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Research on the Development of Jiangsu Textile Industry Based on Input-Output Analysis Method

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ABSTRACT

Based on the latest 2012 input-output data of Jiangsu Province, this paper uses MATLAB-assisted calculation to quantitatively analyze the industrial ripple effect and industry type of textile manufacturing industry in Jiangsu Province. The research results show that the textile manufacturing industry in Jiangsu Province is a type III final demand industrial sector; the current value added of textile manufacturing in Jiangsu Province is low; the textile manufacturing industry's influence coefficient e_i and induction coefficient e_i are higher than the social average.

1. Analysis of Total Output of Textile Manufacturing Industry in Jiangsu Province

The input and output tables for Jiangsu Province in 2017 are still in the statistics, and the latest complete data is the 2012 input-output table. As shown in Figure 1: In 2005, the total output of textile manufacturing in Jiangsu Province reached 35,813,839,500 million yuan. By 2007, the total output of the textile manufacturing industry reached 50,22,975.61 million yuan,

an increase of 40.25% over the same period of 2005. By 2012, the total output of textile manufacturing in Jiangsu Province reached 6,664,445,500 million yuan, an increase of 32.69% compared with the data in 2007. From 2005 to 2012, the total output of textile manufacturing in Jiangsu Province increased by 86.1% year-on-year. The textile manufacturing industry in Jiangsu Province has maintained a large scale in recent years.^[1]In 2005, the textile manufacturing industry in Jiangsu Province accounted for 19.25% of the province's GDP. By 2012, the total output

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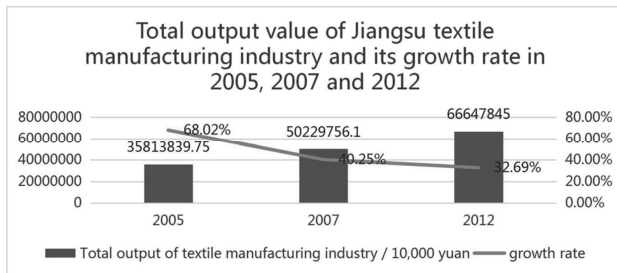
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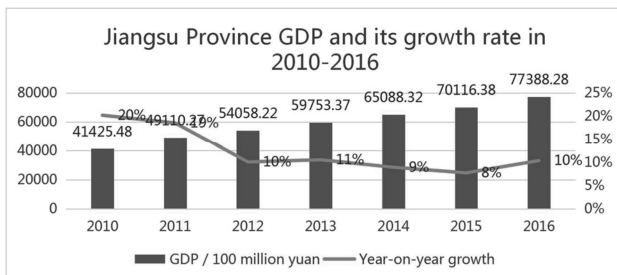
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of textile manufacturing industry accounted for the GDP of Jiangsu Province was 12.3%. Although it has declined year on year, it still has a large share. Judging from the GDP growth rate of Jiangsu Province in 2012, the GDP of Jiangsu Province in 2012 was significantly lower than that of 2011. The slowdown in the growth of textile manufacturing in Jiangsu Province in 2012 has constrained the growth rate of Jiangsu's GDP this year to some extent.



Source: National Bureau of Statistics

Figure 1. Total output value of Jiangsu textile manufacturing industry and its growth rate in 2005, 2007 and 2012



Source: National Bureau of Statistics related data measurement

Figure 2. Jiangsu Province GDP and its growth rate from 2010 to 2016

2. Analysis of the Ripple Effect of the Textile Manufacturing Industry in Jiangsu Province

When a certain industrial sector changes, this change will lead to changes in the industrial sector directly related to it along different industrial linkages, and changes in these related industrial sectors will lead to changes in other industrial sectors directly related to it. In turn, the influence gradually weakens, and this process is ripple effect. The degree of influence of one industrial sector on other industrial sectors is called influence, and the degree of influence of one industrial sector by other industrial sectors is called induction. [2] Analysis of the textile industry's industrial ripple effect in Jiangsu Province requires the use of Jiangsu's value-based input-output table to calculate the input coefficient table and the inverse coefficient table. The influence coefficient e_i and the induction coefficient e_j

are calculated by the matrix determined by the input coefficient table and the inverse matrix coefficient table. [3]

