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The Analysis on the Linkage and Ripple Effect Between Logistics and Each Sector on Input-Output Theory

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Abstract
Along with the development of the logistics industry, the influence of the logistics industry on each industry is increasing significantly in national economy. To entirely find out the effect of the logistics industry on the national economy, the article analyzes the linkage and ripple effect between the logistics and each industry on 2002 input-output table in China. We can conclude that the logistics industry is a bottleneck and basic industry in China. The pulling effect of the logistics industry on the national economy is prominent, but the promotion effect is obviously deficient.

Key words: Industry; Logistics industry; Linkage; Ripple effect; Input-output analysis

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Along with the development of logistics industry, the contribution of the logistics on the economic growth is more and more significant. And the relation between logistics industry and all industries is becoming closer and closer. The article uses the input-output analysis to measure and calculate the correlation and ripple effect of the logistics industries on the others.

1. THE INDUSTRY LINKAGE OF LOGISTICS ON EACH SECTOR

1.1 The Industry Linkage
The industry linkage is the technological and economic relation among the industries by inputs and outputs. In the general economic activity process, each industry needs the other industries to supply various outputs as its own the product factors, at the same time, other industries consume the industrial outputs as a market demand. It is just the complex relation of supply and demand, all industries can survive and develop in the economic activity. The method of industry linkage analysis is the input-output analysis. The method of input-output analysis is an economic and quantitative method which studies on the interdependent relation among all parts (all sectors, industries, products as production or consumption unit, etc.) in the economic system.

1.2 The Backward Linkage of Logistics on Each Sector
The backward linkage is the effect of an industry or sector on the other industries and sectors that supply the production and service for it. From the input point of view, the production process of logistics needs many input factors of other industries or sectors, the more is the intermediate consumption, the more is the linkage of the industry on other industries or sectors, the more significant is the demand for these industries or sector.

The direct input coefficient represents the direct backward linkage of the logistics on each sector, is the directly technological and economic relation of the logistics on each sector in the production process, it reflects the pulling effect of the sector on each sector by the direct input. We use column structure analysis to determine the direct backward linkage sectors of logistics in the column of the direct input coefficient matrix in

input-output table.

The total input coefficient represents the total backward linkage of logistics on each sectors, another basic coefficient, is an index of the direct and indirect technological and economic relation among the industries or sectors in the input point of view. The sum of direct and the total indirect consumption is the total input of the industry or sector. The economic implication of the total input coefficient is the total consumption volume of one industry unit output value on that of another one. The greater is the total input coefficient, the greater is the total backward linkage between industries, and the greater is the pulling effect of an industry on another one. We also use the column structure analysis to determine the total backward linkage of logistics industry in the column of the direct input coefficient matrix of input-output table.

1.2.1 The Direct Input Coefficient of the Logistics on Each Sector

The direct input coefficient of the logistics, as the downstream industry, on the each sector represents the direct backward linkage. In the 2002 input-output table, we can calculate the direct input coefficient of the logistics on each. The results are reported in table 1.

In table 1 the direct input coefficient of the logistics on itself is the biggest, it indicates that the logistics needs its own most direct demand, followed by the Construction industry; Chemical industry; Metal Smelting and Rolling Processing industry; Agriculture; Wholesale and Retail Trade industry; General and Special Equipment Manufacturing industry, thus logistics more tightly depends on these sectors and has the significantly direct backward linkage on these sectors, and the logistics more direct demand for these sectors. But logistics does not have the direct input on Fertilizer and Waste Industry, thus there is no direct interdependent relation between them.

Table 1
The Direct Input Coefficient of Logistics on Each Sector

1	Agriculture	0.0427	22	Waste	0.0000
2	Coal Mining and Dressing	0.0119	23	Electricity, Gas and Water Production and Supply	0.0224
3	Petroleum and Natural Gas	0.0032	24	Gas Production and Supply	0.0016
4	Mining industry	0.0038	25	Water Production and Supply	0.0004
5	Dressing	0.0077	26	Building industry	0.0903
6	Food manufacturing and tobacco processing	0.0272	27	Logistics	0.1124
7	Textile	0.0120	28	Post	0.0024
8	Down and Related Products Leather Clothing	0.0107	29	Information, transmission, computer services, software	0.0036
9	Wood processing and furniture manufacturing	0.0128	30	Wholesale and retail trade	0.0372
10	Paper Manufacturing Printing and stationery	0.0171	31	Accommodation and Catering Services	0.0079
11	Petroleum processing, coking and nuclear fuel	0.0193	32	Finance and Insurance	0.0124
12	Chemical	0.0496	33	Real Estate	0.0048
13	Non-metallic mineral products	0.0238	34	Leasing and Business Services	0.0080
14	Metal smelting and rolling processing	0.0463	35	Tourism	0.0083
15	Fabricated metal products	0.0151	36	Sciences research	0.0016
16	General, special equipment manufacturing	0.0291	37	Integrated Technology Services	0.0042
17	Transport Equipment	0.0154	38	Other Social Services	0.0068
18	Electrical, machinery and equipment manufacturing	0.0146	39	Education	0.0122
19	Communications equipment, computers and other electronic equipment manufacturing	0.0162	40	Health, social security and social welfare	0.0023
20	Measuring Instruments and Office Machinery	0.0032	41	Culture, Sports and Entertainment	0.0037
21	Other manufacturing industries	0.0039	42	Public Management and Social Organization	0.0224

