

The Quality of Exports based on China-India and Its Comparative Research---- From the perspective of trade in value added

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Abstract: This paper compares the export quality of China and India based on the perspective of trade in value added. First, we calculate the volume of value added of exports in China and India from the aspect on total number, industrial number and bilateral number. Then comparing the quality of exports between China and India from three dimensions. Result shows that the proportion of exports in value added of China and India continue to decrease compared with the total exports, and the proportion of value added of exports in these two countries are equal almostly; By the view of industrial level, the proportion of China's exports in value added are relatively balanced among different industries, while India's exports in value added mainly concentrated on agricultural sector, nature resource industries and financial services, software information industries. Take on the comparasion of second dimension, China has slight advantages; From the third dimension of market distribution, China's export market tends to be decentralized and the dependence on a certain market decreased by time goes. Forming a striking contrast, Indian market of export turns to be more and more concentrated. So the overall quality of China's export is better than that of India.

1. Introduction

After the financial crisis, people's vision transfer to the BRIC economies. The most prominent countries among BRIC economies are China and India, meanwhile the two countries are veritable emerging economies. From the view of economic growth in China and India, the growth force has a similar principle. This is the implementation of export-oriented economy development strategy, there is no doubt that the export is a driving force on the economic growth for these two countries [1]. It is also undeniable that export has played a very important role in stimulating its economic growth. China has undergone reform and opening up, taking the lead in incorporating the domestic production factors into the international production system. Although the early Indian economy has been bland, after a period of exploration and imitation of many emerging economies, it also carried out market-oriented reform and gradually embarked on the export-oriented development path that suited the national conditions in 1992. After 2000, the Indian government further introduced trade liberalization policy. Since then, its export substantial increased and its economic growth has also accelerated rapidly [2]. Till 2015, India's economic growth rate began to exceed that of China, and showed a well expectation. Goldman Sachs Group pointed out that the early comparative advantage of China's export is gradually disappearing while India's more optimized export model and structure effected more robustly on its economic growth.

When we compared with total volume, the scale of China's export is far larger than that of India, and the percentage of absolute volume of export in GDP is also higher than that of India. But today's international trade has entered into the Intra-product trade stage, and the commodity production began to be divided into different countries. A large number of intra-mediate trade stuffed the goods production process while the total exports blurred the country attribution of export value [3]. So the quality of export among these two countries can not be truly reflected if we ignore

the import of intermediate goods. In response to this issue, Pascal Lamy, former Director General of the World Trade Organization, at the 2011 Geneva Conference, suggested that trade in value added should be used as the standard for foreign trade statistics. WTO and OECD also launched a research program on value-added trade calculations in 2012.

The world input-output table published by the WIOD database provides a data source for us to calculate the exports in value added of countries at the industrial level, the country's total volume level, and bilateral level in different years. Leontief as early as the 1970s invented the logic of input-output table and introduced the computer calculating export in value added as the mainstream of today's academic methods. Koopman used the World Input-Output Table to divide the value of a country's exports into five parts, and measure the division of labor at the national level based on the data of the five parts [4]. Johnson embedded the global input-output matrix into import and export data between countries, measuring the rate of export value added of some economies [5], and its computational logic is firstly based on the input-output model, but the data source used still limits the accuracy of its calculations. Based on the WIOD database, Stehrer calculates the domestic value of the exported goods by decomposition of the source of the final commodity value of export [6], but the added value of the indirect exports through the third country is ignored, which will affect the accuracy of calculating the export in value-added. Based on the perspective of the final demand and the use of the Leontief inverse matrix, Stehrer first interpreted the concept of trade in value added into three parts in the form of matrix operation and covered trade transfer and the value added part by the third country to the destination country [7]. Many scholars began to use this final method to calculate the national and industrial level of export in value added. Even if this method has been changed by some scholars, it is only the revision based on basic framework.

Under the support of new data, the comparison of quality of China-India export based on the perspective of export in value added is more scientific than the previous comparison based on the total volume trade data. China and India are constantly opening up the domestic market and incorporate the country's production factors into the global production system in the process. What is the heterogeneity of export in value-added between various industries behind the difference in the export structure between the two countries? What is the difference of the world market between the two countries' export? Whether the development of export between China and India has a sign of improvement and how the future sustainability will be? Whether "The tiger and the elephant" in the future can work together to open the door to the world's leading trade system, or be trapped in the processing sector by the global value chain division dominated by developed countries? From the perspective of export in value-added, this paper is based on the above thinking to analyze Sino-Indian export quality and conduct a comparative study between China and India.

