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Impact of the Novel Coronavirus Epidemic on China's Industrial Development

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ABSTRACT. *The novel coronavirus (COVID-19) pneumonia is now driving the "reverse globalization" trend. After the epidemic, many foreign companies may leave China, which will produce great impacts on China's industrial chain and the supply chain. In this paper, the input-output analysis method is used to analyze the impact of the epidemic on the development of various industries in China from three aspects: dependence, influence and possibility of transfer. The sequence of industries affected by the epidemic from highest to lowest is: modern services, advanced manufacturing, the light industry, the heavy industry, traditional services and agriculture.*

KEYWORDS: *Novel coronavirus epidemic, Input industry analysis, Industry chain*

1. Introduction

The epidemic caused by the novel coronavirus has brought about many challenges and impacts to the global economy and social development. It will cause a great impact on the global industrial chain and the supply chain for a long time; the international trade and economic activities will also be seriously affected. It is expected that after the epidemic, distrust will increase in various countries; different countries will make certain adjustments to their policies on industrial chain, and will build more independent, complete and safe industrial chains. [1] The following questions need to be theoretically analyzed: which industries in China are prone to transfer? Which industries are not easy to transfer? Which industrial transfer will produce great impacts on China's economic development?

2. Input Output Analysis

In order to analyze the impact of COVID-19 on China's industrial chain, this paper uses the input-output table data of 2017 to analyze the degree of dependence and influence coefficients of different industries, so as to analyze the difficult degree of transferring an industry after the epidemic, and the degree of influence of transferring the industry on other industries.[2]

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2.1 Analysis of Industrial Dependence

The national economy is a complex whole. The difficulty of an industry to transfer and whether it can survive after moving out depends on its dependence on other industries. If an industry is less dependent on other industries, it will be easier for it to transfer and survive after moving out; on the contrary, the transfer cost will be high, and it will be not easy to survive after moving out. In order to determine the dependence of an industry on other industries, we use the dependence coefficient to measure it. The dependence coefficient can reflect the number of intermediate products that other industries need to provide for an industry to increase the final use of a unit. When the coefficient of dependence of an industry is less than 1, it means that the dependence of the industry on other industries is lower than the average level. The industrial transfer is relatively easy, and the survival rate after moving out is also high. When the coefficient of dependence of an industry is greater than 1, it means that the dependence of the industry on other industries is higher than the average level. The industrial transfer is difficult, and the survival rate after moving out is low. The formula which calculates the dependence of each industry is as follows.

$$E_i = \frac{\sum_{j=1}^{n} c_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}} \quad (1)$$

According to the formula, and using the 2017 China input-output table, the dependence coefficient of each industry can be obtained. The data from low to high can be found in Table 1.

Table 1 Dependence Coefficient And Ranking of Various Industries.

No.	Industry	Dependence coefficient	rank
1	Agriculture	1.1958	12
2	Extractive industries	1.1805	11
3	Food and tobacco processing industries	0.7300	6
4	Textile, clothing, shoes, leather and down products manufacturing	0.8968	8
5	Wood processing, furniture, paper making and printing, stationery and art supplies manufacturing	0.7937	7
6	Oil refining, coking and chemical products manufacturing	2.0765	17
7	Manufacturing of non-metallic mineral products	0.6822	5
8	Metal smelting, processing and product	1.4105	14

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	manufacturing		
9	Machinery and equipment, transportation equipment, electronics and other equipment manufacturing	1.7691	16
10	Other manufacturing industries	0.2599	2
11	Production and supply of electricity, heat, gas and water	0.9676	9
12	The construction industry	0.0835	1
13	Wholesale and retail, transportation, storage and postal services	1.7573	15
14	Information transmission, software and information technology services	0.4295	4
15	Finance and real estate	1.1159	10
16	Scientific research and technical services	0.3919	3
17	Other services	1.2593	13

Source: China Statistical Yearbook (2019).