1.2.2 The Material Input Coefficient of Logistics

We further merge the sectors into the three industries and calculate the direct input coefficient and the material input coefficient of the logistics on the three industries, the results are reported in table 2.

In table 2 the direct input coefficient of logistics on the second industry is the biggest, from another perspective, the pulling effect of logistics on the second industry is the greatest. Compared with 1997, the input coefficient of logistics on the third industry (excluding logistics) is significantly increasing, the growth speed of the input coefficient of logistics on the third industry is faster than on the second industry, thus the pulling effect of logistics on the third industry is significantly increasing, the demand of logistics on Postal and Telecommunications Services, Business Catering Services, Finance and Insurance Services and Other Social Services is greatly increasing. The linkage of logistics on Agriculture is smaller than on the second and third industry. The direct input of logistics on itself is also increasing.

Table 2
The Direct Input Coefficient and the Material Input Coefficient of the Logistics on the Three Industries

	The first industry	The second industry	The third industry(excluding logistics)	Logistics	Material consumption coefficient
1997	0.0030	0.3056	0.0081	0.0436	0.4343
2002	0.0427	0.4588	0.1384	0.1124	0.7525

1.2.3 The Total Input Coefficient of the Logistics on Each Sector

The total backward linkage of logistics on each sector can be described by the total input coefficient; it shows the sum of the direct and indirect input relation of the logistics on each sector. The results are reported in table 3.

In table 3 the total input coefficients of logistics on Petroleum and Natural Gas Mining Industry are the largest, followed by Finance and Insurance, Logistics, Transportation Equipment Manufacturing, Petroleum Processing, Coking and Nuclear Fuel Processing. According to these results, the linkages of logistics on these industries are tightly total backward, thus the demand pulling of logistics on these industries is greater.

Table 3
The Total Input Coefficients of the Logistics on Each Sector

1	Agriculture	0.0159	22	Electricity, Gas and Water Production	0.0591
2	Coal Mining and Dressing	0.0782	23	and Supply	0.0807
3	Petroleum and Natural Gas	0.437	24	Gas Production and Supply	0.0786
4	Mining industry	0.078	25	Water Production and Supply	0.0848
5	Dressing	0.0328	26	Building industry	0.0089
6	Food manufacturing and tobacco processing	0.0132	27	Logistics	0.1658
7	Textile	0.0152	28	Post	0.0413
8	Down and Related Products Leather Clothing	0.0148	29	Information, transmission ,computer services, software	0.0606
9	Wood processing and furniture manufacturing	0.0229	30	Wholesale and retail trade	0.0475
10	Paper Manufacturing Printing and stationery	0.0426	31	Accommodation and Catering Services	0.0422
11	Petroleum processing, coking and nuclear fuel	0.3923	32	Finance and Insurance	0.1571
12	Chemical Industry	0.0503	33	Real Estate	0.0164
13	Non-metallic mineral products industry	0.0264	34	Leasing and Business Services	0.0792
14	Metal smelting and rolling processing industry	0.0646	35	Tourism	0.0050
15	Fabricated metal products	0.0420	36	Sciences research	0.0149
16	General, special equipment manufacturing industry	0.0739	37	Integrated Technology Services	0.0242
17	Transport Equipment	0.1767	38	Other Social Services	0.0310
18	Electrical, machinery and equipment manufacturing	0.0491	39	Education	0.0090
19	Communications equipment, computers and other electronic equipment manufacturing	0.0381	40	Health, social security and social welfare	0.0097
20	Measuring Instruments and Office Machinery	0.0662	41	Culture, Sports and Entertainment	0.0212
21	Other manufacturing industries	0.0306	42	Public Management and Social Organization	0.0000

We merge the table 3 into table 4, the results indicate that the total input coefficient of logistics on the second industry is the biggest, much larger than that of logistics on the first and second industry. It indicates the demand pulling effect of logistics on the second industry is the most significant. Compared with 1997 input-output table, the interdependence between logistics and other industries is increasing; the growth rate of logistics on the second industry is still the most. The logistics development need more input of the second industry, and then it will have stronger pulling effect on the second industry.

