Empirical Analysis of the Influence of Tianjin Textile and Garment Industry

Kangli Wang, Yangying Li, Shuli Hao*

Beijing Institute of Fashion Technology, No.2, Cherry Garden East Street, Beijing, 100105, China

*Corresponding author's email:sxyhsl@bift.edu.cn

Abstract. This paper adopts the input-output method to explore the influence of Tianjin's textile and garment industry and analyze the industrial status of Tianjin's textile and garment industry as well as its relationship with other sectors based on Tianjin's latest published 2017 input-output table. After analyzing the consumption coefficients, intermediate input and demand rates, influence coefficients and inductance coefficients, the results show that: Tianjin textile and garment industry is a sector that mainly provides intermediate products and has a high level of dependence on other sectors. It has close economic and technical links with the primary, secondary and tertiary industries. However, its role as a pillar of Tianjin's economy is weak, its pulling force on Tianjin's economy is relatively limited, and its influence in Tianjin's economy is below average.

Keywords: Input-output Method; Tianjin Textile and Garment Industry; Industrial Influence

1   Introduction

China's textile and garment industry is a pillar industry with strong competitiveness, and with its continuous development, it also drives the prosperous development of other related industries and the overall national economy. As China's old textile and garment industrial base and a major textile and garment export port, Tianjin's textile and garment industry is an important part of the national economy. However, the comprehensive adjustment of the industrial structure of Beijing, Tianjin and Hebei in recent years has brought great challenges to the textile and garment industry, and the role of the textile and garment industry as a pillar of Tianjin's national economy is slowly diminishing, while the industrial layout of the textile and garment industry in Tianjin has also changed. Therefore, it is particularly important to determine the correlation between this industry sector and other industries, as well as the impact on the overall economy of Tianjin.

This paper uses the input-output model, selects the newly released 2017 Tianjin input-output table, quantitatively analyses the impact of the industrial linkage of the textile and garment industry and its impact on Tianjin's economy. It aims to provide a

reference for the transformation, upgrading and sustainable development of the textile and garment industry in Tianjin.

2   Determination of Input-Output Tables

Economist Vassily W. Leontief first proposed the input-output analysis method in the 1930s, which can comprehensively analyze whether the inputs and outputs of the various sectors of the national economy are connected and balanced with each other as well as with each other[1]. Through the study of the national economic structure, Leontief and other economists proposed, studied and compiled the input-output table on the basis of the previous research on the interdependence of economic activities, and the input-output model was also established on the basis of the input-output table. Which is now widely used at all levels of the socio-economic spectrum and has achieved remarkable results.

In recent years, an increasing number of scholars have used this method to analyze industries. Morrone H used this method to conclude that changes in the structure of the Brazilian economy have led to a reduction in inter- and intra-sectoral economic linkages[2]; Manisha Das examined the interconnections between the pharmaceutical industry and the rest of the Indian economy[3]; Kim TaeJin et al. analyzed the impact of the logistics industry and its four subsectors on the economy. impact of the logistics industry and its four sub-sectors on the economy[4]. In terms of China's textile and garment industry, Youqian analyzed China's textile and garment industry and found that its position in the national economy is decreasing[5]. For different provinces and cities, Qi Xiaonan[6], Li Mingjie[7], and Zhao Junge[8] analyze the total output, industrial ripple effects, and industrial structure of the textile industry in Shandong Province, Zhejiang Province, and Beijing Municipality, respectively.

It is stipulated in China that the input-output table should be compiled once every five years. Tianjin's input-output compilation work is synchronized with that of the country, and the latest input-output table published was compiled in 2017. Therefore, all the following data in this paper are based on the 2017 Tianjin input-output table. First of all, the input-output flow table of the textile and garment industry in Tianjin in 2017 was organized, as shown in Table 1. All subsequent studies are based on the data in this table. (Unit: ten thousand yuan).

