

Analysis of the Commodity Structure Index of Bilateral Trade between China and Germany

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Abstract: The year 2022 is the 50th anniversary of the establishment of diplomatic relations between China and Germany, and China-Germany trade has always been highly complementary, but with China's continuous promotion of industrial structure upgrading in recent years, China's capital- and technology-intensive industries have been growing, and the competition of China-Germany bilateral trade has become more and more intense, and the intra-industry trade has been developing. This paper mainly studies the competitive index, the index of demonstrated comparative advantage and the index of intra-industry trade of Sino-German trade, and comes to the conclusion that the degree of intra-industry trade between China and Germany has been strengthening, but China still does not have an advantage in the production of capital- and technology-intensive industrial products.

Keywords: Sino-German trade; commodity structure; index analysis

1. Introduction

After 50 years of friendly diplomatic relations, China and Germany have become important trading partners with each other, the trade relationship between the two countries is getting closer and more mature, and the reform and upgrading of our industries has been quite effective. Trade between China and Germany has always been strongly reciprocal, but now trade competition between the two countries in some industries is on the rise.

Manufactured goods have accounted for a large share of bilateral trade between the two countries for many years, and China's export trade is mainly concentrated in primary consumer goods or labor-intensive products such as textiles and electromechanical products. Over the last decade, China's industrial structure has been continuously restructured, and the evolution of trade volumes varies considerably among the various sub-sectors. Through the comprehensive comparison of the trade competitiveness index, the index of demonstrated comparative advantage, and the index of intra-industry trade, it is possible to analyze the optimization trend of China's export structure to Germany, and to analyze the trade competitiveness and the level of intra-industry trade between the two countries, which is of great significance for improving the bilateral economic and trade relations between the two countries and adjusting and optimizing the trade structure.^[1]

2. Establishment of the index evaluation system for the commodity structure of bilateral trade between China and Germany

The research objectives and research targets of different indices are also different. In this paper, three trade indices suitable for studying the issue of bilateral trade commodity structure are selected as econometric indicators to systematically evaluate the relevant characteristics of the commodity structure of bilateral trade between China and Germany.

2.1. Trade Competitiveness Index (TC)

The TC index refers to the proportion of a country's import and export trade balance of a particular industry's products in the country's import and export trade volume. The closer its value is to 0 means that the industry imports and exports both products in the production of the product, and the closer it is to -1 means the weaker the competitiveness; the closer it is to 1 means the greater the competitiveness of the

industry. The formula is:

$$TC_{ij} = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij}) \quad (1)$$

where M_{ij} denotes country's imports of a particular type of product from country j .

X_{ij} denotes the value of exports from country i to country j for a particular type of product.

2.2. Index of Revealed Comparative Advantage (RCA)

The RCA index, which measures the international competitiveness of a product produced in a country by placing the country's total exports of products in a given industry in the framework of international markets and commodity trade. The calculation formula is:

$$RCA_{ij} = (X_{ij} / X_{tj}) \div (X_{iW} / X_{tW}) \quad (2)$$

where X_{tj} denotes the total value of exports of a country j

X_{ij} denotes the value of exports of product category i from a country j

X_{tW} denotes the total value of world exports

X_{iW} denotes the value of exports of product category i for worldwide exports.

For this equation, the results can be roughly divided by using 1 as a benchmark for measurement, or by three values: 0.8, 1.25 and 2.5. If the index value is greater than 2.5, the product has a strong competitive advantage; if the index value is within 1.25 to 2.5, it represents a strong competitive advantage for the product; if the calculation result is between 0.8 and 1.25, the competitive advantage of the product is average. If the calculation result is between 0.8 and 1.25, the product has a general competitive advantage, which can only be considered as medium level; if the calculation result is less than 0.8, the product category has only a weak competitive advantage.

2.3. Intra-Industry Trade IIT (IIT)

The intra-industry trade index allows for an indirect assessment of the degree of competition and complementarity between products through the calculation of intra-industry trade indicators, and here we choose the Grubel-Lloyd index, also known as the G-L index, with the formula:

$$T = 1 - |X - M| / (X + M) \quad (3)$$

In the formula, X and M indicate the export and import value of an industry or a certain type of goods, and $X - M$ should take the absolute value. The value of T is in the range of $[0, 1]$, when $T = 0$, it indicates that this industry only inter-industry trade; when $T = 1$, it indicates that the degree of intra-industry trade in a certain industry is the largest.^[2]