Table 4
The Direct Input Coefficient and the Material Input Coefficient of the Logistics on the Three Industries

	The first industry	The second industry	The third industry(excluding logistics)	Logistics
1997	0.0127	1.5627	0.5631	0.1024
2002	0.0159	2.057	0.7251	0.1658

1.2.4 The Total Demand Coefficient of Logistics on Each Sector

The total demand relation of logistics on each sector can be described to be the total demand coefficient. Compared with the total input coefficient, the total demand coefficient is to add the total input coefficient of logistics on itself on 1. That is, the total demand coefficient of logistics on itself has not only the total input of logistics on each but also the one unit logistics final product. The results are reported in table 5.

Table 5
The Total Demand Coefficient of Logistics on Each Sector

1	Agriculture	0.0159	22	Waste	0.0591
2	Coal Mining and Dressing	0.0782	23	Electricity, Gas and Water Production and Supply	0.0807
3	Petroleum and Natural Gas	0.437	24	Gas Production and Supply	0.0786
4	Mining industry	0.078	25	Water Production and Supply	0.0848
5	Dressing	0.0328	26	Building industry	0.0089
6	Food manufacturing and tobacco processing	0.0132	27	Logistics	1.1658
7	Textile	0.0152	28	Post	0.0413
8	Down and Related Products Leather Clothing	0.0148	29	Information, transmission ,computer services, software	0.0606
9	Wood processing and furniture manufacturing	0.0229	30	Wholesale and retail trade	0.0475
10	Paper Manufacturing Printing and stationery	0.0426	31	Accommodation and Catering Services	0.0422
11	Petroleum processing, coking and nuclear fuel	0.3923	32	Finance and Insurance	0.1571
12	Chemical Industry	0.0503	33	Real Estate	0.0164
13	Non-metallic mineral products industry	0.0264	34	Leasing and Business Services	0.0792
14	Metal smelting and rolling processing industry	0.0646	35	Tourism	0.0050
15	Fabricated metal products	0.0420	36	Sciences research	0.0149
16	General, special equipment manufacturing industry	0.0739	37	Integrated Technology Services	0.0242
17	Transport Equipment	0.1767	38	Other Social Services	0.0310
18	Electrical, machinery and equipment manufacturing	0.0491	39	Education	0.0090
19	Communications equipment, computers and other electronic equipment manufacturing	0.0381	40	Health, social security and social welfare	0.0097
20	Measuring Instruments and Office Machinery	0.0662	41	Culture, Sports and Entertainment	0.0212
21	Other manufacturing industries	0.0306	42	Public Management and Social Organization	0.0000

1.3 The Forward Linkage of Logistics on Each Sector

The forward linkage is the effect of one industry or sector on each industry or sector that use the production and service of the industry as inputs and product materials. In the supply view of point, the logistics supply other sectors as a factor, in the production process of other sectors; they consume directly or indirectly the production or service that logistics supply. Thus in the input-output relation between logistics and other sectors, the portion of logistics product or service in other sectors input directly reflect the linkage effect of logistics on the forward linkage sectors. The more is the input portion, the greater is the pulling and supply effect of logistics on them, the closer is the linkage among them.

The direct linkage of logistics on the upstream sectors can be described to be the direct distribution coefficient. In the output view of point, the direct distribution coefficient is the directly technological and economic index among industries or sectors. It is the ratio of the direct use value of the intermediate products that are the products of one industry or sector distributing another industry or sector to the total products of this kind of product. The bigger is the logistics direct distribution coefficient, the greater is the direct demand of other sectors on logistics, the more significant is the direct promotion effect of logistics.

The total distribution coefficient is an index of directly or indirectly technological and economic relation among industries or sectors in the output view of point. Its economic implication is that one unit added value of one industry or sector distributes another industry or sector by direct or indirect demand. The greater is the total distribution coefficient of logistics on other industries or sectors, the greater is the promotion effect of logistics on them, and the greater is the forward total linkage of logistics on them.

1.3.1 The Direct Distribution Coefficient of Logistics on Each Sector

The direct distribution of logistics on each sector is the forward direct interdependence of each sector on logistics as upstream sector. We calculate the direct distribution coefficient of each sector on logistics on 2002 input-output table. The results are reported in Table 6.

In Table 6 the direct distribution coefficients of Petroleum Processing, Coking and Nuclear Fuel Processing on logistics are the greatest, it indicates Petroleum Processing, Coking and Nuclear Fuel Processing are close direct forward linkage of logistics, which is significantly direct promotion effect. The direct distribution coefficients of Mining industry, Scrap and Wastrel industry, Public Administration and Social Organizations on logistics are zero, that is, there is no direct forward linkage between them and logistics, the direct distribution coefficients of other sectors on logistics are relatively well-distributed, rather than concentrated distribution in several sectors. It indicates logistics has a characteristic of basic industry; also logistics is the basic and necessary condition in the social production.

