; X is the total output vector; Y is the end demand vector. Now, an international input-output table including three regions, i.e. s, t and r, and two sectors i and j is given, so its row model is:

$$\begin{pmatrix} X_i^s \\ X_j^s \\ X_i^t \\ X_j^t \\ X_i^r \\ X_j^r \end{pmatrix} = \begin{pmatrix} A_{ii}^{ss} & A_{ij}^{ss} & A_{ii}^{st} & A_{ij}^{st} & A_{ii}^{sr} & A_{ij}^{sr} \\ A_{ji}^{ss} & A_{jj}^{ss} & A_{ji}^{st} & A_{jj}^{st} & A_{ji}^{sr} & A_{jj}^{sr} \\ A_{ii}^{ts} & A_{ij}^{ts} & A_{ii}^{tt} & A_{ij}^{tt} & A_{ii}^{tr} & A_{ij}^{tr} \\ A_{ji}^{ts} & A_{jj}^{ts} & A_{ji}^{tt} & A_{jj}^{tt} & A_{ji}^{tr} & A_{ij}^{tr} \\ A_{ii}^{rs} & A_{ij}^{rs} & A_{ji}^{rt} & A_{ij}^{rt} & A_{ii}^{rr} & A_{jj}^{rr} \\ A_{ji}^{ss} & A_{jj}^{rs} & A_{ji}^{rt} & A_{jj}^{rt} & A_{ji}^{rr} & A_{jj}^{rr} \end{pmatrix} \begin{pmatrix} X_i^s \\ X_j^s \\ X_i^t \\ X_j^t \\ X_i^r \\ X_j^r \end{pmatrix} + \begin{pmatrix} Y_i^s \\ Y_j^s \\ Y_i^t \\ Y_j^t \\ Y_i^r \\ Y_j^r \end{pmatrix}$$

A_{ij}^{st} is the direct consumption coefficient of sector j in country t from sector i in country s; X_i^s and Y_i^s are the total output and end demand of sector i in country s, and the like.

Suppose that some output of sector i in country s is transferred to country r because country t imposes additional tariffs on country s, and this part of the transferred industry will develop into a new sector in country r. Two stages are involved in this process. At the first stage, the transferred industry will suspend production in the country s and pose negative impact on the domestic output. At the second stage, the transferred industry will re-construct its industrial chain in country r, bring demands for local and other regions (including country s), and drive the GDP of country s. On such basis, the paper will divide its analysis into two parts in terms of model construction.

First, the influence of outward industrial transfer on country s at the first stage is considered. After some output of sector i in country s is transferred, the sector is basically subject to an exogenous supply constraint (negative supply impact). On this account, the international input-output table can be divided into constrained sectors and unconstrained sectors, with sector i in country s being a block and other sectors being another block (expressed as v). The partitioned row model is expressed as:

$$\begin{pmatrix} X_i^s \\ X_v \end{pmatrix} = \begin{pmatrix} A_{ii}^{ss} & A_{iv} \\ A_{vi} & A_{vv} \end{pmatrix} \begin{pmatrix} X_i^s \\ X_v \end{pmatrix} + \begin{pmatrix} Y_i^s \\ Y_v \end{pmatrix} \tag{1}$$

Based on the above formula, we get:

$$\begin{aligned} X_i^s &= A_{ii}^{ss} X_i^s + A_{iv} X_v + Y_i^s \\ X_v &= A_{vi} X_i^s + A_{vv} X_v + Y_v \end{aligned} \tag{2}$$

According to formula (1) and (2), we further get:

$$X_v = \left(I - A_{vv}\right)^{-1} \left(A_{vi} X_i^s + Y_v\right) \tag{3}$$

Outward industrial transfer will not pose influence on end demand of other sectors (sectors apart from sector i in country s) or internal direct consumption relationship, and thus A_{vv} and Y_v remain unchanged. Therefore, according to formula (3), the influence of transfer from sector i in country s on other sectors can be expressed as:

$$\triangle X_v = \left(I - A_{vv}\right)^{-1} A_{vi} \triangle X_i^s \tag{4}$$

Next, the transferred sector develops into a new sector (expressed as i^*) in country r and meanwhile constructs a new industrial chain. The new sector will change the original economic system in two ways. First, the new sector will change the input structure of the previous industry. Also, suppose products of sector i^* are only for supply to country t and its own consumption ($A_{ii^*}^{rs} = A_{i^*j}^{rs} = A_{i^*i}^{rr} = A_{i^*j}^{rr} = 0$), and then the previous industrial chains in country s and country r are not affected. But part of the previous exports from sector i in country s to country t is now replaced by sector i^*, and so A_{ij}^{st} and A_{ij}^{st} will be changed. Second, the new sector shapes a new industrial chain in country r and produces new ties with the previous economic system. After the industrial transfer, the new input-output row model is changed to:

$$\begin{pmatrix} X_i^{s*} \\ X_v^* \\ X_{i^*}^r \end{pmatrix} = \begin{pmatrix} A_{ii}^{ss} & A_{iv}^* & A_{ii^*}^{sr} \\ A_{vi} & A_{vv} & A_{vi^*} \\ A_{i^*i}^{rs} & A_{i^*v}^{rt} & A_{i^*i}^{rr} \end{pmatrix} \begin{pmatrix} X_i^{s*} \\ X_v^* \\ X_{i^*}^r \end{pmatrix} + \begin{pmatrix} Y_i^{s*} \\ Y_v^* \\ Y_{i^*}^r \end{pmatrix}$$