Table 1. Input-output flow chart of Tianjin textile and garment industry in 2017

Sectors	Output of the Textile and garment industry	Inputs from the Textile and garment industry	Total outputs (total inputs) by sector
Agricultural, forestry and fishery products and services	3142	48023	3717500
Coal, oil and gas mining products	7049	3992	8155885
Metal ore mining products	364	0	626586
Non-metallic and other mineral extraction products	16139	41	3722614
Vegetables, fruits, nuts and other processed agri-food products	4632	19618	6015349
Foods	7052	0	3343865
Alcohol and tobacco	2417	9294	1679235

Sectors	Output of the Textile and garment industry	Inputs from the Textile and garment industry	Total outputs (total inputs) by sector
Textile and garment industry	1306707	1306707	3277354
Woodwork and furniture	44462	4863	855911
Paper, printing and educational and sporting goods	108071	29070	4570317
Petroleum, coal products and processed nuclear fuel products	1480	5658	7840010
Chemical raw materials and products	31036	42932	12558189
Pharmaceuticals, chemical fibers, rubber and plastic products	51429	78473	7913983
Non-metallic mineral products	7538	1305	2560112
metalwork	22886	17906	30526122
General equipment	9842	8351	6632077
Specialized equipment	8924	3594	4762805
Transport equipment	69524	3223	24041528
Electrical machinery and equipment	7146	6337	7203008
Communications, electronic equipment	16002	495	18462325
Instrumentation and other manufactured products	6919	5989	1532819
Waste and scrap, metal products, machinery and equipment repair service	802	7316	870803
Production and supply of electricity, heat, gas and water	3963	29357	10249677
Constructions	115840	3504	41390700
Retail and wholesale	31313	76506	19742056
Transport, storage and postal services	69098	152494	33520944
Accommodation and catering	5110	19647	3924316
Information transmission, software and information technology services	9265	31994	8916174
Financial	29222	42524	21531281
Real estates	7040	3069	18085266
Leasing and business services	40586	106861	12755518
Scientific research and technical services	24452	7926	14730178
Water, environment and utilities management	5842	1123	1597476
Resident and other services	11002	21632	2112789
Education, health and social work	35620	805	13934363
Culture, sports and recreation	25282	3188	1177844
Public administration, social security and social organizations	121634	834	9578422

3   Tianjin Textile and Garment Industry Industrial Linkage Analysis

Industrial linkages refer to the extensive, complex and close techno-economic connections that exist between industries in economic activities, specifically the intrinsic links between industries through the supply and demand of products[1]. The direct and full consumption coefficients are useful in understanding the strength of interdependencies and constraints among industry sectors. The coefficient of intermediate demand

and intermediate input can reflect the demand situation of each industrial sector, and also reflect the influence of the textile and garment industry on other industries.

In this paper, we use the direct and complete consumption coefficients, intermediate demand and intermediate inputs of Tianjin textile and garment industry to study the degree of consumption of products from other sectors and the demand of products from textile and garment industry from various industrial sectors during the production process of Tianjin textile and garment industry, in order to reflect the degree of dependence of the textile and garment industry on other industrial sectors and the degree of influence of the textile and garment industry on other industries.

3.1 Direct Consumption Coefficient

The direct consumption coefficient of the Tianjin textile and garment industry reflects the direct consumption of the textile and garment industry in the production of a product in the process of the products of various sectors[1]. Specifically, the ratio of the consumption of a product to the total annual production of the textile and garment industry.

The formula for calculating the direct consumption coefficient is as follows:

$$a_{ij} = \frac{x_{ij}}{x_j}(i, j = 1,2, \dots, n) \tag{1}$$

In Formula (1), a_{ij} is the direct consumption coefficient; x_{ij} is the direct depletion of sector i by the products of one sector j; and x_j is the total inputs to sector j. A large value of a_{ij} indicates that sector j is closely linked to sector i, and vice versa for loose linkages. Direct consumption coefficients above 0.01 should belong to the sectors with higher consumption.