2.1 Induction Coefficient Analysis

The induction coefficient is used to measure the degree of impact of an industry's response to changes in other industries. The calculation formula is as shown in equation (1):

$$e_i = \frac{\sum_{j=1}^n C_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n C_{ij}} \quad (i, j = 1, 2, \dots, n) \quad (1)$$

Where: e_i is the sensitivity coefficient of the i industry; i, j are the rows and columns in the input-output table; n is the number of industrial sectors; C_{ij} is the element in the column C of the Leontief inverse matrix coefficient ($i, j=1, 2, \dots, n$). From the input-output table of Jiangsu Province in 2012, the induction coefficient of 42 major industries in Jiangsu Province can be calculated.

If $e_i > 1$, it indicates that the demand for the industry is higher than the social average for each additional unit of output in the national economy. [4] The data in Table 1 shows that the induction coefficient of textile manufacturing industry in Jiangsu Province in 2012 was 1.02, slightly higher than 1, indicating that the textile manufacturing industry in Jiangsu Province had a slight impact on other industry changes.

Table 1. Table of Jiangsu Province Industry Induction Coefficients

Industry	Induction coefficient
Metal smelting and rolling processed products	4.349599896
Chemical product	3.673072135
Metal mining products	2.541016427
Coal mining products	1.741110874
Electricity and heat production and supply	1.599368905
Transportation, warehousing and postal services	1.519540246
Financial	1.321382297
Leasing and business services	1.313707955
Agriculture, forestry, animal husbandry and fishery products and services	1.245157315
Wholesale and Retail	1.215404917
Metal products	1.182858034
Paper printing and cultural and educational sporting goods	1.121861101
Oil and gas extraction products	1.066541545
Gas production and supply	1.063494193

Communication equipment, computers and other electronic equipment	1.058832769
Textile	1.0154514
Food and tobacco	0.992532268
Petroleum, coking products and nuclear fuel processed products	0.949632757
Electrical machinery and equipment	0.89983984
Non-metallic mineral products	0.893329361
General Equipment	0.850457171
Non-metallic minerals and other mining products	0.817890294
Waste scrap	0.741589805
Accommodation and catering	0.67915136
Wood processed products and furniture	0.606804087
Professional setting	0.581187023
Resident services, repairs and other services	0.52928799
Real estate	0.529109614
Information transfer, software and information technology services	0.527372968
Transportation equipment	0.517437767
Other manufactured products	0.475431415
Textile clothing, shoes and hats, leather down and its products	0.467810479
Instrumentation	0.442910387
Repair of metal products, machinery and equipment	0.433440675
Building	0.413948056
Scientific research and technical services	0.399484456
Water production and supply	0.386560677
Education	0.385913576
Culture, sports and entertainment	0.379723675
Health and social work	0.361481461
Public administration, social security and social organization	0.35480022
Water, environmental and public facilities management	0.354472613

2.2 Analysis of Influence Coefficients

The influence coefficient is used to measure the extent to which the production and supply of other industries change correspondingly when the production and demand of an industry change.

$$e_j = \frac{\sum_{i=1}^n C_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n C_{ij}} \quad (i, j = 1, 2, \dots, n) \quad (2)$$

Where: e_j is the influence coefficient of the j industry; i, j are the rows and columns in the input-output table; n is the number of industrial sectors; C_{ij} is the element in

the column C of the Leontief inverse matrix coefficient ($i, j=1, 2, \dots, n$). From the input-output table of Jiangsu Province in 2012, the influence coefficient of 42 major industries in Jiangsu Province can be calculated.

If $e_j > 1$, it indicates that the influence of the industry sector is above average in 42 industries. The data in Table 2 shows that the influence coefficient of the textile manufacturing industry in Jiangsu Province in 2012 was 1.18, which has a strong driving effect on the economy of Jiangsu Province.