2. Summary of accounting methods for export value added

Customs data just show only the total statistics of export and industrial data. For the constitution of raw materials source of export commodities, we can only rely on the input and output table of the goods production. WIOD database published the input-output table of 35 industries from 1995 to 2011, covering 40 economies and more than 95% of global trade volume. For the accounting of trade in value added, scholars at home and abroad has been extensively studied [8]. Stehrer is currently the most recognized method in calculating export in value added among a large number of scholars. He incorporates the value of intermediate goods in export commodities to WIOD database decomposition in the form of transfer trade and reentry trade, at the same time based on the world input-output table, link the input and output between countries together to calculate the trade in value added.

The goods export from one country to another consists of two parts, mainly for the export of intermediate commodity and final commodity. The goods country 1 exports to the country 2, that is, the input of country 2 from country 1.

$$EX_{12} = X_{12} + F_{12}. \quad (1)$$

X_{ij} denotes the middle commodity value country i exports to country j , F_{ij} denotes the final

commodity value country i exports to country j.

But the export of intermediate commodity and final commodity of country 1 contains the input of middle goods of other countries, so the calculating of export in value added can't be based on the total export data to divest the added value of the third countries. So the goods value added of the commodity destination country and the import country of origin includes three parts: (1) the added value of original country included in the import of the intermediate commodity; (2) the added value of source country included in the import of the final commodity; (3) the added value of the intermediate goods of original country included in the goods imported by the destination country from the third country. This method of calculating the export in value added is the trade in value added, which is described by Stehrer based on calculating from the perspective of destination country. We first calculate the export in value added at the total volume level and the specific calculation logic is as follows:

$$X = AX + F \longrightarrow X = (I - A)^{-1}F = LF \quad (2)$$

In this formula, X denotes the total output column vector of countries, A denotes the intermediate consumption coefficient matrix, and the elements in the matrix of specific intermediate consumption coefficient are calculated as: $A_{ij} = X_{ij}/X_j$, F denotes the final product matrix and I denotes the unit matrix, $(I - A)^{-1}$ is the corresponding Leontief inverse matrix, that is, L matrix, in which L_{ij} means how much output from country i is needed when country j increases a unit of the final consumption of goods. We can conclude the calculating formula of export in value added of country 1 exports to country 2 as follows:

$$EX_r^{TivA} = v_r^* Lf_r = (0, 0 \dots v_r) L \begin{bmatrix} F_{11} + F_{12} + F_{13} + \dots 0 \\ F_{21} + F_{22} + F_{23} + \dots 0 \\ \vdots \\ F_{r1} + F_{r2} + F_{r3} + \dots 0 \end{bmatrix} = v_r^* L \begin{bmatrix} F_1^r \\ F_2^r \\ \vdots \\ F_r^r \end{bmatrix} \quad (3)$$

In $v_j = V_j/X_j, j \in (1, r)$, v_j denotes the the value added rate of country j in the production of goods. When we calculate the export in value added in country j, by excluding $[F_{1j}, F_{2j} \dots F_{rj}]^T$ in order to exclude the country's domestic use of the final commodity. We can get the following formula:

$$EX_j^{TivA} = v_j^* Lf_j = v_j L_{j1} F_1^j + v_j L_{j2} F_2^j + \dots + v_j L_{jr} F_r^j \quad (4)$$

The above description is the export in value-added of one countries for all countries. In the economic study, we often use bilateral export in value added accounting, and in order to calculate the trade balance of bilateral added value to reflect the bilateral trade relationship. Then we will introduce the calculating of export in value added between countries:

In r countries, take the export of country m to country n for example, the trade in value added of country m exports to country n includes three parts,

As detailed above, the formula based on the input-output table is as follows:

$$EX_{mn}^{TivA} = v_m L_{m1} F_{1n} + v_m L_{m2} F_{2n} + v_m L_{mr} F_{rn} = v_m^* Lf_n \quad (5)$$