As shown in Table 2, there are 8 sectors that consume more in Tianjin textile and garment industry, and it is found through analysis that the textile and garment industry consumes more and relies on this sector to the highest degree. The 8 sectors that consume more are dispersed among the primary, secondary and tertiary sectors. This shows that Tianjin textile and garment industry and the primary, secondary and tertiary industries have close economic and technological links.

Table 2. Direct consumption coefficients for Tianjin textile and garment industry

Sectors	Direct consumption coefficient	Rankings
Textile and garment industry	0.398708	1
Transport, storage and postal services	0.046530	2
Leasing and business services	0.032606	3
Pharmaceuticals, chemical fibers, rubber and plastic products	0.023944	4
Retail and wholesale	0.023344	5
Agricultural, forestry and fishery products and services	0.014653	6
Chemical raw materials and products	0.013100	7
Financial	0.012975	8
..	...	...

3.2   Complete Consumption Coefficient

Tianjin textile and garment industry's complete consumption coefficient means that the textile and garment industry produces a product in all segments of the use of the products of various industrial sectors. Expressed in b_{ij}, the formula is:

$$b_{ij} = a_{ij} + \sum_{k=1}^{n} b_{ik}a_{ik} \ (i,j = 1,2,\dots,n) \tag{2}$$

In Formula (2), b_{ij} is the complete consumption coefficient, which represents the sum of the amount of product i directly and indirectly consumed by product j in the production unit; a_{ij} is the direct consumption coefficient; $\sum_{k=1}^{n} b_{ik}a_{ik}$ represents the indirect consumption coefficient, where k is the sector of intermediary products; and $\sum_{k=1}^{n} b_{ik}a_{ik}$ represents the full indirect consumption of product i by product j in the production unit formed through the k types of intermediary products.

The complete consumption coefficient more completely describes the level of dependence of the industry on other sectors. The larger the coefficient, the closer the technical and economic links. As shown in Table 3, the direct consumption coefficient of the textile and garment industry is 0.669408, ranking first among 37 sectors, and by analyzing the industry sectors at the top, it can be seen that it has a greater depletion of the primary, secondary and tertiary industries, which also indicates that the textile and garment industry has a higher level of dependence on other sectors.

Table 3. the Complete consumption coefficient for Tianjin textile and garment industry

Sectors	Complete consumption coefficient	Rankings
Textile and clothing industry	0.669408	1
Transport, storage and postal services	0.163089	2
Leasing and business services	0.107695	3
Chemical raw materials and products	0.086884	4
Financial	0.085259	5
Retail and wholesale	0.080879	6
Production and supply of electricity, heat, gas and water	0.079394	7
Pharmaceuticals, chemical fibers, rubber and plastic products	0.074073	8
Metalwork	0.073708	9
Petroleum, coal products and processed nuclear fuel products	0.060122	10
...	...	...

3.3   Intermediate Input Rate

The intermediate input rate of Tianjin textile and garment industry reflects the input of each industrial sector to Tianjin textile and garment industry, which can show its driving effect on upstream enterprises, and its calculation formula is as follows:

$$F_j = \frac{\sum_{i=n}^{n} x_{ij}}{\sum_{i=1}^{n} x_{ij} + D_j + N_j} (i = 1,2,\dots,n) \tag{3}$$

In Formula (3), F_j is the intermediate input rate of the industry sector j; D_j is the full depreciation expense of the industry sector j in one year; N_j is the value created by the industry sector j. The higher the intermediate input rate of an industry sector, the lower the value added rate of the industry, high intermediate input rate industry sector is low value added rate, and vice versa[1].

As shown in Table 4, the intermediate input rate of Tianjin textile and garment industry is 0.642180259, ranked 24th, according to this index, it can be determined that the value-added rate of Tianjin textile and garment industry is 0.357819741, which indicates that the pulling strength of Tianjin textile and garment industry for Tianjin's economy is relatively limited, and thus it should be adjusted and upgraded to the structure of textile and garment industry.