Table 6
The Direct Distribution of Each Sector on Logistics

1	Agriculture	0.0093	22	Waste	0.0000
2	Coal Mining and Dressing	0.0029	23	Electricity, Gas and Water Production and Supply	0.0126
3	Petroleum and Natural Gas	0.0018	24	Gas Production and Supply	0.0010
4	Mining industry	0.0000	25	Water Production and Supply	0.0013
5	Dressing	0.0006	26	Building industry	0.0118
6	Food manufacturing and tobacco processing	0.0025	27	Logistics	0.1124
7	Textile	0.0010	28	Post	0.0005
8	Down and Related Products Leather Clothing	0.0023	29	Information, transmission ,computer services, software	0.0085
9	Wood processing and furniture manufacturing	0.0011	30	Wholesale and retail trade	0.0183
10	Paper Manufacturing Printing and stationery	0.0034	31	Accommodation and Catering Services	0.0098
11	Petroleum processing, coking and nuclear fuel	0.1266	32	Finance and Insurance	0.0505
12	Chemical Industry	0.0094	33	Real Estate	0.0017
13	Non-metallic mineral products industry	0.0014	34	Leasing and Business Services	0.0097
14	Metal smelting and rolling processing industry	0.0036	35	Tourism	0.0001
15	Fabricated metal products	0.0021	36	Sciences research	0.0004
16	General, special equipment manufacturing industry	0.0239	37	Integrated Technology Services	0.0005
17	Transport Equipment	0.0664	38	Other Social Services	0.0041
18	Electrical, machinery and equipment manufacturing	0.0034	39	Education	0.0021
19	Communications equipment, computers and other electronic equipment manufacturing	0.0031	40	Health, social security and social welfare	0.0014
20	Measuring Instruments and Office Machinery	0.0015	41	Culture, Sports and Entertainment	0.0004
21	Other manufacturing industries	0.0012	42	Public Management and Social Organization	0.0000

1.3.2 The Substance Distribution of Logistics on the Three Industries

We merge all sectors into the three industries and calculate the direct distribution coefficient of logistics on the three industries and substance distribution coefficient (intermediate rate). The results are reported in table 7.

In table 7 the direct distribution coefficient of logistics on the first industry is the smallest, that of logistics on the second industry is the largest, and the difference of the substance distribution coefficients between the first industry and the second one is small, the substance distribution coefficients of logistics on the second and third industry are much larger than that of the first industry. Compared with 1997, it is not changed that the characteristic of logistics is the producer service industry.

Table 7
The Direct Distribution Substance Distribution Coefficient of Logistics on the Three Industries

	The first industry	The second industry	The third industry(excluding logistics)	Logistics	Substance coefficient
1997	0.0056	0.2012	0.0749	0.0912	0.3729
2002	0.0093	0.2861	0.1088	0.1124	0.5160

1.3.3 The Total Distribution Coefficient of Logistics on Each Sector

The total distribution relation of logistics on each sector is the complex of direct and indirect distribution relation of logistics on each sector. The total distribution coefficient represents the relation. The results are reported in table 8 and 9.

In table 8 the total distribution coefficients of logistics on Petroleum Processing, Coking and Nuclear Fuel are the largest, followed by Logistics, Transportation Equipment Manufacturing, Oil and Gas industry, it indicates that the total forward linkage of logistics on these sectors is prominent, the promotion effect of logistics on them are larger.

Table 8
The Total Distribution Coefficient of Logistics on Each Sector

1	Agriculture	0.0322	22	Waste	0.0035
2	Coal Mining and Dressing	0.0223	23	Electricity, Gas and Water Production and Supply	0.0453
3	Petroleum and Natural Gas	0.1012	24	Gas Production and Supply	0.0020
4	Mining industry	0.0080	25	Water Production and Supply	0.0034
5	Dressing	0.0037	26	Building industry	0.0178
6	Food manufacturing and tobacco processing	0.0136	27	Logistics	0.1658
7	Textile	0.0097	28	Post	0.0015
8	Down and Related Products Leather Clothing	0.0070	29	Information, transmission ,computer services, software	0.0237

To be continued

Continued

9	Wood processing and furniture manufacturing	0.0064	30	Wholesale and retail trade	0.0577
10	Paper Manufacturing Printing and stationery	0.0213	31	Accommodation and Catering Services	0.0214
11	Petroleum processing, coking and nuclear fuel	0.1693	32	Finance and Insurance	0.0815
12	Chemical Industry	0.0769	33	Real Estate	0.0086
13	Non-metallic mineral products industry	0.0109	34	Leasing and Business Services	0.0251
14	Metal smelting and rolling processing industry	0.0704	35	Tourism	0.0003
15	Fabricated metal products	0.0179	36	Sciences research	0.0008
16	General, special equipment manufacturing industry	0.0682	37	Integrated Technology Services	0.0037
17	Transport Equipment	0.1210	38	Other Social Services	0.0118
18	Electrical, machinery and equipment manufacturing	0.0248	39	Education	0.0040
19	Communications equipment, computers and other electronic equipment manufacturing	0.0350	40	Health, social security and social welfare	0.0028
20	Measuring Instruments and Office Machinery	0.0079	41	Culture, Sports and Entertainment	0.0027
21	Other manufacturing industries	0.0045	42	Public Management and Social Organization	0.0000