$A_{ii^*}^{sr}$, A_{vi^*} and $A_{i^*i}^{rr}$ are new industrial chains shaped by sector i^*. Similarly, after

country *r* undertakes the industry transferred from sector *i* in country *s*, it is basically subject to a positive supply impact, which can not only bring direct output and value-added growth, but also drive output growth of related industries in country *r* and country *s* through industrial interconnections. We take sector i^* as a block and other sectors as another block (express with *a*, i.e. all the sectors at the first stage), and then the influence of production of sector i^* in country *r* on other regions and sectors can be expressed as:

$$\triangle\begin{pmatrix} X_i^{s*} \\ X_v^* \end{pmatrix} = \left[I - \begin{pmatrix} A_{ii}^{ss} & A_{iv}^* \\ A_{vi} & A_{vv} \end{pmatrix} \right]^{-1} \triangle \left[\begin{pmatrix} A_{ii^*}^{sr} \\ A_{vi^*} \end{pmatrix} X_{i^*}^r \right]$$

or

$$\triangle X_u = \left(I - A_{uu} \right)^{-1} \triangle \left(A_{ui^*} X_{i^*}^r \right) \tag{5}$$

Further suppose that the transferred industry maintains the same output size as before and then the industrial transfer poses the supply impact that is same in size but opposite in direction on country *s* and country *r*, meeting $\triangle X_i^s + \triangle X_{i^*}^r = 0$.

As for the new economic system shaped because of the industrial transfer, it is changed in two aspects compared with the previous system. First, intermediate consumption of country *t* from sector *i* in country *s* is partially changed in from consumption from sector i^*. Make this ratio the proportion of sector i^*'s output in country *s*' total export to country *t* and define it as *a*. Then we get:

$$A_{iv}^* = \left(A_{ij}^{ss} \left(1 - a \right) A_{ii}^{st} \left(1 - a \right) A_{ij}^{st} \; A_{ii}^{sr} \; A_{ij}^{sr} \right)$$

Second, sector i^* will re-arrange its supporting production according to actual conditions, and thus shape new industrial chains, and establish direct or indirect industrial connections with country *s* through the new industrial chains. Since industrial transfer is more reflected in the change of place of production and generally has little influence on the technical level of related sectors, sector i^* maintains the same technical level as sector *i* in country *s*, meeting:

$$A_{ii^*}^{sr} + A_{ii^*}^{rr} + A_{ii^*}^{tr} + A_{i^*i^*}^{rr} = A_{ii}^{ss} + A_{ii}^{ts} + A_{ii}^{rs}$$
$$A_{ji^*}^{sr} + A_{ji^*}^{tr} + A_{ji^*}^{rr} = A_{ji}^{ss} + A_{ji}^{ts} + A_{ji}^{rs}$$

Next, after sector *i* in country *s* is transferred, its source of intermediate products

will inevitably be changed. In other words, some intermediate products previously provided by country *s* are now supplied by country *r*. We can divide the direct consumption coefficient vector of sector i^* into three parts for analysis.

The first is the direct consumption coefficient from country *t* and sector *i* in country *r*. The industrial transfer will not affect its intermediate consumption from country *t* and sector *i* in country *r*, thus meeting $A_{ii^*}^{tr} = A_{ii}^{ts}$, $A_{ji^*}^{tr} = A_{ji}^{ts}$ and $A_{ii^*}^{rr} = A_{ii}^{rs}$.

The second is the direct consumption coefficient of sector i^* from itself and sector *i* in country *s*, i.e. re-distribution by A_{ii}^{ss} between $A_{ii^*}^{sr}$ and $A_{i^*i^*}^{rr}$. In fact, in the short term, sector i^* finds it difficult to meet its entire consumption from itself and needs to import some intermediate products from sector *i* in country *s*. Therefore, sector i^* can realize self-supply partially in short term, and for this ratio, sector *i* in country *r* can be taken as reference. Suppose the self-supply ratio (proportion of intermediate products of sector *i* required from i^* in country *r* in all of their intermediate products acquired from country *s* and country *r*) of sector i^* equals that of sector *i* in country *r*, and it meets:

$$\frac{A_{ii^*}^{sr}}{A_{ii^*}^{sr} + A_{ii^*}^{rr} + A_{i^*i^*}^{rr}} = \frac{A_{ii^*}^{sr}}{A_{ii}^{ss} + A_{ii^*}^{rr}} = \frac{A_{ii}^{sr}}{A_{ii}^{sr} + A_{ii}^{rr}}$$

In the long run, sector i^* can keep improving its self-supply ratio and even completely replace its intermediate product demand from sector *i* in country *s* under extreme conditions, i.e. $A_{i^*i^*}^{rr} = 0$.

The third is the direct consumption coefficient of sector i^* from sector *j* in country *s* and sector *j* in country *r*. Here, tradability of intermediate products must be taken into consideration, with un-tradable intermediate products supplied only by sector *j* in country *r* and tradable ones supplied by both countries. Similarly, we need discuss it in both the short term and long term.