Table 4. Intermediate input rates of Tianjin textile and garment industry

Sectors	Intermediate input rate	Rankings
Metalwork	0.904829	1
Vegetables, fruits, nuts and other processed agri-food products	0.861623	2
Communications, electronic equipment	0.845310	3
...	...	...
Textile and garment industry	0.642180	24
...	...	...
Coal, oil and gas mining products	0.326219	35
Financial	0.318422	36
Real estates	0.256700	37

3.4   Intermediate Demand Rate

The intermediate demand rate helps to grasp the proportion of the products of each industrial sector in the means of production and the means of consumption, so as to effectively grasp the position of each industrial sector in the national economy[1]. From the point of view of each industrial sector in Tianjin, the degree of its demand for the products of the textile and garment industry is the intermediate demand rate of the textile and garment industry in Tianjin, which is calculated as follows:

$$G_i = \frac{\sum_{j=1}^{0} x_{ij}}{\sum_{j=1}^{0} x_{ij} + Y_i} (i = 1,2,\dots,n) \tag{4}$$

In Formula (4): G_i is the intermediate demand rate; $\sum_{j=1}^{0} x_{ij}$ is the total loss of each part to the sector; $\sum_{j=1}^{0} x_{ij} + Y_i$ is the total output of the industrial sector; Y_i is the total amount of final products of the sector.

As can be seen from Table 5, the intermediate demand rate of Tianjin's textile and garment industry is at a lower level on average compared with other sectors, ranking

20th among 37 sectors. As the relationship between intermediate demand and final demand is "intermediate demand rate + final demand rate = 1", the final demand rate of Tianjin's textile and garment industry is also low, so Tianjin's textile and garment industry is a sector mainly providing intermediate products, and the sector has the nature of raw material industry.

Table 5. Intermediate demand rate of Tianjin textile and garment industry

Sectors	Intermediate input rate	Rankings
Metal ore mining products	6.950086	1
Non-metallic mineral products	3.551239	2
Waste and scrap, metal products, machinery and equipment repair service	3.355125	3
...	...	...
Textile and garment industry	0.692167	20
...	...	...
Constructions	0.049954	35
Education, health and social work	0.048554	36
Public administration, social security and social organizations	0.045285	37

4   Analysis of the Ripple Effect of Tianjin's Textile And Garment Industry

Due to the forward and backward correlation between industries, changes in the production activities of any industry will affect other industries, and changes in other industries will also affect the industry. The influence of an industry on other industries is called influence, and the degree of influence of the industry by other industries is called induction degree. The influence coefficient of Tianjin's textile and garment industry can reflect the driving effect of its textile and garment industry on Tianjin's economy, and the inductance coefficient can reflect its pulling effect on Tianjin's economy.

4.1   Industrial Influence Coefficient

Tianjin textile and garment industry's influence coefficient refers to when the textile and garment industry changes a unit of product on the various sectors of the degree of influence. Generally speaking, the greater the influence coefficient of the sector on other sectors of the pulling effect is more obvious, the formula for:

$$e_j = \frac{\sum_{i=1}^{0} c_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij}} (i, j = 1, 2, \dots, n) \tag{5}$$

In Formula (5), e_j is the influence coefficient of sector j. If $e_j < 1$ then it indicates that the influence of this industry sector is at the downstream level in the whole apparel industry.

As shown in Table 6, the influence coefficient of Tianjin's textile and garment industry, e_j=0.910305 (ranked 23rd), is less than 1. This indicates that the influence of the textile and garment industry in Tianjin's economy is below the average level, and it has a smaller influence on other industrial sectors. The overall improvement of the national economic level will not have a significant pulling effect on the textile and garment industry.

Table 6. Tianjin Industry Influence Coefficient

Sectors	Influence coefficients	Rankings
Metalwork	1.428777	1
Communications, electronic equipment	1.395197	2
Electrical machinery and equipment	1.335758	3
...	...	...
Textile and garment industry	0.910305	23
...	...	...
Coal, oil and gas mining products	0.598930	35
Financial	0.559533	36
Real estates	0.525935	37

4.2   Industrial Inductance Coefficient

Generally speaking, the inductance coefficient is positively correlated with the sector's sense of need for economic development. The inductance coefficient of Tianjin textile and garment industry reflects the sensitivity of Tianjin textile and garment industry to changes in other industrial sectors, and the formula is:

$$e_i = \frac{\sum_{j=1}^{n} c_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}} \ (i, j = 1, 2, ..., n) \tag{6}$$

In Formula (6), e_i is the inductance coefficient of sector i. If $e_i < 1$ it means that the adjustment of other sectors will have less impact on this sector.