It can be seen from table 1 that the industry with the lowest degree of dependence is the construction industry. It is because, the construction industry is a labor-intensive industry, with a short industry chain, a small number of intermediate inputs, and low dependence on other industries. It is followed by other manufacturing industries; they have many types, small scales, low product value and low dependence. The third and fourth places belong to modern service industry, which is technology intensive, with less intermediate investment and low dependence on other industries. The fifth to ninth places belong to the light industry. The industry chain of light industry is gradually increasing; the amount of intermediate inputs and the amount of value are also gradually increasing. But the coefficient of dependence is still lower than 1, which indicates that on the whole, its dependence on other industries is relatively low. After the tenth place, the dependence coefficient is greater than 1. They are mainly agriculture, heavy industry, traditional service industry and modern manufacturing industry. This kind of industry has a long industry chain, a large number of intermediate inputs and a large amount of value. Therefore, it is difficult for them to transfer due to their high dependence on other industries.

2.2 Industrial Influence Coefficient

In order to study the impact of foreign-funded enterprises' moving out on China's economic development, we use the influence coefficient to measure. The influence coefficient reflects the extent to which the demand for each industry of the national economy is affected by the addition of a unit product to an industry. When the influence coefficient of an industry is less than 1, it means that the impact of the industry's moving out on other industries is lower than the average impact level. When the influence coefficient of an industry is greater than 1, it means that the impact of the industry's moving out on other industries is higher than the average level. Industries with greater influence coefficients can produce more impact on

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other sectors after its relocation. The calculation formula of the influence coefficient of each industry is as follows.

$$F_{j=} = \frac{\sum_{i=1}^{n} b_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}} \quad (2)$$

According to above formula, and using the 2017 China input-output table, the influence coefficients of various industries are obtained, which can be seen in Table 2.

Table 2 Influence Coefficients And Ranking of Various Industries.

No.	Industry	Influence coefficient	rank
1	Agriculture	0.6053	16
2	Extractive industries	0.7541	12
3	Food and tobacco processing industries	1.0665	9
4	Textile, clothing, shoes, leather and down products manufacturing	1.4437 2	
5	Wood processing, furniture, paper making and printing, stationery and art supplies manufacturing	1.3192	3
6	Oil refining, coking and chemical products manufacturing	1.2475	6
7	Manufacturing of non-metallic mineral products	1.1579	7
8	Metal smelting, processing and product manufacturing	1.2717	5
9	Machinery and equipment, transportation equipment, electronics and other equipment manufacturing	1.5115	1
10	Other manufacturing industries	0.7248	13
11	Production and supply of electricity, heat, gas and water	1.0684	8
12	The construction industry	1.2750	4
13	Wholesale and retail, transportation, storage and postal services	0.6204	15
14	Information transmission, software and information technology services	0.6996	14
15	Finance and real estate	0.4515	17
16	Scientific research and technical services	0.9730	10
17	Other services	0.8101	11

Source: China Statistical Yearbook (2019).

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As can be seen from table 2, the most influential industry is the mechanical equipment, transportation equipment, electronics and other equipment manufacturing industry. It is not only the intermediate input of other industries, but also the final consumables, so it has the greatest influence. Textile, clothing, shoes, leather and down products manufacturing industry ranks the second place; wood processing, furniture, paper making and printing, stationery and art supplies manufacturing industry ranks the third place. These two types of industries are light industries; the products they produced are closely related to people's life, and can also be used as intermediate investment in other industries, so they have great influence. The fourth is the construction industry. With the development of China's real estate, the construction industry has more and more influence on China's economy and society. Oil refining, coking and chemical products manufacturing, non-metallic mineral products manufacturing and metal smelting, processing and product manufacturing industries rank fifth to seventh places. These three industries are all heavy industries, and the products they produced are indispensable intermediate inputs for other industries, so they have a relatively important impact on China's economic development. The eighth and ninth places are the production and supply of electricity, heat, gas and water, as well as the food and tobacco processing industry. These two industries provide power, energy, food and water resources for people's production and life; their impact on social and economic development cannot be ignored. Scientific research and technological service industry and other service industries rank tenth and eleventh places. These two industries are modern service industries; they provide knowledge, technology and information for producers for intermediate input, and play an important role in social and economic development. Agriculture, traditional service industry and the extractive industry are main industries after the 11th. They provide less intermediate products; their influence coefficients are less than 1.