Scenario 1: In the short term, under the impact of supply capacity, product quality etc., sector i^* finds it hard to establish complete industrial chains in country *r* and remains dependent on the domestic industrial chains to some extent. At this point, tradable products in intermediate consumption of sector i^* from sector *j* are all supplied by country *s*, but un-tradable products must be supplied by country *r*. Then, in scenario 1, the direct consumption coefficient vector of sector i^* from other sectors can be expressed as:

$$A_{vi^*} = \begin{pmatrix} A_{ji}^{ss} - A_{ji}^{ss*} \\ A_{ii}^{ts} \\ A_{ji}^{ts} \\ A_{ii}^{rs} \\ A_{ji}^{rs} + A_{ji}^{ss*} \end{pmatrix}$$

In $A_{ji}^{ss^*}$, corresponding elements of other industries apart from un-tradable products are zeros. It can be seen that under scenario 1, sector i^* maintains its economic ties with country s to the maximal extent.

Scenario 2: In the long run, sector i^* will gradually seek supply of its intermediate products in country r and have all of its intermediate products supplied by country r under extreme conditions. Meanwhile, suppose other industrial chains remain unchanged, and then:

$$A_{vi^*} = \begin{pmatrix} 0 \\ A_{ii}^{ts} \\ A_{ji}^{ts} \\ A_{ii}^{rs} \\ A_{ji}^{rs} \end{pmatrix}$$

The formula shows that under scenario 2, sector i^* has no demand of intermediate products from country s and only has trade relationships with country t and country r. As sector i^* doesn't have any direct influencing relationship with country s under scenario 2, we predict that scenario 2 poses the greatest influence upon country s. Actual influence will range between scenario 1 and scenario 2.

According to the two-stage analysis, total impact on country s is partially from the negative impact due to the reduced output of its sector i and partially from the new demand of sector i^*. Based on formula (4) and (5), we can introduce a value-added rate vector and eventually get the total impact of industrial transfer on value added of country s:

$$\triangle V^s = \underbrace{w_i^s \triangle X_i^s}_{\text{Direct effect}} + \underbrace{e_i^s \widehat{w_v} \left(I - A_{vv}\right)^{-1} A_{vi} \triangle X_i^s}_{\text{Correlation effect}} + \underbrace{e^s \widehat{w_u} \left(I - A_{uu}\right)^{-1} \triangle \left(A_{ui^*} X_{i^*}^s\right)}_{\text{Spillover effect}} \tag{6}$$

V^s is the total value added in country s; w_i^s is the value-added rate of sector i in country s; $\widehat{w_v}$ and $\widehat{w_u}$ are the diagonal matrix generated with value-added rate of each sector as diagonal element; $e_i^s = \left(\underbrace{1, \cdots, 1}_{\text{Number of industries in sector } i \text{ in country } s}, 0, \cdots, 0 \right)$, $e^s = \left(\underbrace{1, \cdots, 1}_{\text{Total number of industries in country } s}, 0, \cdots, 0 \right)$. Formula (6) reflects the influencing mechanism of outward industrial transfer on value added of country s. First, transfer of sector i in country s will directly cause decrease of output and value added of sector i in country s. Second, after output of sector i is reduced in country s, intermediate

consumption (including direct consumption and indirect consumption) of other connected sectors will be accordingly decreased, causing further decline in total output and value added of country *s*. Lastly, after sector *i* is transferred to country *r* and develops into sector i^*, output growth of sector i^* will bring demand to connected sectors on industrial chains (new industrial chains with different source structure of intermediate input from sector *i*), which will result in output growth of the connected sectors including demand driven for all sectors in country *s*, and drive the growth in output and value added of country *s*. In the process, three influencing channels are included. The first is the direct influence of industrial transfer on sector *i* in country *s*, i.e. direct effect whose direction of influence is negative. The second is the change in value added of other sectors caused by output reduction in sector *i* in country *s* through industrial correlation, i.e. correlation effect whose direction of influence is negative as well. The third is the new demand for other sectors as a result of output increase in sector i^*, i.e. spillover effect, and the direction of influence is positive. In consequence, after the industrial transfer, value added generated by the new sector is all in country *r* and its correlation with other sectors in the country will not be stronger than sector *i*. Therefore, the total influence of the industrial transfer on country *s* should be negative.

The data in this paper is all sourced from the World Input-Output Database (WIOD), and the latest 2014 World Input-Output Table data is adopted, including 56 sectors and 44 countries and regions. As required by the research, the paper further consolidates it into the three-regional input-output table covering China, the United States and another region and on such basis, analyzes the influence of China's manufacturing transfer to other regions on China's GDP and industrial structure.

4. Analysis of the Calculation Results

4.1. Export Structure of China's Manufacturing to the United States

China's export to the United States is predominated by goods trade and export products are concentrated in manufacturing. Therefore, manufacturing products are the main target that the United States increases tariffs on against China in the China-US trade frictions and manufacturing is also the main sector of international industrial transfer. This is the reason why the paper takes manufacturing as its target of study. In addition, given that manufacturing sectors in different technology groups differ widely in product nature and trade with the United States, transfer of manufacturing in different technology groups will inevitably pose varied influences. The paper refers to the United Nations Industrial Development Organization (UNIDO)'s classification of manufacturing into different technology groups and classifies manufacturing into low-tech, medium-tech and high-tech

manufacturing.[1] On such basis, it studies China's export of manufacturing in different technology groups to the United States and the influence of outward industrial transfer.