Table 9
The Total Distribution Coefficient of Logistics on the Three Industries

	The first industry	The second industry	The third industry(excluding logistics)	Logistics
1997	0.0210	0.5302	0.1648	0.1231
2002	0.0322	0.8720	0.2456	0.1658

In table 9 the order of the total distribution coefficient of logistics on the three industries is the second industry, the third one and the first one. It indicates that the forward linkage of logistics on the second industry is the largest, compared with 1997, the promotion effect of logistics on the second industry is significantly enhancing, but that of logistics on the third one is apparently weak. The linkage of logistics on itself is also relatively close.

1.3.4 The Total Supply Coefficient of Logistics on Each Sector

The total supply coefficient represents the total supply relation. The total supply coefficient is to add the total distribution coefficient on itself on 1. The total supply coefficient of logistics on itself includes not only the total distribution of logistics on each sector but also a unit initial input of itself. The results are reported in table 10.

Table 10
The Total Supply Coefficient of Logistics on Each Sector

1	Agriculture	0.0322	22	Waste	0.0035
2	Coal Mining and Dressing	0.0223	23	Electricity, Gas and Water Production and Supply	0.0453
3	Petroleum and Natural Gas	0.1012	24	Gas Production and Supply	0.0020
4	Mining industry	0.0080	25	Water Production and Supply	0.0034
5	Dressing	0.0037	26	Building industry	0.0178
6	Food manufacturing and tobacco processing	0.0136	27	Logistics	1.1658
7	Textile	0.0097	28	Post	0.0015
8	Down and Related Products Leather Clothing	0.0070	29	Information, transmission ,computer services, software	0.0237
9	Wood processing and furniture manufacturing	0.0064	30	Wholesale and retail trade	0.0577
10	Paper Manufacturing Printing and stationery	0.0213	31	Accommodation and Catering Services	0.0214
11	Petroleum processing, coking and nuclear fuel	0.1693	32	Finance and Insurance	0.0815
12	Chemical Industry	0.0769	33	Real Estate	0.0086
13	Non-metallic mineral products industry	0.0109	34	Leasing and Business Services	0.0251
14	Metal smelting and rolling processing industry	0.0704	35	Tourism	0.0003
15	Fabricated metal products	0.0179	36	Sciences research	0.0008
16	General, special equipment manufacturing industry	0.0682	37	Integrated Technology Services	0.0037
17	Transport Equipment	0.1210	38	Other Social Services	0.0118
18	Electrical, machinery and equipment manufacturing	0.0248	39	Education	0.004
19	Communications equipment, computers and other electronic equipment manufacturing	0.0350	40	Health, social security and social welfare	0.0028
20	Measuring Instruments and Office Machinery	0.0079	41	Culture, Sports and Entertainment	0.0027
21	Other manufacturing industries	0.0045	42	Public Management and Social Organization	0.0000

2. THE ANALYSIS ON THE RIPPLE EFFECT OF LOGISTICS ON NATIONAL ECONOMY

2.1 The Driving Effect of Logistics on National Economy

The driving effect of logistics on national economy has the absolute and relative effect. The driving force represents the absolute effect; the driving coefficient represents the relative effect. The driving effect is based on the final using of logistics product.

2.1.1 The Driving Effect of the Logistics and Other Sectors

The driving force reflects the absolute volume of driving force of the unit final product of each sector on national economy. It can be calculated by the sum of total input coefficient or the sum of total demand coefficient. We use the sum of total demand coefficient as the driving force, that is, to produce a unit final product need the sum of each sector product in national economy. The results are reported in table 11.

In table 11 the driving force of logistics is 3.0051 and ranks the 16th in all sectors. It indicates that the driving force of logistics on national economy is not strong.