3. Analysis on the Possibility of Enterprise Transfer

After analyzing the difficulty of industrial transfer and the impact on other industries, it is necessary to further analyze the possibility of foreign-funded enterprises to transfer. We studied the possibility of transferring foreign-funded enterprises in various industries by taking the percentage of foreign-funded registered capital in each industry at the end of 2018 as the indicator. If the proportion of foreign capital is higher in a certain industry, the possibility of the enterprise to transfer will be higher; otherwise, the possibility of enterprise transfer will be lower. [3-4] The percentage and ranking of foreign registered capital in various industries are shown in Table 3.

Table 3 Proportion and Ranking of Foreign Registered Capital in Each Industry.

No.	Industry	Proportion of registered foreign capital	rank
1	Agriculture	2.709	9

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2	Extractive industries	0.296	16
3	Food and tobacco processing industries	2.252	10
4	Textile, clothing, shoes, leather and down products manufacturing	1.022	14
5	Wood processing, furniture, paper making and printing, stationery and art supplies manufacturing	1.850	13
6	Oil refining, coking and chemical products manufacturing	5.485	6
7	Manufacturing of non-metallic mineral products	0.951	15
8	Metal smelting, processing and product manufacturing	1.862	12
9	Machinery and equipment, transportation equipment, electronics and other equipment manufacturing	14.807	3
10	Other manufacturing industries	0.147	17
11	Production and supply of electricity, heat, gas and water	2.789	8
12	The construction industry	1.999	11
13	Wholesale and retail, transportation, storage and postal services	10.497	4
14	Information transmission, software and information technology services	3.517	7
15	Finance and real estate	20.330	2
16	Scientific research and technical services	7.814	5
17	Other services	21.673	1

Source: China Statistical Yearbook (2019).

It can be seen from table 3 that the industry with the largest amount of foreign investment is the service industry, especially the modern service industry. It includes other service industries which ranks the first, finance and real estate industry which ranks the second, wholesale and retail, transportation, storage and postal service industry which ranks the fourth, scientific research and technical service industry which ranks the fifth, and information transmission, software and information technology service industry which ranks seventh.

Heavy industry has less foreign investment. It includes machinery and equipment, transportation equipment, electronics and other equipment manufacturing industry which ranks the third, oil refining, coking and chemical products manufacturing industry which ranks the sixth, power, heat, gas and water production and supply industry which ranks the eighth, and metal smelting, processing and product manufacturing which ranks the twelfth.

The heavy industry is followed by light industry. It includes the food and tobacco processing industry which ranks the tenth, the wood processing, furniture, paper making and printing, stationery and art supplies manufacturing industry which ranks

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he 13th, textile, clothing, shoes, leather and down products manufacturing industry which ranks the 14th, and the non-metallic mineral products manufacturing industry which ranks the 15th.

Finally, there are other industries, including agriculture, construction, extractive and other manufacturing industries. In these industries, the proportions of foreign registered capital are less than 1%.

4. Conclusion

This paper analyzes the impact of novel coronavirus epidemic on industries from three aspects: dependency, influence and probability.[5] The ranking of these three industries is not consistent from the three aspects. In order to comprehensively analyze the impact of the epidemic on industries, we need to give corresponding weights to the three aspects so as to conduct a comprehensive analysis.