Table 2. 2012 Jiangsu Province Influence Coefficient Table

Industry	Influence coefficient
Metal mining products	1.610248269
Metal smelting and rolling processed products	1.415224825
Transportation equipment	1.414389258
Electrical machinery and equipment	1.359226555
Communication equipment, computers and other electronic equipment	1.346334206
Repair of metal products, machinery and equipment	1.317137552
General Equipment	1.302538657
Metal products	1.284285472
Other manufactured products	1.283469593
Instrumentation	1.278854866
Professional setting	1.275948815
Building	1.229510752
Gas production and supply	1.207059173
Wood processed products and furniture	1.18204446
Textile	1.177280286
Non-metallic mineral products	1.169520614
Textile clothing, shoes and hats, leather down and its products	1.154588215
Chemical product	1.142591204
Paper printing and cultural and educational sporting goods	1.116043964
Non-metallic minerals and other mining products	1.071342779
Electricity and heat production and supply	1.044597923
Scientific research and technical services	0.959629791
Health and social work	0.933051241
Food and tobacco	0.89563038
Culture, sports and entertainment	0.865939411
Resident services, repairs and other services	0.847037502
Transportation, warehousing and postal services	0.844592343
Coal mining products	0.839321666
Accommodation and catering	0.836808941
Water production and supply	0.805760011

Water, environmental and public facilities management	0.796695017
Information transfer, software and information technology services	0.787666955
Petroleum, coking products and nuclear fuel processed products	0.784678617
Leasing and business services	0.776313918
Financial	0.733392934
Agriculture, forestry, animal husbandry and fishery products and services	0.714323959
Public administration, social security and social organization	0.629841961
Real estate	0.550603191
Education	0.513826692
Waste scrap	0.513476133
Wholesale and Retail	0.511012951
Oil and gas extraction products	0.478158946

3. Analysis of the Types of Textile Manufacturing Industry in Jiangsu Province

According to the 2012 input-output table of Jiangsu Province, the intermediate demand rate and the intermediate investment rate of the industry can be obtained separately. The intermediate demand rate and the intermediate investment rate can be used to analyze the type of industry, as shown in Table 3:

Table 3. Schematic diagram of industrial three-dimensional structure

	Small intermediate demand rate	Large intermediate demand rate
large intermediate investment rate	III Final demand industry sector	II Intermediate product industry sector

Table 4. Intermediate demand rate of various departments in Jiangsu Province in 2012 (unit 10000RMB)

Industry	Intermediate demand rate	Total intermediate demand	Total output
Oil and gas extraction products	0.999122873	18938273.9	1053666.914
Non-metallic minerals and other mining products	0.987633538	21263542.79	2265445.072
Metal mining products	0.98712649	16621515.45	1163896.355
Repair of metal products, machinery and equipment	0.98204223	3713155.639	336183.6639
Coal mining products	0.977011058	30243925.05	3447888.35
Metal smelting and rolling processed products	0.954993897	254290304	154742095.4
Electricity and heat production and supply	0.926878523	45992144.38	45992143.95
Water production and supply	0.857885897	1145492.696	1141229.736
Waste scrap	0.855212781	17115805.29	17115805.1
Leasing and business services	0.841611569	52561926.44	43847183.57
Non-metallic mineral products	0.81272698	59841662.32	36948592.22
Metal products	0.765142856	51070842.23	49392966.07
Paper printing and cultural and educational sporting goods	0.760386412	35533518.61	26328378.83

small intermediate investment rate	IV Final demand-based basic industry sector	I Intermediate product-based basic industry sector
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The research results show that in 2012, the textile manufacturing industry in Jiangsu Province has a large intermediate investment rate and a small intermediate demand rate, which belongs to the final demand-oriented industrial sector.