Table 11
The Driving Force of Each Sectors on National Economy

1	Agriculture	2.1742	22	Waste	4.6417
2	Coal Mining and Dressing	3.6872	23	Electricity, Gas and Water Production and Supply	3.6857
3	Petroleum and Natural Gas	5.8958	24	Gas Production and Supply	2.4026
4	Mining industry	5.8590	25	Water Production and Supply	3.1918
5	Dressing	3.2709	26	Building industry	1.1286
6	Food manufacturing and tobacco processing	1.8770	27	Logistics	3.0051
7	Textile	2.5271	28	Post	2.3114
8	Down and Related Products Leather Clothing	1.5439	29	Information, transmission ,computer services, software	2.7174
9	Wood processing and furniture manufacturing	2.5504	30	Wholesale and retail trade	2.6212
10	Paper Manufacturing Printing and stationery	3.1957	31	Accommodation and Catering Services	2.0665
11	Petroleum processing, coking and nuclear fuel	3.9958	32	Finance and Insurance	3.266
12	Chemical Industry	3.8877	33	Real Estate	1.5813
13	Non-metallic mineral products industry	2.6947	34	Leasing and Business Services	3.162
14	Metal smelting and rolling processing industry	4.0185	35	Tourism	1.2901
15	Fabricated metal products	3.0047	36	Sciences research	1.5573
16	General, special equipment manufacturing industry	2.7476	37	Integrated Technology Services	2.0328
17	Transport Equipment	2.7125	38	Other Social Services	1.8901
18	Electrical, machinery and equipment manufacturing	2.9501	39	Education	1.1719
19	Communications equipment, computers and other electronic equipment manufacturing	3.1834	40	Health, social security and social welfare	1.1983
20	Measuring Instruments and Office Machinery	3.1847	41	Culture, Sports and Entertainment	1.9042
21	Other manufacturing industries	2.1865	42	Public Management and Social Organization	1.0000

2.1.2 The Driving Coefficient of Logistics and Other Sectors

The driving coefficients of each sector are in table 12. In table 12 the driving force of logistics is 1.4514, it is bigger than 1, it indicates that the driving force level of logistics in all sectors is above average. The driving coefficient of logistics ranks 16th in all sectors. The changes of other sectors greatly influence on the logistics, and logistics is relatively significantly driven by national economic growth. Moreover, logistics is an essential industry in national economy. When the economy growth is accelerating, the demand pressure of logistics is much greater, and it is easy to be in short supply, making logistics become a bottleneck industry to impede the development of other sectors.

Table 12
The Driving Coefficient of Each Sector in National Economy

1	Agriculture	1.0501	22	Waste	2.2418
2	Coal Mining and Dressing	1.7808	23	Electricity, Gas and Water Production and Supply	1.7801
3	Petroleum and Natural Gas	2.8475	24	Gas Production and Supply	1.1603
4	Mining industry	2.8298	25	Water Production and Supply	1.5416
5	Dressing	1.5798	26	Building industry	0.5451
6	Food manufacturing and tobacco processing	0.9065	27	Logistics	1.4514
7	Textile	1.2205	28	Post	1.1164
8	Down and Related Products Leather Clothing	0.7457	29	Information, transmission ,computer services, software	1.3124
9	Wood processing and furniture manufacturing	1.2318	30	Wholesale and retail trade	1.2659
10	Paper Manufacturing Printing and stationery	1.5434	31	Accommodation and Catering Services	0.9981
11	Petroleum processing, coking and nuclear fuel	1.9299	32	Finance and Insurance	1.5774
12	Chemical Industry	1.8777	33	Real Estate	0.7637
13	Non-metallic mineral products industry	1.3015	34	Leasing and Business Services	1.5272
14	Metal smelting and rolling processing industry	1.9408	35	Tourism	0.6231
15	Fabricated metal products	1.4512	36	Sciences research	0.7521
16	General, special equipment manufacturing industry	1.3270	37	Integrated Technology Services	0.9818
17	Transport Equipment	1.3101	38	Other Social Services	0.9129
18	Electrical, machinery and equipment manufacturing	1.4248	39	Education	0.5660
19	Communications equipment, computers and other electronic equipment manufacturing	1.5375	40	Health, social security and social welfare	0.5788
20	Measuring Instruments and Office Machinery	1.5381	41	Culture, Sports and Entertainment	0.9197
21	Other manufacturing industries	1.0560	42	Public Management and Social Organization	0.3653

2.2 The Promotion Effect of Logistics and Other Sectors

The promotion effect of logistics on national economy has the absolute and relative promotion effect. The absolute effect is described by the absolute promotion force and the relative effect is described by the promotion coefficient. The promotion force and coefficient are based on the initial input of products of logistics.

2.2.1 The Promotion Force of Logistics and Other Sectors

The promotion force of each sector is calculated by the sum of total distribution coefficient or the sum of total supply coefficient. We use the sum of total supply coefficient to calculate the promotion force of each sector. The promotion force reflects the absolute effect of a unit initial input of logistics to promote the total output of national economy. The results are reported in table 13.

In table 13 the promotion force of logistics 2.3156 in 2002 and ranks 28th in 42 sectors. It indicates that the promotion effect of logistics is weak.

2.2.2 The promotion coefficient of logistics and other sectors

The promotion coefficient of logistics refers to the relative effect of the supply volume of each sector as logistics enhances a unit initial input. The results of promotion coefficient of each sector are reported in table 14.