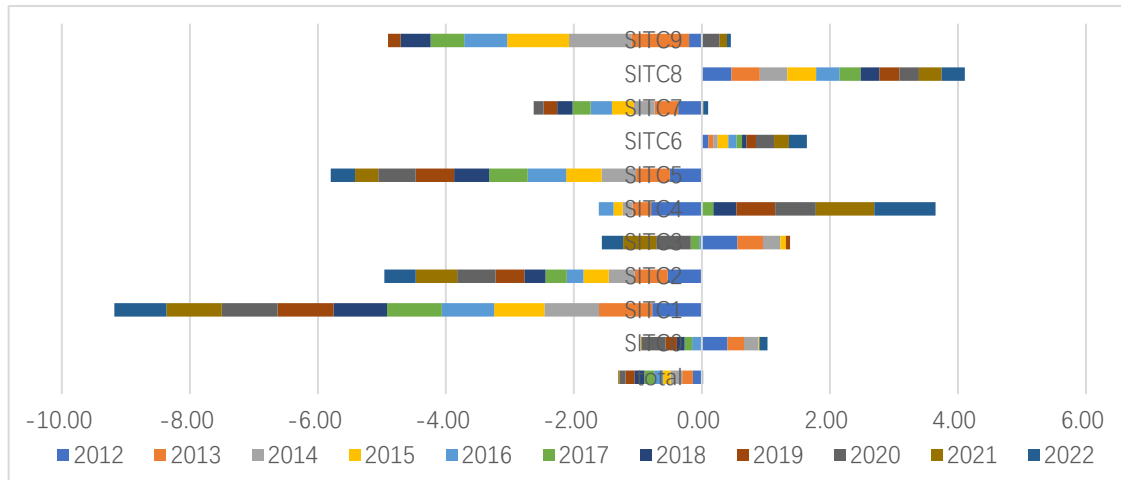
3. Empirical analysis and results of the commodity structure of bilateral trade between China and Germany

3.1. Trade competitiveness index

According to the formula 1 of the trade competitiveness index (RCA), China's export competitiveness index to Germany is shown as Figure 1:

From Figure 1, it can be seen that: first, on the whole, the trade competitiveness indices of China's exports to Germany are negative except for 0.02 in 2022, indicating that China's competitiveness relative to Germany is low. Second, according to the results of the primary products index, the competitiveness indices of SITC0, SITC3 and SITC4 for China's exports to Germany are relatively high, while SITC3 shows an overall decreasing trend, indicating a gradual weakening of competitiveness. In contrast, the trade competitiveness index of SITC4 commodities is rising and gradually converging to 1, indicating that its competitiveness is gradually increasing. Among primary products, the competitiveness indices of SITC1 and SITC2 are both negative in the past 10 years, showing a decreasing trend of trade competitiveness compared with 2001-2012, and have been showing weaker competitiveness in recent years. Third, from the index results of manufactured goods, China's exports to Germany mainly belong to the SITC6 and SITC8 categories, which are highly competitive labor-intensive goods. Fourth, from the results of the index of capital- and technology-intensive goods, the index of SITC5 has been consistently

negative, with low competitiveness; whereas the index of the SITC7 category of goods, which was negative from 2012 to 2020, reverses the situation and turns negative to positive in 2021 and 2022, and trade competitiveness is gradually increasing.

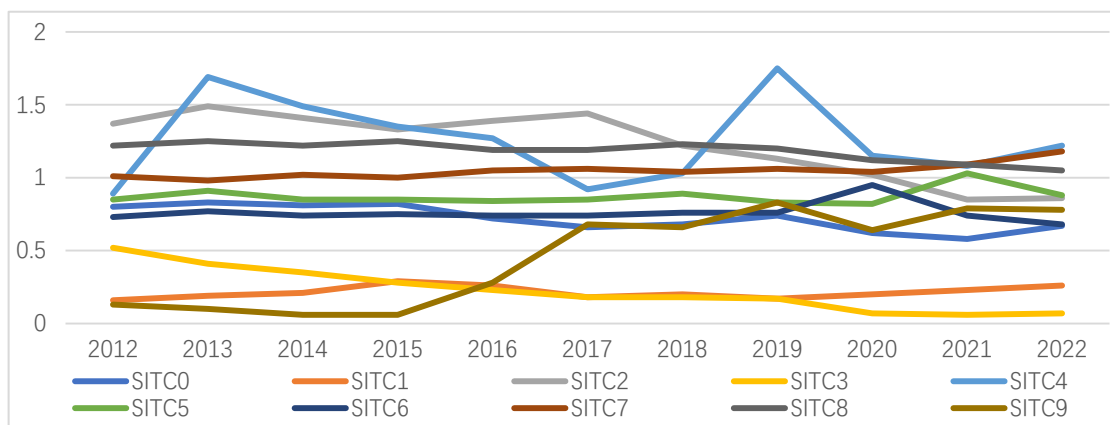


Source: UN Comtrade database

Figure 1: Stacked Bar Chart of China's Trade Competitiveness Index for Exports to Germany, 2012-2022

In the author's view, the trade competitiveness of China and Germany is very different, China is still in the low-end industrial manufactured goods industry, the competitive advantage is more obvious, exports are still dominated by labor-intensive products; while Germany, as a strong development of the world's capitalist countries, its higher level of technology, the export structure of the core competitiveness of technological superiority, non-substitutability is strong, and the product value-added is high. This difference is determined by China's early comparative advantages and factor endowments, which put China in the position of the world's factory, sending labor-intensive products to other big countries in the world. Although China has committed itself to industrial upgrading, the development of science and technology and the promotion of innovative industries, there is still a gap with the competitiveness of Germany's capital-technology industries.^[3]