Table 1. Export Structure of China's Manufacturing to the United States in 2014 (Unit: 100 Million Dollars)

Technology group	Sector	Intermediate product	End product	Total value
Low-tech manufacturing	Manufacturing of food, beverages and tobacco products	9.38	42.95	52.33
	Manufacturing of textiles, wearing apparel and leather	31.09	503.70	534.79
	Manufacturing of wood, wood products, articles of straw and plaiting materials (except furniture)	17.66	8.21	25.88
	Manufacturing of paper and paper products	22.49	7.58	30.07
	Printing and reproduction of recorded media	0.58	1.22	1.81
	Other manufacturing (including furniture)	32.70	213.30	246.00
	Total	113.90	776.97	890.87
Medium-tech manufacturing	Manufacturing of coke and refined petroleum products	14.60	5.45	20.05
	Manufacturing of rubber and plastics products	55.03	40.05	95.09
	Manufacturing of other non-metallic mineral products	38.53	15.58	54.11
	Manufacturing of basic metals	42.22	28.51	70.73
	Manufacturing of fabricated metal products (except machinery and equipment)	83.92	59.75	143.67
	Total	234.3	149.34	383.65

[1] UNIDO classifies manufacturing by research & development density into low-tech manufacturing, medium-low-tech manufacturing, medium-high-tech manufacturing and high-tech manufacturing. For brevity, the paper takes the medium-low-tech manufacturing in the UNIDO classification as medium-tech manufacturing, and combines medium-high-tech manufacturing (including manufacturing of chemicals and chemical products, manufacturing of basic medical products and medical preparations, manufacturing of electrical machinery and apparatus, manufacturing of machinery and equipment not elsewhere classified, manufacturing of motor vehicles, trailers and semi-trailers, and manufacturing of other transport equipment) and high-tech manufacturing (manufacturing of computers, electronic products and optical products) into high-tech manufacturing.

Technology group	Sector	Intermediate product	End product	Total value
High-tech manufacturing	Manufacturing of chemicals and chemical products	143.23	24.49	167.72
	Manufacturing of basic medical products and medical preparations	11.63	16.07	27.70
	Manufacturing of computers, electronic products and optical products	343.78	729.21	1072.98
	Manufacturing of electrical machinery and apparatus	125.72	194.97	320.69
	Manufacturing of machinery and equipment, not elsewhere classified	135.10	163.93	299.03
	Manufacturing of motor vehicles, trailers and semi-trailers	96.96	42.41	139.37
	Manufacturing of other transport equipment	13.22	20.86	34.08
	Total	869.64	1191.94	2061.57

Source: WIOD.

According to Table 1, first, in 2014, China's export to the United States was predominated by high-tech products, which accounted for 61.8% of total export to the United States, and then included low-tech product (26.7% of the total) and medium-tech products (11.5%) as the smallest part, showing the U-shaped feature relative to technological level. The reasons behind were as follows. Firstly, medium-tech manufacturing was predominated by processing and manufacturing of bulk commodities such as minerals, petroleum and rubber, while for these products, China heavily relied on import and related industries in the country were small in size and intended mainly for internal supply. Secondly, low-tech manufacturing still took up a certain proportion in China and still enjoyed some comparative advantages in the international trade. Manufacturing of textiles, wearing apparel and leather was especially large in export size and served as the second largest manufacturing sector in China's export to the United States. Thirdly, as China's technologies kept advancing in recent years, the export structure of China was gradually developing towards high end and competitiveness of its export products was continuously improved.

Second, what China exported to the United States was mainly end products, which especially had a large proportion in low-tech and high-tech manufacturing with the largest export size. Low-tech products were mostly consumer goods as end products and medium-tech products were mainly raw materials used as intermediate products. However, high-tech products showed no distinct features of either intermediate products or end products. According to Table 1, manufacturing of computers, electronic products and optical products was the main sector in China's export to the United States (52% of total export of high-tech manufacturing to the United States), but 70% of its export

products were used as end products. This reflected that though its export structure started to develop towards the high end, China was still predominated by processing and assembling in the global industrial division and was still at down-stream industrial chains globally and "seized by the throat" at key nodes of the industrial chains (Tan, 2019).

Among the three categories of manufacturing, high-tech manufacturing is the main sector of China's export to the United States and thus should be the focus of attention amid industrial transfer. According to the analysis above, influence of outward industrial transfer on a country is determined by value-added rate of the sector, its correlation with other sectors and new industrial chains developed after the sector's transfer. Sectors in different technology groups differ in the three aspects and therefore, which category of manufacturing has larger influence depends on the relative size of the three factors, which will be further examined later in the paper.

4.2. Influence of Manufacturing Transfer on China's GDP

According to setting in the model, the paper first divides all the sectors into tradable sectors and un-tradable ones, and then makes calculations in two scenarios based on different sources of tradable sectors. As per China's intermediate product trade relationship with most countries, the paper defines un-tradable sectors as water collection, treatment and supply, construction, and other sectors in the tertiary industry apart from land transport and transport via pipelines, water transport, air transport, legal and accounting activities, activities of head offices, management consultancy activities, administrative and support service activities, and other service activities.