$Inf_n = (F_{1n}, F_{2n} \dots F_{mn})^T$, f_n in the input-output matrix means the final commodities country n import from other countries. Based on the decomposition of the added value of bilateral export trade between countries and countries, we can get the analogy of the calculation of the trade in added value between countries and countries at the industrial level. Because there is such a relationship in the value-added increase rate of the export at the industrial level: $\sum_{j=1}^{35} v_{ij} \neq 35v_i$, in which v_{ij} is the rate of value added of industry j in country i, v_i means the rate of value added of the initial investment of country i, and there is a mutual investment relationship between the industries. So the calculating of export in value added at the national level is not equal to the sum of the added value of the export trade of the industries.

3. Comparison of Export Quality between China and India

As to the study of the export quality, academic world mainly focused on the perspective of micro view, especially the enterprise heterogeneity in new trade theory emerged since 2003. Although the micro-commodity perspective can reflect the quality of export to a certain extent, it does not reflect the overall export structure and the quality of export at the industrial level. In the product perspective study, Flam reflect the impact of the product perspective on the quality of export by constructing a theoretical model [9]. In subsequent empirical studies, numerous literatures use unit products, unit prices as alternative indicators of export quality and regard the price as a indicator of export quality [10,11]. It is clearly biased in the intra-product trade stage. The price of the final commodity can no longer reflect the export quality, a large number of intermediate imports led to that the high price of final commodity are carved up to the different parts of the value chain, so high price of goods is also the manifestation of high cost and high percent of intermediate input goods. If you do not distinguish the categories of goods, the discussion of the price of goods only is also meaningless.

Some scholars bases on Uncomtrade database to analyze one country's comparative advantage index of commodities, but this indicator still measures the export quality based on the export volume and it makes no difference with the analysis of export quality at the total volume level. The United Nations Development and Trade Commission has also used the Hirschman Index to reflect the quality of export. but it does not fully reflect the overview of export quality in one country. Rodrik introduced the Commodity Technology Sophistication for the first time [12], but this indicator only measures the technological sophistication of the terminal's exports. And under the reality of a large number of processing trade, it can not reflect the quality of a country's export.

Based on the thinking of current intra-product trade phase, trade in value added can reflect the real benefits of the economy from export, thus reflecting the true quality of export. We separately calculated the trade in value added at the horizontal total volume, industrial level, bilateral level and the value added of export vertically to truly find reflects the quality of China and India's export.

(1) The proportion of value added in total trade volume. The absolute quantity of export between China and India can not reflect the issue which country's quality of export is more superior. Opening the domestic market and the rapid integration of domestic production factors into the international production system can quickly increase the absolute amount of a country's export trade, especially for the energy and natural resources exports of developing countries, So We first calculated the share of added value in the total trade volume between China and India, as shown in Table 1.

Table 1 Value added of total exports volume (Unit: US \$ million)

country year	China			India		
	Export in value added	Export volume	Proporation of value added	Export in value added	Export volume	proportion of value added
1995	146256.6783	167973.6864	0.870711844	36576.73647	42069.79802	0.869429809
1997	182379.5115	207238.7277	0.880045509	41342.01655	47419.91864	0.871828078
1999	193089.762	218500.636	0.883703432	47084.3204	54831.03749	0.858716569
2001	259304.2812	299418.5393	0.866026138	56927.62709	66714.83915	0.853297824
2003	400292.6287	485016.1948	0.825318068	74965.70056	88039.79729	0.851497878
2005	658422.1584	836718.6704	0.786909844	129197.8553	157500.0984	0.820303331
2007	1063060.108	1342004.108	0.792143706	194848.6213	242248.6692	0.804333093
2009	1117573.639	1332256.345	0.838857809	187890.2587	225984.1224	0.831431238
2011	1689055.766	2084042.917	0.810470721	279156.1097	325273.1197	0.858220655