The principles of giving weight to the three aspects are as follows. First, the proportion of foreign investment is the material basis of industrial transfer. With higher foreign investment proportion, the enterprise is more likely to transfer to foreign countries, which will produce greater impacts on China's economy. Therefore, a weight of 0.45 is given. Second, the degree of dependence is the technical condition of industrial transfer. With higher degree of dependence, it will be very difficult for foreign-funded enterprises to transfer even if they want to. Therefore, a weight of 0.35 is given. Third, as for the influence coefficient, the industrial transfer is mainly affected by government policies and populism. So less consideration is given to the impact of the industry itself. Therefore, a weight of 0.2 is given. [6]

Table 4 Comprehensive Ranking Of Various Industries

No.	Industry	Rank of dependence	Rank of influence	Rank of foreign investment	Comprehensive ranking
1	Agriculture	12	16	9	16
2	Extractive industries	11	12	16	17
3	Food and tobacco processing industries	6	9	10	8
4	Textile, clothing, shoes, leather and down products manufacturing	8	2	14	10
5	Wood processing, furniture, paper making and	7	3	13	9

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	printing, stationery and art supplies manufacturing				
6	Oil refining, coking and chemical products manufacturing	17	6	6	11
7	Manufacturing of non-metallic mineral products	5	7	15	12
8	Metal smelting, processing and product manufacturing	14	5	12	15
9	Machinery and equipment, transportation equipment, electronics and other equipment manufacturing	16	1	3	3
10	Other manufacturing industries	2	13	17	13
11	Production and supply of electricity, heat, gas and water	9	8	8	7
12	The construction industry	1	4	11	2
13	Wholesale and retail, transportation, storage and postal services	15	15	4	14
14	Information transmission, software and information technology services	4	14	7	5
15	Finance and real estate	10	17	2	6
16	Scientific research and	3	10	5	1

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	technical services				
17	Other services	13	11	1	4

The impacts of COVID-19 on industries can be divided into six levels according to comprehensive ranking.

The first level is modern service industry, including scientific research and technology service industry which ranks the first, other service industry which ranks the fourth, information transmission, software and information technology service industry which ranks the fifth, and financial and real estate industry which ranks the sixth. This kind of industry has a high proportion of foreign investment and low dependence. Therefore, this epidemic is very likely to cause industrial transfer. Although these industries have little influence on the supply of intermediate inputs, they have a great impact on the development of advanced manufacturing industry as well as the science and technology industry.

The second level includes advanced manufacturing industries, like the construction industry which ranks the second, the machinery equipment, transportation equipment, electronics and other equipment manufacturing industry which ranks the third, and the production and supply of electric power, heat, gas and water industry which ranks the seventh. They are affected because of large foreign investment and great impacts on other industries.

The third level belongs to light industries, including food and tobacco processing industry which ranks the eighth, wood processing, furniture, paper making and printing, stationery and art supplies manufacturing industry which ranks the ninth, and textile, clothing, shoes, leather and down products manufacturing industry which ranks the tenth. Their products are closely related to people's life and can also be used as intermediate investment of other industries. Therefore, their industrial influence is high. At the same time, due to short industrial chains and low industry dependence coefficients, they are easy to transfer. However, they are not affected by the epidemic largely because the proportions of foreign investment are not high.

The fourth level belongs to heavy industry, including refining, coking and chemical products manufacturing industry which ranks the 11th, nonmetallic mineral products manufacturing industry which ranks the 12th, metal smelting, processing and product manufacturing industry which ranks the 15th, and the extractive industry which ranks the 16th. The epidemic has relatively small influence on them, because these industries have long industrial chains, and high value of intermediate products. Their dependence on other industries is also high, but the level of foreign investment is low.

The fifth level includes traditional service industry, namely the wholesale and retail, transportation, warehousing and postal industry which ranks the 14th. It is less affected by the epidemic because of low foreign investment and high dependence on other industries.

The sixth level is agriculture. The agriculture industry has small foreign investment, high industry dependence and small influence on other industries.

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Therefore, it is the least affected by the epidemic.

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