Table 2. Influencing Channels and Level of Manufacturing Transfer on China's GDP (Unit: 1 Million Dollars)

Technology group	Sector	Direct effect	Correlation effect	Scenario 1		Scenario 2	
				Spillover effect	Total influence	Spillover effect	Total influence
Low-tech manufacturing	Manufacturing of food, beverages and tobacco products	−0.228	−0.420	0.392	−0.256	0.011	−0.636
	Manufacturing of textiles, wearing apparel and leather	−0.199	−0.297	0.255	−0.241	0.030	−0.466
	Manufacturing of wood, wood products, articles of straw and plaiting materials (except furniture)	−0.229	−0.285	0.253	−0.261	0.017	−0.497
	Manufacturing of paper and paper products	−0.206	−0.399	0.338	−0.267	0.018	−0.587
	Printing and reproduction of recorded media	−0.285	−0.544	0.466	−0.363	0.017	−0.812
	Other manufacturing (including furniture)	−0.395	−0.474	0.416	−0.453	0.017	−0.852

Technology group	Sector	Direct effect	Correlation effect	Scenario 1		Scenario 2	
				Spillover effect	Total influence	Spillover effect	Total influence
Medium-tech manufacturing	Manufacturing of coke and refined petroleum products	−0.129	−0.515	0.516	−0.128	0.014	−0.630
	Manufacturing of rubber and plastics products	−0.187	−0.464	0.415	−0.236	0.024	−0.628
	Manufacturing of other non-metallic mineral products	−0.252	−0.439	0.379	−0.313	0.017	−0.674
	Manufacturing of basic metals	−0.153	−0.370	0.351	−0.171	0.019	−0.503
	Manufacturing of fabricated metal products (except machinery and equipment)	−0.192	−0.508	0.453	−0.246	0.022	−0.678
	Manufacturing of chemicals and chemical products	−0.162	−0.363	0.335	−0.189	0.020	−0.504
	Manufacturing of basic medical products and medical preparations	−0.268	−0.493	0.395	−0.365	0.014	−0.747
High-tech manufacturing	Manufacturing of computers, electronic products and optical products	−0.165	−0.265	0.239	−0.191	0.048	−0.382
	Manufacturing of electrical machinery and apparatus	−0.157	−0.493	0.448	−0.202	0.031	−0.620
	Manufacturing of machinery and equipment, not elsewhere classified	−0.220	−0.436	0.383	−0.273	0.027	−0.629
	Manufacturing of motor vehicles, trailers and semi-trailers	−0.182	−0.314	0.238	−0.259	0.028	−0.469
	Manufacturing of other transport equipment	−0.210	−0.420	0.356	−0.274	0.030	−0.600

Table 2 shows the influencing severity of per unit (1 million dollars) output of industrial transfer in each sector of China's manufacturing on its GDP under two scenarios. Based on the calculation, we come to the following conclusions.

First, in terms of direct effect, average direct effect of low-tech manufacturing is −0.257, much greater than that of medium- and high-tech manufacturing (medium-tech manufacturing at −0.183 and high-tech manufacturing at −0.195). Direct effect depends on value-added rate of an industry, and higher value-added rate indicates larger decrease in value added of the sector directly caused by outward industrial transfer. Value-added rate is affected by intra-product specialization. If the industrial chain specialization of a sector is further segmented, manufacturing of its products will require more intermediate steps and intermediate input, which implies longer value chains and greater value of intermediate products, and then correspondingly, the value-added rate will decline (Yu and Chang, 2015). Low-tech manufacturing includes mostly traditional industries with short industrial chains and backward intra-product specialization, while medium- and high-tech manufacturing has longer

industrial chains and further refined intra-product specialization. Also, China basically remains at a medium- and down-stream position in industrial chains and depends more on intermediate input. Therefore, the value-added rate of medium- and high-tech manufacturing (direct effect) is lower.

Second, regarding correlation effect, the average correlation effect of medium-tech manufacturing (−0.459) is higher than that of low-tech (−0.403) and high-tech manufacturing (−0.398). Correlation effect depends on two factors. The first is industrial correlation intensity of the transferred sector with other sectors, and longer industrial chains mean greater correlation effect. The second is the value-added rate of main supporting industries in the industrial chains, and higher value-added rate of main correlated industries brings greater correlation effect. Medium-tech manufacturing is predominated by upper-stream raw material production and highly correlated with mining and the primary industry which both feature considerably high value-added rate. Low-tech manufacturing generally has short industrial chains and drives other sectors weakly. But similar to medium-tech manufacturing, low-tech manufacturing has some of sectors that are correlated with sectors of high value-added rate and thus the correlation effect is noticeable, manufacturing of food, beverages and tobacco products and manufacturing of paper and paper products, for instance. High-tech manufacturing should theoretically feature strong correlation effect because of its long industrial chains, but some sectors heavily consume themselves, which relatively lessens the correlation effect with other sectors, such as manufacturing of computers, electronic products and optical products.

Third, with respect to spillover effect, the average influence of medium-tech manufacturing is still the highest (0.353), followed by low-tech manufacturing (0.353) and then high-tech manufacturing that has the lowest spillover effect (0.342). The influence of spillover effect, similar to that of correlation effect, is the comprehensive driving effect of a transferred sector on all the sectors in the country. As in the short term (scenario 1), the transferred sector needs to import intermediate products from the country, its driving effect on the country in the short term is apparently greater than in the long term, indirectly resulting in the weaker total influence in the short term. By technology group, the greatest short-term spillover effect lies with medium-tech manufacturing. Besides the same reason as correlation effect, another reason is that correlation between medium-tech manufacturing with un-tradable sectors is stronger, while the latter is supplied by the industry-undertaking country in the short term. Meanwhile, in scenario 2, spillover effect of all the sectors is visibly lessened, indicating that total influence of industrial transfer on the country will rise in the long term. In comparison by their level of influence, correlation effect exerts the greatest influence and is followed by spillover effect and then direct effect. Correlation effect of all sectors is basically greater than spillover effect, meaning that every sector has stronger industrial correlation with other sectors in the country than outside the country.