3.1 Intermediate Demand Rate Analysis

The intermediate demand rate refers to the ratio of the intermediate demand of each industrial sector to the total demand of the industrial sector, as shown in formula (3):

$$G_i = \frac{\sum_{j=1}^n X_{ij}}{\sum_{j=1}^n x_{ij} + Y_i} (i, j = 1, 2, \dots, n) \tag{3}$$

Where: G_i is the intermediate demand rate of the i -th industry sector; $\sum_{j=1}^n X_{ij}$ is the sum of the intermediate demand for the i -sector products of each department; Y_i is the final demand part of the products of the i -th industrial sector. From the 2012 Jiangsu Province Input-Output Table, the intermediate demand rate of 42 major industries can be calculated.

Since the “intermediate demand rate” + “final demand rate” = 1, the higher the intermediate demand rate of an industrial sector, the lower the final demand rate; the lower the intermediate demand rate of an industrial sector, the higher the final demand rate. These two cases represent two different industries, the first reflects the nature of the sector's raw materials industry, and the second reflects the nature of the sector's final product.

Other manufactured products	0.760323544	5467753.174	2704310.98
Transportation, warehousing and postal services	0.744120462	65017499.52	53707475.28
Petroleum, coking products and nuclear fuel processed products	0.725093426	31535431.05	23017271.95
Agriculture, forestry, animal husbandry and fishery products and services	0.700191123	66737284.44	57612890.8
Chemical product	0.694086345	269181668.6	219715247.5
Gas production and supply	0.673557535	4841091.31	3236689.47
Financial	0.62949255	58185088.8	57158987.96
Textile	0.601774435	71517111.39	66647844.94
Accommodation and catering	0.595098947	24931453.75	24898027.38
Resident services, repairs and other services	0.542457062	13447119.73	13197063.08
Wholesale and Retail	0.501472219	72602755.2	72602755.15
Wood processed products and furniture	0.479942337	22353398.96	18482246.5
Food and tobacco	0.465037454	65413447.21	54523386.81
General Equipment	0.452747804	83164346.35	64187499.72
Communication equipment, computers and other electronic equipment	0.409979716	221948322.9	169813878.9
Information transfer, software and information technology services	0.357883196	25240932.34	22089754.69
Electrical machinery and equipment	0.323799012	143268604.6	134722259.3
Instrumentation	0.249645392	32912047.09	27087819.04
Culture, sports and entertainment	0.240037418	6199004.145	5974807.97
Scientific research and technical services	0.233032521	15761916.75	14150397.45
Real estate	0.221774826	41737137.23	41185629.35
Transportation equipment	0.208487554	89267187.35	87339443.54
Professional setting	0.204889085	51511798.32	40669030.4
Textile clothing, shoes and hats, leather down and its products	0.144665276	44092172.34	43257442.4
Education	0.107439189	18414552.24	17993120.53
Water, environmental and public facilities management	0.088509786	5806457.632	5911074.903
Health and social work	0.041880788	15206691.12	14921699.15
Building	0.027746641	163994429.4	125590876.2
Public administration, social security and social organization	0.021266338	538819.5757	25175338.81

As shown in Table 4, the intermediate demand rate of the textile manufacturing industry in Jiangsu Province is 0.6, and the intermediate demand rate is relatively small, so it has the nature of the final product.

3.2 Analysis of the Intermediate Input Rate

The intermediate input rate refers to the ratio of the intermediate input to the total input in a certain period of time (usually one year) in an industrial sector^[5], as shown in formula (4):

$$F_j = \frac{\sum_i^n x_{ij}}{\sum_{i=1}^n x_{ij} + D_i + N_j} \quad (i, j = 1, 2, \dots, n) \quad (4)$$

Where: F_j is the intermediate input rate for the j-th industrial sector; $\sum_{i=1}^n x_{ij}$ is the sum of the intermediate

demand for the i-sector products for each department; D_j is the full depreciation charge for the j-th industrial sector for one year; N_j is the value created by the j-th industrial sector. From the 2012 Jiangsu Province Input-Output Table, the intermediate input rate of 42 major industries can be calculated.