Table 13
The Promotion Force of Each Sector on National Economy

1	Agriculture	1.9814	22	Waste	1.000
2	Coal Mining and Dressing	2.1099	23	Electricity, Gas and Water Production and Supply	2.2039
3	Petroleum and Natural Gas	1.746	24	Gas Production and Supply	2.8814
4	Mining industry	2.4628	25	Water Production and Supply	2.236
5	Dressing	2.3847	26	Building industry	3.0319
6	Food manufacturing and tobacco processing	2.5619	27	Logistics	2.3156
7	Textile	3.0243	28	Post	2.5900
8	Down and Related Products Leather Clothing	3.1059	29	Information, transmission ,computer services, software	2.2811
9	Wood processing and furniture manufacturing	2.9100	30	Wholesale and retail trade	2.1571
10	Paper Manufacturing Printing and stationery	2.7410	31	Accommodation and Catering Services	3.3069
11	Petroleum processing, coking and nuclear fuel	2.6367	32	Finance and Insurance	1.8491
12	Chemical Industry	2.9657	33	Real Estate	1.6580
13	Non-metallic mineral products industry	2.7095	34	Leasing and Business Services	2.7472
14	Metal smelting and rolling processing industry	2.9655	35	Tourism	2.0666
15	Fabricated metal products	3.1413	36	Sciences research	2.5416
16	General, special equipment manufacturing industry	3.0499	37	Integrated Technology Services	2.0664
17	Transport Equipment	3.1761	38	Other Social Services	2.4667
18	Electrical, machinery and equipment manufacturing	3.1821	39	Education	2.0100
19	Communications equipment, computers and other electronic equipment manufacturing	3.5222	40	Health, social security and social welfare	2.4153
20	Measuring Instruments and Office Machinery	3.2426	41	Culture, Sports and Entertainment	2.3690
21	Other manufacturing industries	2.9094	42	Public Management and Social Organization	2.1900

In table 14 the promotion coefficient of logistics is 0.9484 in 2002, it is smaller than 1, the logistics effect in all sectors is below average. It indicates the promotion of logistics on national economy is weak compared with the other sector, especially with manufacturing.

Table 14
The Promotion Coefficient of Each Sector on National Economy

1	Agriculture	0.8116	22	Waste	0.4096
2	Coal Mining and Dressing	0.8642	23	Electricity, Gas and Water Production and Supply	0.9027
3	Petroleum and Natural Gas	0.7151	24	Gas Production and Supply	1.1801
4	Mining industry	1.0087	25	Water Production and Supply	0.9158
5	Dressing	0.9767	26	Building industry	1.2418
6	Food manufacturing and tobacco processing	1.0493	27	Logistics	0.9484
7	Textile	1.2387	28	Post	1.0608
8	Down and Related Products Leather Clothing	1.2721	29	Information, transmission ,computer services, software	0.9343
9	Wood processing and furniture manufacturing	1.1919	30	Wholesale and retail trade	0.8835
10	Paper Manufacturing Printing and stationery	1.1227	31	Accommodation and Catering Services	1.3545
11	Petroleum processing, coking and nuclear fuel	1.0800	32	Finance and Insurance	0.7574
12	Chemical Industry	1.2147	33	Real Estate	0.6791
13	Non-metallic mineral products industry	1.1098	34	Leasing and Business Services	1.1252
14	Metal smelting and rolling processing industry	1.2146	35	Tourism	0.8464
15	Fabricated metal products	1.2866	36	Sciences research	1.0410
16	General, special equipment manufacturing industry	1.2492	37	Integrated Technology Services	0.8464
17	Transport Equipment	1.3009	38	Other Social Services	1.0103
18	Electrical, machinery and equipment manufacturing	1.3033	39	Education	0.8233

To be continued

Continued

19	Communications equipment, computers and other electronic equipment manufacturing	1.4427	40	Health, social security and social welfare	0.9892
20	Measuring Instruments and Office Machinery	1.3281	41	Culture, Sports and Entertainment	0.9703
21	Other manufacturing industries	1.1917	42	Public Management and Social Organization	0.8970

2.3 The Induced Effect of Logistics and Other Industry

The induced effect coefficient represents the induced effect of each sector on national economy. The induced effect coefficient refers to the product volume of logistics final product driving national economy in each unit final product. The results are reported in table 15.

In table 15 the induced coefficient of logistics is 0.0722 and ranks 31st in all sectors. It indicates that the portion of logistics final product in the total volume of national economic final product is much small. Thus compared with the promotion effect of other sectors on the national economy, the promotion effect of logistics final product is not significant.