The reason is that, after the industrial transfer, some domestic intermediate products will inevitably be substituted by foreign products, causing its driving effect on the country to weaken. By technology group, the majority of low-tech manufacturing sectors (other sectors except printing and reproduction of recorded media and other manufacturing) see a smaller decline than medium- and high-tech manufacturing, resulting in a larger decrease of China's GDP caused by medium- and high-tech manufacturing transfer in the long term. On this account, in the long run, we need to pay closer attention to the influence of medium- and high-tech manufacturing on China's GDP.

Fourth, as for total influence, in the short term (scenario 1), the largest influence is from other manufacturing, with transfer of one unit output reducing China's GDP by 0.453 unit, the second and third largest influence is from manufacturing of basic medical products and medical preparations (−0.365) and printing and reproduction of recorded media (−0.363), and the smallest influence is from manufacturing of coke and refined petroleum products (−0.128), manufacturing of basic metals (−0.171) and manufacturing of chemicals and chemical products (−0.189). In the long term (scenario 2), the greatest influence is from other manufacturing (−0.852) and printing and reproduction of recorded media (−0.812), the second largest influence is from manufacturing of basic medical products and medical preparations (−0.747), and the smallest influence is from manufacturing of computers, electronic products and optical products (−0.382), manufacturing of textiles, wearing apparel and leather (−0.466) and manufacturing of motor vehicles, trailers and semi-trailers (−0.469). In the short term, the average influence of manufacturing in the three technology groups is −0.307, −0.219 and −0.250, while in the long term, the influence is −0.642, −0.623 and −0.564 respectively.

It is noted that internal gap of different technology groups of manufacturing is wide as well. For instance, in low-tech manufacturing, printing and reproduction of recorded media and other manufacturing are noticeably different from other sectors, being the main reasons behind the largest influence of low-tech manufacturing. With the two sectors removed, low-tech manufacturing has a short-term and long-term influence of −0.256 and −0.547 respectively, which is higher than medium- and high-tech manufacturing in the short term but the situation is the reverse in the long term. In the meantime, printing and reproduction of recorded media, with a small export value to the United States (181 million dollars), is not worth excessive attention. Apart from the two sectors, other low-tech manufacturing sectors generally exert weaker influence than medium- and high-tech manufacturing. Also, as mentioned above, some high-tech manufacturing sectors (such as manufacturing of computers, electronic products and optical products) heavily consume themselves and thus have weaker correlation with other sectors. However, if manufacturing is classified in a finer way, the influence of high-tech manufacturing is expected to increase considerably. Another explanation is that quite a large part of China's high-tech manufacturing is at the down-stream position of industrial chains such as assembling, with low product value added, and it

is hard to establish stronger industrial correlation with other sectors in the country (Xie and Yang, 2015; Yu, 2017). Moreover, as high-tech manufacturing is the main sector for China's export to the United States, its size of possible transfer will be bigger and therefore in the long term, more attention should be paid to high-tech manufacturing.

4.3. Influence of Manufacturing Transfer on China's Industrial Structure

In addition to the perspective of GDP, we should also take into consideration the influence of manufacturing transfer in different sectors on the economic structure. This should be taken as an important perspective of related study, especially at the moment when China is under industrial structure adjustment and the structural influence of industrial transfer is critical.

Table 3 displays the influence of manufacturing transfer on value added of three industries in China. According to the calculation results, we conclude as follows.

First, manufacturing transfer exerts the heaviest influence on the secondary industry, which result is quite obvious. The transfer first causes the decrease of value added in its own sector and the secondary industry (direct effect), while the influence on value added of other sectors and industries is indirect.

Second, if we compare the change in value added of different industries under the influence in the long term and short term, we find all sectors will generally cause a larger decrease in value added of the secondary industry in the long term (i.e. the difference in the value added of the secondary industry under the influence between the two scenarios is greater). As the difference between the short term and long term lies in spillover effect, it indicates that for one thing, all manufacturing sectors generally enjoy strong correlation with the secondary industry. For another, since most sectors of the secondary industry are tradable sectors and but sectors in the tertiary industry are not, in the long term, the transferred sector will change its import from the secondary industry in the country into local procurement. Meanwhile, in comparison of different technology groups of manufacturing, we find that most transfers of medium- and high-tech manufacturing sectors cause a larger drop in value added of the secondary industry than low-tech manufacturing in the long term.

Third, the influence of low-tech manufacturing transfer on the primary industry is apparently higher than other sectors, while its influence on the secondary and tertiary industry is weak. Especially in the long run, except for the two special sectors of printing and reproduction of recorded media and other manufacturing, transfer of other low-tech manufacturing sectors will generally pose heavy influence on the primary industry, while its influence on the tertiary industry is lower than that of medium- and high-tech manufacturing. As for the reason, low-tech manufacturing is predominated by primary processed products on the basis of products of the primary industry and has a stronger correlation with the primary industry, while medium- and high-tech

manufacturing requires more support from the service industry such as research and development, logistics and information. This also reflects the different industrial chain characteristics of different technology groups of manufacturing. It should be noted that transfer of some low-tech manufacturing sectors will result in rise of value added in the primary industry, because the transferred sectors will generate additional demand for the corresponding sectors in the country and the multiplier at the second stage (Leontief inverse matrix) is relatively larger. The two factors may lead to positive influences on some industries (such as manufacturing of food, beverages and tobacco products).

In general, manufacturing transfer will inevitably result in the largest decline in the proportion of the secondary industry. In addition, we need to pay more attention to the influence on the primary industry during transfer of low-tech manufacturing, and to the influence on the tertiary industry during transfer of medium- and high-tech manufacturing.