According to the "intermediate input rate" + "additional value rate" = 1, the higher the intermediate input rate of an industrial sector, the lower the value-added rate; the lower the intermediate input rate of an industrial sector, the higher the value-added rate.^[6]

According to the data in Table 5, the intermediate investment rate of textile manufacturing industry in Jiangsu Province in 2012 was 0.8, and the added value was low, which was a high intermediate investment rate. Therefore, the textile manufacturing industry needs to optimize the industrial structure and increase the value-added rate in the future development.

Table 5. Intermediate investment rate of various industries in Jiangsu Province in 2012 (unit 10000RMB)

Industry	Intermediate investment rate	Total intermediate investment	Total investment
Metal mining products	0.842505078	980588.5891	1163896.355
Transportation equipment	0.835169321	72943223.78	87339443.54
Other manufactured products	0.822385912	2223987.252	2704310.98
Metal smelting and rolling processed products	0.820897947	127027468.4	154742095.4
Textile	0.797321042	53139729.2	66647844.94
Wood processed products and furniture	0.795739773	14707058.63	18482246.5
Petroleum, coking products and nuclear fuel processed products	0.792721068	18246276.4	23017271.95
Electrical machinery and equipment	0.792388656	106752389.9	134722259.3
Communication equipment, computers and other electronic equipment	0.787013	133645730.3	169813878.9
Metal products	0.779644309	38508944.9	49392966.07
Textile clothing, shoes and hats, leather down and its products	0.77451128	33503377.06	43257442.4
General Equipment	0.771946277	49549301.47	64187499.72
Gas production and supply	0.770251476	2493064.841	3236689.47
Non-metallic mineral products	0.767311265	28351071.05	36948592.22
Electricity and heat production and supply	0.758965162	34906435	45992143.95
Chemical product	0.756425744	166198269.6	219715247.5
Paper printing and cultural and educational sporting goods	0.755649976	19895038.85	26328378.83
Repair of metal products, machinery and equipment	0.755416373	253958.6439	336183.6639
Instrumentation	0.747292554	20242525.47	27087819.04
building	0.743613176	93391030.26	125590876.2
Professional setting	0.737982607	30013037.06	40669030.4
Non-metallic minerals and other mining products	0.708080997	1604118.606	2265445.072
Food and tobacco	0.691902348	37724859.35	54523386.81
Leasing and business services	0.648026684	28414144.96	43847183.57
Accommodation and catering	0.580203691	14445927.38	24898027.38
Scientific research and technical services	0.576392437	8156182.076	14150397.45
Transportation, warehousing and postal services	0.569760131	30600378.17	53707475.28
Culture, sports and entertainment	0.536710487	3206742.098	5974807.97
Coal mining products	0.532657419	1836543.308	3447888.35
Health and social work	0.516019609	7699889.361	14921699.15
Resident services, repairs and other services	0.512063397	6757732.946	13197063.08
Water, environmental and public facilities management	0.510550922	3017904.744	5911074.903
Water production and supply	0.5075405	579220.3103	1141229.736
Information transfer, software and information technology services	0.455067348	10052326.09	22089754.69
Financial	0.451265494	25793878.96	57158987.96
Agriculture, forestry, animal husbandry and fishery products and services	0.406679451	23429978.8	57612890.8
Public administration, social security and social organization	0.31944213	8042063.855	25175338.81
Real estate	0.273337752	11257587.35	41185629.35
Wholesale and Retail	0.214263978	15556155.15	72602755.15
Education	0.182755933	3288349.533	17993120.53
Waste scrap	0.177184355	3032652.879	17115805.1
Oil and gas extraction products	0.156985111	165410.0178	1053666.914

4. Concluding Remarks

The share of total textile manufacturing output in Jiangsu's GDP has been declining this year, but the contribution of textile manufacturing to Jiangsu's economic development cannot be ignored. From the perspective of the influence coefficient, the textile manufacturing industry has a strong driving force for the province's GDP. Under the general environment of slowing GDP growth in Jiangsu Province, the textile and garment industry should play its positive role and drive a new round of growth in the Jiangsu economy. The added value of textile manufacturing in Jiangsu Province is low, and it is necessary to increase investment in technology, improve the operational efficiency of enterprises, and increase the added value of the textile manufacturing industry.

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