Table 15
The Induced Coefficient of Each Sector on National Economy

1	Agriculture	0.1791	22	Waste	0.0002
2	Coal Mining and Dressing	0.0134	23	Electricity, Gas and Water Production and Supply	0.0293
3	Petroleum and Natural Gas	0.0070	24	Gas Production and Supply	0.0027
4	Mining industry	0.0015	25	Water Production and Supply	0.0032
5	Dressing	0.0039	26	Building industry	0.2085
6	Food manufacturing and tobacco processing	0.1056	27	Logistics	0.0722
7	Textile	0.0609	28	Post	0.0032
8	Down and Related Products Leather Clothing	0.0538	29	Information, transmission ,computer services, software	0.0246
9	Wood processing and furniture manufacturing	0.0203	30	Wholesale and retail trade	0.1174
10	Paper Manufacturing Printing and stationery	0.0326	31	Accommodation and Catering Services	0.0504
11	Petroleum processing, coking and nuclear fuel	0.0096	32	Finance and Insurance	0.0331
12	Chemical Industry	0.1015	33	Real Estate	0.0562
13	Non-metallic mineral products industry	0.0151	34	Leasing and Business Services	0.0242
14	Metal smelting and rolling processing industry	0.0129	35	Tourism	0.0050
15	Fabricated metal products	0.0357	36	Sciences research	0.0063
16	General, special equipment manufacturing industry	0.1441	37	Integrated Technology Services	0.0173
17	Transport Equipment	0.0793	38	Other Social Services	0.0488
18	Electrical, machinery and equipment manufacturing	0.0719	39	Education	0.0492
19	Communications equipment, computers and other electronic equipment manufacturing	0.1970	40	Health, social security and social welfare	0.0323
20	Measuring Instruments and Office Machinery	0.0396	41	Culture, Sports and Entertainment	0.0158
21	Other manufacturing industries	0.0164	42	Public Management and Social Organization	0.0697

2.4 The Actuation Coefficient of Logistics and Other Sectors on National Economy

The actuation coefficient of logistics represents the actuated effect of logistics on national economy. The auction coefficient of logistics initial input on national economy refers to the product volume of logistics initial input promoting national economy in each unit initial input of national economy. The results of actuation coefficient of each sector are in table 16.

In table 16 the logistics actuation coefficient is 0.1296 and ranks 5th in all sectors, and the logistics promotion force ranks 28th in table 13. It indicates that the promotion effect of logistics is not great in initial input volume of logistics, but if we enhance the share of logistics initial input in the total volume of national economic initial input, then the promotion effect of logistics on national economy will be more significant.

Table 16
The Actuation Coefficient of Each Sector on National Economy

1	Agriculture	0.2704	22	Waste	0.0069
2	Coal Mining and Dressing	0.0394	23	Electricity, Gas and Water Production and Supply	0.0716
3	Petroleum and Natural Gas	0.0332	24	Gas Production and Supply	0.0017
4	Mining industry	0.0126	25	Water Production and Supply	0.0050
5	Dressing	0.0144	26	Building industry	0.1640
6	Food manufacturing and tobacco processing	0.0945	27	Logistics	0.1296
7	Textile	0.0553	28	Post	0.0043
8	Down and Related Products Leather Clothing	0.0415	29	Information, transmission ,computer services, software	0.0578
9	Wood processing and furniture manufacturing	0.0257	30	Wholesale and retail trade	0.1643
10	Paper Manufacturing Printing and stationery	0.0533	31	Accommodation and Catering Services	0.0785

To be continued

Continued

11	Petroleum processing, coking and nuclear fuel	0.0226	32	Finance and Insurance	0.0709
12	Chemical Industry	0.1413	33	Real Estate	0.0731
13	Non-metallic mineral products industry	0.0424	34	Leasing and Business Services	0.0393
14	Metal smelting and rolling processing industry	0.0912	35	Tourism	0.0067
15	Fabricated metal products	0.0360	36	Sciences research	0.0071
16	General, special equipment manufacturing industry	0.0913	37	Integrated Technology Services	0.0210
17	Transport Equipment	0.0659	38	Other Social Services	0.0490
18	Electrical, machinery and equipment manufacturing	0.0448	39	Education	0.0636
19	Communications equipment, computers and other electronic equipment manufacturing	0.0788	40	Health, social security and social welfare	0.0408
20	Measuring Instruments and Office Machinery	0.0115	41	Culture, Sports and Entertainment	0.0159
21	Other manufacturing industries	0.0137	42	Public Management and Social Organization	0.0874

CONCLUSIONS

On 2002 input-output table we measure quantitatively the linkage effect and ripple effect of logistics on each sector. According to the results, the pulling effect of logistics on the second industry is the greatest, thus the logistics significantly pull the development of second industry. Compared with the third industry, the pulling effect of logistics on the third industry is greatly increasing, the growth rate of pulling effect on the third industry is faster than on the second industry, but the promotion effect of logistics on the third industry is apparently insufficient. In a word, the driving effect of logistics on national economy is still insufficient, but the logistics development is significantly pulled by national economy. The share of logistics final product is small in the national economy final product volume. It result in the driving effect of logistics final product on national economy is not significant compared with that of other sectors. The promotion effect of logistics initial input on national economy is not strong, if the logistics initial input share can be enhanced in the national economic initial input volume, and then the promotion effect of logistics on national economy will be more significant.

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