Table 3. Influence of Manufacturing Transfer on Value Added of Three Industries in China (Unit: 1 Million Dollars)

Technology group	Sector	Scenario 1			Scenario 2		
		Primary industry	Secondary industry	Tertiary industry	Primary industry	Secondary industry	Tertiary industry
Low-tech manufacturing	Manufacturing of food, beverages and tobacco products	0.016	−0.214	−0.058	−0.231	−0.287	−0.119
	Manufacturing of textiles, wearing apparel and leather	0.005	−0.185	−0.061	−0.084	−0.275	−0.108
	Manufacturing of wood, wood products, articles of straw and plaiting materials (except furniture)	0.001	−0.226	−0.036	−0.078	−0.322	−0.097
	Manufacturing of paper and paper products	−0.001	−0.209	−0.057	−0.073	−0.370	−0.143
	Printing and reproduction of recorded media	−0.003	−0.291	−0.069	−0.049	−0.566	−0.197
	Other manufacturing (including furniture)	−0.002	−0.400	−0.052	−0.055	−0.641	−0.157
Medium-tech manufacturing	Manufacturing of coke and refined petroleum products	0.000	−0.106	−0.022	−0.013	−0.486	−0.130
	Manufacturing of rubber and plastics products	0.000	−0.179	−0.057	−0.040	−0.419	−0.169
	Manufacturing of other non-metallic mineral products	−0.002	−0.252	−0.058	−0.018	−0.493	−0.164
	Manufacturing of basic metals	−0.001	−0.133	−0.037	−0.011	−0.370	−0.121
	Manufacturing of fabricated metal products (except machinery and equipment)	−0.002	−0.187	−0.057	−0.019	−0.476	−0.182

Technology group	Sector	Scenario 1			Scenario 2		
		Primary industry	Secondary industry	Tertiary industry	Primary industry	Secondary industry	Tertiary industry
High-tech manufacturing	Manufacturing of chemicals and chemical products	0.000	−0.143	−0.047	−0.029	−0.344	−0.131
	Manufacturing of basic medical products and medical preparations	−0.004	−0.277	−0.084	−0.151	−0.410	−0.186
	Manufacturing of computers, electronic products and optical products	−0.001	−0.131	−0.059	−0.009	−0.252	−0.121
	Manufacturing of electrical machinery and apparatus	−0.002	−0.143	−0.058	−0.018	−0.419	−0.182
	Manufacturing of machinery and equipment, not elsewhere classified	−0.002	−0.209	−0.062	−0.016	−0.438	−0.174
	Manufacturing of motor vehicles, trailers and semi-trailers	−0.002	−0.183	−0.073	−0.012	−0.315	−0.142
	Manufacturing of other transport equipment	−0.002	−0.212	−0.060	−0.014	−0.427	−0.159

Table 4 shows the influence level of manufacturing transfer on value added of different technology groups of manufacturing. Similar to the influence on the three industries, in the short term, direct effect is dominant and so all the sectors have the largest influence upon themselves at this point. In the long run, both medium- and low-tech manufacturing exerts the greatest influence on high-tech manufacturing except for on themselves, which means that the correlation between high-tech manufacturing and medium- and low-tech manufacturing is stronger than the correlation between medium- and low-tech manufacturing. Meanwhile, transfer of low-tech manufacturing poses weaker influence on high-tech manufacturing than that from medium-tech manufacturing transfer. For high-tech manufacturing, transfer of the majority of its sectors (except manufacturing of basic medical products and medical preparations) has stronger influence on medium-tech manufacturing than on low-tech manufacturing and therefore, mutual driving capacity of the correlation between medium- and high-tech manufacturing is stronger. These results demonstrate that during transfer of medium- and low-tech manufacturing, their influence on high-tech manufacturing cannot be overlooked. Another possible conclusion is that transfer of manufacturing with a higher technological level will, apart from the direct influence on its own, cause output reduction more in other manufacturing sectors with a high technological level.

Table 4. Influence of Manufacturing Transfer on Value Added of Different Technology Groups of Manufacturing in China (Unit: 1 Million Dollars)

Technology group	Sector	Scenario 1			Scenario 2		
		Low-tech manufacturing	Medium-tech manufacturing	High-tech manufacturing	Low-tech manufacturing	Medium-tech manufacturing	High-tech manufacturing
Low-tech manufacturing	Manufacturing of food, beverages and tobacco products	−0.212	0.000	0.000	−0.235	−0.013	−0.017
	Manufacturing of textiles, wearing apparel and leather	−0.184	0.000	0.000	−0.213	−0.013	−0.024
	Manufacturing of wood, wood products, articles of straw and plaiting materials (except furniture)	−0.224	0.000	0.000	−0.241	−0.020	−0.028
	Manufacturing of paper and paper products	−0.205	−0.001	−0.001	−0.240	−0.025	−0.045
	Printing and reproduction of recorded media	−0.285	−0.001	−0.002	−0.410	−0.041	−0.056
	Other manufacturing (including furniture)	−0.395	−0.001	−0.001	−0.494	−0.049	−0.042
Medium-tech manufacturing	Manufacturing of coke and refined petroleum products	0.000	−0.121	0.001	−0.018	−0.151	−0.036
	Manufacturing of rubber and plastics products	0.000	−0.180	0.002	−0.040	−0.217	−0.088
	Manufacturing of other non-metallic mineral products	−0.002	−0.248	−0.001	−0.028	−0.291	−0.048
	Manufacturing of basic metals	0.000	−0.142	0.001	−0.020	−0.178	−0.032
	Manufacturing of fabricated metal products (except machinery and equipment)	−0.002	−0.185	0.000	−0.032	−0.279	−0.055