Based on the data in Table 1, we find that the added value share of export in China and India is showing a declining trend, while India's export in value added is higher than that of China. However,

according to the proportion of export in added value of the developed countries we have calculated, the proportion of export in added value is relatively low in the countries with higher degree of division of labor in the world. China's exports are mainly based on the industrial sector, the input of the intermediate goods is relatively simple. So, there is little use of the intermediate imports. But a large number of export processing trades use relatively large proportion of foreign intermediate goods. From the perspective of the proportion of trade in value added, China's participation in the international division of labor system is higher. Also, the annual decrease in value-added also shows that China has been deeply embedded in the international production system. India's high proportion also reflects India's participation degree in the international division of labor system is relatively backward as India's exports commodity use less foreign intermediate input. However, compared to India, China is mainly concentrated in the global production system processing links while high value-added of R&D and sales are mainly controlled by the developed countries. Once we observe the classification of China's export commodities secondly, result shows that China's export focus on secondary industry which relying on scale economy and low labor costs. China's value increase rate of the industries producing export goods is generally low, which reflects the gradual deterioration of China's export quality. While exports of primary commodities in India are declining, with the exception of the export of energy and mineral resources, the proportion of the export of the business services sector, the Internet and related services, software and information technology services in India and the like is relatively large [13]. Overall, China's export relies on the export of labor-intensive products, while India's export relies on the export of services brought by technological innovation [14]. Only from the export volume, the number of production factors, China incorporates into the international production system is far greater than India, but the quality of production factors in international production is not high, which also aroused our concerns about China's export, and the large number of exports of India trade in the high-tech industries, especially the software industry, comparing with China, is high-quality export model. The share of total value-added can only reflect the quality of a country's export to a certain extent, and it needs to refer to the industrial structure of the total export. Only under the assumption that the export commodity have the same industrial structure, the analysis of the total volume will be meaningful. Based on this, we continue to divest the total volume trade to further explore the comparison of Sino-Indian export trade quality at the industrial level.

(2) Comparison of Export Quality between China and India by Industrial Classification. Based on the thinking of the classification of the industry, the logical view is that the high value-added industries like the sunrise industry, high-tech industries, service industry accounted for a higher proportion of exports, representing a country's higher export quality, such as VR industry, high-end services, tourism, intelligent robot. The exports of these industries are actual the export of high-end elements like artificial intelligence, technology, natural scenery and so on. And a higher proportion of export in value added on the sunset industry, low-end manufacturing represents a country's lower export quality, such as the exports of steel and coal, even if all the added value is from the exporting country, the value increase of such goods' exports is very low, and the input of the production factors are mainly low-end production factors, which leads to great consumption and pollution of the environment, resulting in ecological damage. This kind of export is typical of low quality export. Limited to space, Table 2 shows the export in value added of some Chinese and Indian industries every five years and its share of the total value-added.

According to the results of Table 2, China and India have similar comparative advantages in some traditional industries of export trade. From the development of the textile and clothing products in recent years, India's textile and garment manufacturing industry has gradually lost its advantage while the comparative advantage began to tilt the weight toward China. Based on the dynamic perspective study, the value added of export trade between China and India shows the feature of increasing of the total volume and the differentiation of structure. The distribution of high value-added export industry in the two countries is very heterogeneous, and China mainly concentrates on traditional manufacturing industries with a high value-added, which is closely related to China's perfect manufacturing industry chain. But India's high value-added export

industries concentrated mainly on traditional energy exports and high-end services while the total volume its manufacturing exports is small and its added value is not high. However, when it comes to the exports of services related to communications software, India's export value-added accounted for a higher proportion. The export value added of China's industries reflects a relatively balanced development trend of various industries in China. The export value added of agricultural areas has been very low, while the proportion of industrial sector is still relatively high. And at the same time, the export value added of financial intermediaries and industrial services improves steadily. In the short term, the export trade quality of China's industrial level is better. India's export value added of the industrial sector is extremely uneven, the share of export value added in the agricultural sector is still large, while the total volume of machinery manufacturing and electrical equipment exports is not only small but also takes low proportion. Based on the value-added trade, the observation of China-India export trade quality at the industrial level shows that, in general, China has more advantages and the development is more stable.