As shown in Table7, the coefficient of influence of Tianjin textile and garment industry e_i=0.704741893 (ranked 20th), less than 1, which indicates that the coefficient of inductivity of textile and garment industry is lower than the average level of Tianjin. This indicates that when there are fluctuations in other industrial sectors in Tianjin, the degree of change in the textile and garment industry will be smaller. On the other hand, the textile and garment industry is not sensitive to the changes in other sectors, and its development has less ability to promote the development of other industries.

Table 7. Inductance coefficient of Tianjin industry

Sector	Inductance coefficients	Rankings
Metalwork	2.899276	1
Transport, storage and postal services	2.171588	2
Chemical raw materials and products	1.951257	3
...	...	...
Textile and garment industry	0.704742	20
...	...	...
Education, health and social work	0.354343	35
Water, environment and utilities management	0.342401	36
Public administration, social security and social organizations	0.330655	37

5   Conclusion

Based on the input-output method, it can be seen through the industrial association analysis that in 2017, Tianjin textile and garment industry consumes more to this sector and has a close connection with the economic technology of the first, second and third industries. Tianjin textile and garment industry has a high level of dependence on other sectors, but the pulling strength of Tianjin's economy is relatively limited, which should be adjusted and upgraded to the structure of the garment industry. Tianjin textile and garment industry is a sector that mainly provides intermediate products and has the nature of raw material industry. The analysis of the ripple effect is easy to obtain that the influence of Tianjin textile and garment industry in Tianjin's economy is below the average level, and it has a smaller influence on other industrial sectors. When there is fluctuation in other industrial sectors in Tianjin, the degree of change in the textile and garment industry will be smaller. For other industries, the textile and garment industry is not sensitive to changes in other sectors, and its development has less ability to promote the development of other industries. Therefore, on balance, the role of the textile and garment industry as a pillar industry in Tianjin is weakening in the context of the implementation of the Beijing-Tianjin-Hebei coordinated development strategy.

References

1. Lu, A., Hao, S.L. (2013) Clothing Industry Links. In: Clothing Industry Organization. People's Publishing House, Beijing. 179-213.
2. Morrone H. (2021) Qualitative input-output analysis of the brazilian structural transformation. Revista de Economia Contemporânea: 2021; 25.
3. Das M., Kashyap A. (2021) An Analysis of Backward and Forward Linkages of Pharmaceutical Sector in India Based on an Input- Output Model. Journal of Pharmaceutical Research International. 2021.
4. TaeJin K., Nikolas T. (2022) The Economic Impact of the Logistics Industry in South Korea: Based on an Input-Output Approach. LOGI–Scientific Journal on Transport and Logistics. 2022,13(1).

5. YU, Q., LU, An. (2018) Research on the development of China's textile and apparel industry based on input-output analysis. Wool Textile Science and Technology,2018,46(01): 73-77. DOI: 10.19333/j.mfkj.2017020180105.

6. Qi, XN., Cai, J. (2022) Research on the Development of Textile Industry in Shandong Province Based on Input-Output Model. Information Systems and Economics, 2022,3(4).

7. LI, MJ., LU, A. (2018) Research on the development of textile manufacturing industry in Zhejiang Province based on input-output analysis. Wool Textile Science and Technology,2018,46(03):79-84. DOI: 10.19333/j.mfkj.2016110230306.

8. ZHAO, JG., LU An., ZHU, GH. (2018) Empirical analysis of the influence of Beijing textile and garment industry. Wool Textile Science and Technology,2018,46(04): 85-89. DOI: 10.19333/j.mfkj.2016120150405.