Technology group	Sector	Scenario 1			Scenario 2		
		Low-tech manufacturing	Medium-tech manufacturing	High-tech manufacturing	Low-tech manufacturing	Medium-tech manufacturing	High-tech manufacturing
High-tech manufacturing	Manufacturing of chemicals and chemical products	0.000	0.002	−0.150	−0.027	−0.040	−0.176
	Manufacturing of basic medical products and medical preparations	−0.004	−0.002	−0.268	−0.045	−0.023	−0.301
	Manufacturing of computers, electronic products and optical products	0.000	0.004	−0.136	−0.013	−0.029	−0.183
	Manufacturing of electrical machinery and apparatus	−0.001	0.004	−0.147	−0.027	−0.094	−0.217
	Manufacturing of machinery and equipment, not elsewhere classified	−0.002	0.002	−0.209	−0.025	−0.072	−0.275
	Manufacturing of motor vehicles, trailers and semi-trailers	−0.002	0.000	−0.179	−0.019	−0.044	−0.213
	Manufacturing of other transport equipment	−0.002	−0.001	−0.207	−0.021	−0.064	−0.286

To sum up, according to the estimation and calculation on the influence on China's industrial structure, transfer of manufacturing at a higher technological level poses greater influence on the manufacturing and the service industry at a higher level. Correspondingly, transfer of manufacturing at a lower level mainly affects manufacturing and the primary industry which are at a lower level. Therefore, more attention should be paid to the influence of medium- and high-tech manufacturing transfer on the industrial structural upgrading.

5. Conclusions and Policy Suggestions

The paper constructs an international input-output supply-constraint model and uses the 2014 WIOD data to estimate and analyze the influence of transfer of different technology groups of manufacturing on China's GDP and industrial structure in the short term and long term and in three channels. The conclusions are as follows.

First, currently, among China's export products to the United States, high-tech products account for the largest proportion and are followed by low-tech products, with export products in these two sectors both predominated by end products. Meanwhile,

China's high-tech manufacturing still revolves on processing and assembling activities with low value added in some sectors, and its outward transfer is not difficult and possibly large in scale. Therefore, special attention should be paid to the impact of such factors as trade frictions and cost rise on high-tech manufacturing, a large part of export to the United States, as well as its desire for transfer.

Second, manufacturing transfer exerts influence on China's GDP and industrial structure in the three channels of direct effect, correlation effect and spillover effect. As transferred sectors will gradually seek foreign supply of intermediate products to partially and even entirely replace domestic industrial chains, which will weaken the driving effect (spillover effect) on the country in the long term, the influence of industrial transfer on the country will keep increasing as time goes by. As for influence of different technology groups of manufacturing, transfer of low-tech manufacturing will pose higher total influence than medium- and high-tech manufacturing in the short term, while in the long term, as increasingly more intermediate products are supplied by the industry-undertaking countries, the negative impact of medium- and high-tech manufacturing transfer on China's GDP will gradually surpass that of low-tech manufacturing (sectors except for printing and reproduction of recorded media and other manufacturing). At the same time, as China's manufacturing keeps improving in its technological level and especially keeps ascending in global industrial chains, high-tech manufacturing will have stronger driving capacity for the overall economy and by then, its transfer will result in heavier GDP loss in China.

Third, manufacturing transfer will inevitably cause the value added of the secondary industry to decline by a larger margin than other industries. Besides, low-tech manufacturing poses more noticeable impact on the primary industry, while medium- and high-tech manufacturing exerts more significant influence on the service industry. Within manufacturing, except for their influence on their own, transfer of all technology groups of manufacturing generally affects manufacturing at a higher technological level to a large extent, and especially, the correlated influence of transfer of different sectors on high-tech manufacturing in the long term should not be neglected.

Based on the conclusions, in order to mitigate the negative impact of manufacturing transfer on China, the paper proposes the following suggestions.

First, it is important to keep a close eye on the manufacturing sectors which are a large part of China's export to the United States and take measures to reduce the risk and cost from them. The additional tariffs imposed by the United States impact China's high-tech manufacturing heavily. In response, it is imperative to take countermeasures as soon as possible and lower the operation cost of enterprises by cutting tax and fees and improving business environment, etc. to mitigate the influence of trade frictions and other external impacts.

Second, attentions need to be paid to the influence of low-tech manufacturing transfer in the short term and to medium- and high-tech manufacturing transfer in the long term. In the short term, low-tech manufacturing transfer is more likely to happen and will pose greater influence, but in the long term, medium- and high-tech

manufacturing transfer has a greater influence on China's GDP and goes against the adjustment of industrial structure. Subject to flexible adjustments, short-term policies should focus on preventing the negative impact of low-tech manufacturing transfer, while long-term policies should shift focus to medium- and high-tech manufacturing.

Third, the ties between China's industrial chains and transferred sectors should be maintained as much as possible, and involvement of other sectors in an industrial chain by transfer of a single sector should be prevented. In the case of large-scale industrial transfer that is difficult to reverse, the transferred enterprises should be guided to maintain and enhance their ties with domestic industrial chains and measures should be taken to decrease trade cost of the transferred enterprises with domestic sectors. Meanwhile, domestic control over upper-stream links of industrial chains should be strengthened to avoid being "seized by the throat" in key areas and enhance dominance and irreplaceability in the industrial chains.

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