Table 2 The absolute amount of export value-added of some Chinese and Indian industries every five years and its share of the total value-added. (unit: \$ billions of dollars)

country year	China						India					
	farming and fishing		Mining industry		textile		farming and fishing		Mining industry		textile	
1995	85.6	0.058	169.9	0.115	174	0.117	44.30	0.133	58.9	0.177	37.6	0.113
2000	62.20	0.015	160.6	0.077	242	0.058	66.9	0.095	85.6	0.183	53.7	0.076
2005	128	0.019	480.6	0.071	484.7	0.072	88	0.084	131.1	0.125	69.1	0.066
2010	267	0.017	1295	0.081	1075	0.067	172.9	0.092	219.5	0.116	82.1	0.044
industry	machine manufacturing		Optics and electrical equipment		wholesale trade		machine manufacturing		Optics and electrical equipment		wholesale trade	
1995	37.1	0.025	145.9	0.077	141	0.073	3.61	0.011	7.74	0.023	1.17	0.004
2000	74.7	0.018	311.2	0.103	198.7	0.087	7.68	0.011	8.203	0.012	1.78	0.003
2005	198.7	0.029	813.2	0.121	427.7	0.063	17.2	0.017	22.9	0.022	2.73	0.003
2010	599.6	0.037	1978	0.123	859.2	0.053	35.07	0.019	78.9	0.042	2.59	0.001
industry	retail trade		Financial intermediary exports		Rental and supporting business		Retail trade export		Financial intermediary exports		Rental and ancillary business	
1995	38.6	0.017	9.66	0.007	10.64	0.007	0.32	0.001	5.58	0.017	6.02	0.018
2000	50.1	0.012	5.73	0.001	63.31	0.015	0.25	0.001	9.52	0.014	37.62	0.054
2005	108.9	0.016	18.4	0.003	329.4	0.049	0.004	0.000	47.55	0.045	225.4	0.217
2010	177.1	0.011	51.58	0.003	842.9	0.053	2.6	0.001	81.25	0.043	318.2	0.168

(3) A Comparative Analysis of Export between China and India Based on Different Markets in the World. Export is dependent on the international market, external capacity output and exchange for foreign exchange in order to obtain their own economic growth. Also, export quality will also based on whether the international market is broad. Export with large market expansion boundary is conducive to a country to resist export instability brought about by the regional economic risks. The more export markets there are, the more dispersed the market density and the smaller the price elasticity of the exporting countries' exports goods would be. We analyze the export between China and India from the perspective of export destination countries. We regard The G7 Economic Group and the BRIC countries as the export destination countries of China and India to observe whether the export market of China and India are scattered. Because the G7 and BRIC countries represent the world's 77% of the population and 84% of the total economy, these several countries are more representative. The variance of the data can reflect the degree of discrepancy of the data distance mean. The smaller variance of the added value indicates that the market of the exporting country is more uniform. Based on this, we calculated the standard deviation of the annual market data to reflect the horizontal Sino-Indian contrast and vertical dynamic change process.

The United States occupies the largest market of export in value added of China and India, which has a great relationship with the huge market demand in the United States. Japan, England, France and Germany also occupies a pivotal position in the export market of India and China. The mutual export between the BRIC countries has gradually increased. In the perspective of added value, the BRIC countries supply intermediate goods and final commodities with each other and the

relationship of cooperation production is more important. In addition to G7 and BRIC countries, China and India began to strengthen dependence on the remaining countries. The standard deviation of the proportion of the value added that China exports to G7 and BRIC countries gradually reduced, which also reflects that the trend of China's export market becomes more and more dispersed. But the standard deviation of India not only did not reduce, even insteadly increased in 2011. The Indian export market is increasingly dependent on the G7 economies and BRIC countries. Analysis of the quality of export between China and India is conducted based on the perspective of market concentration and the quality of China's export trade is higher than that of India.

4. Conclusion

Overall, China's export quality is higher than that of India. China's export in value added is mainly undertaken by the industrial sector, but the export of high-end services is relatively lacking. The proportion of export in value added of India's agricultural sector and energy and mineral resources is still high. The industrial sector is India's short board, but the export in value added of its financial services industry and communications and information industry accounted for a higher proportion [15]. China's export market tends to be scattered, while the Indian export market tends to be concentrated. According to Prebisch's theory of development economics, it seems that India has developed the "Great Leap Forward" development model in which the industrial export has not been achieved but the export of service industry has been made, while China has been trapped in the "conservative" trade model in which there is export of large quantities of industrial products but breakthrough can not be made.

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