3.2. Indicative comparative advantage index



Source: UN Comtrade database

Figure 2: Trend of Indicative Comparative Advantage Index of Chinese and German Export Commodities, 2012-2022

The comparative advantage index of China's exports to Germany for various types of goods from 2012 to 2022, can be included as follows: firstly, in terms of the overall results of the primary product index, the comparative advantage of China's exports to Germany is weak, and the index value of the rest of the products is basically lower than 0.8 except for the products of the categories of SITC2, SITC4; secondly, from the point of view of the labor-intensive products of manufactured goods, the comparative advantage index of the categories of goods of SITC6 category of goods always fluctuates around 0.8, and

the comparative advantages of labor-intensive products of SITC8 are all kept between 1-1.25, which indicates that this type of products have general competitive advantages; secondly, from the viewpoint of labor-intensive products in manufactured goods, the comparative advantage index of labor-intensive products of SITC8 basically stays between 1-1.25, which indicates that this type of product has a general competitive advantage. Finally, from the results of the index for capital- and technology-intensive goods, the comparative advantages of both SITC5 and SITC7 are at an average level, but in comparison, the comparative advantage of SITC5 is greater than that of goods in the SITC category.^[4]

Figure 2, we can visualize the difference in comparative advantage of different kinds of goods during the 10-year period, as well as the trend of the change in the comparative advantage of different kinds of goods during the 10-year period.

It is clear that the most comparative advantage in each commodity category is for SITC4 commodities, which, despite fluctuations from year to year, has the strongest comparative advantage in general. In the category of manufactured goods, both SITC7 and SITC8 are more competitive and have stable indicators over the last 10 years and are also in a period of steady increase.

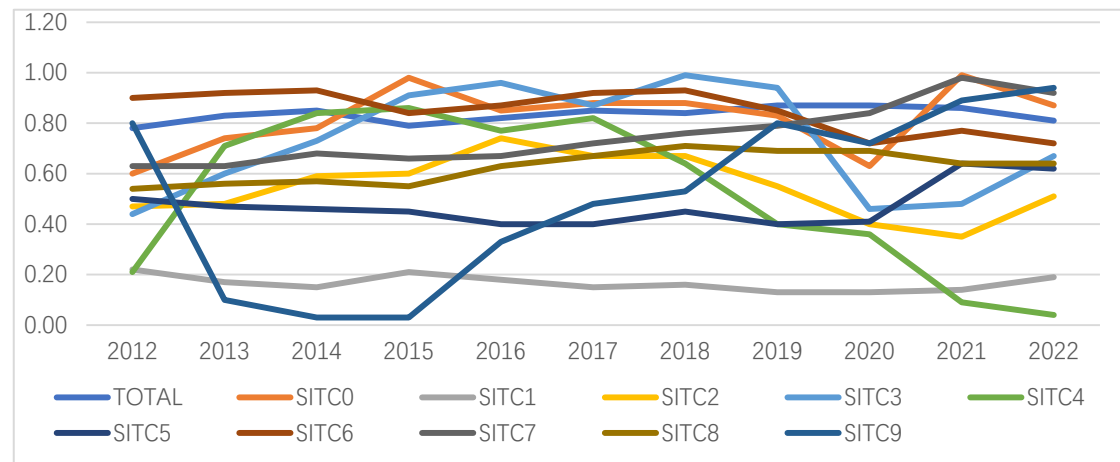
From the above analysis, it can be seen that: firstly, at present, the trade between China and Germany China has a strong comparative advantage in the production of primary products, which is consistent with the reality of China's production of primary products of natural and human resources in abundance, but its comparative advantage is also gradually weakened, and the comparative advantage of some categories of commodities is even very weak, which is also related to the industrial upgrading of China, and no longer focusing on the production of low-value-added primary products. This is also related to China's industrial upgrading, no longer producing low value-added primary products. Second, China still has a strong comparative advantage in the production of labor-intensive products, but this advantage is gradually weakening over time; nevertheless, labor-intensive commodities are still the backbone of China's comparative advantage. Third, China's comparative advantage in capital- and technology-intensive commodities has gradually increased and is expected to increase further.^[5]

In the author's view, it is mainly the following factors that have led to the relevant features concerning the comparative advantages of the export commodities of China and Germany: the first is that in the past 10 years, China has been pushing forward industrial upgrading, and the proportion of capital and technology-intensive commodities in exports has been on the rise, which has also gradually promoted the adjustment of changes in the structure of China's and Germany's export structure, which in turn has increased the value-added of China's and Germany's exports, and at the same time has improved the competitiveness of China's exports. Because China and Germany have great differences in factor endowments, they have strong complementarity, and such convergent development will inevitably result in the improvement of the competitiveness of some products. Thirdly, German direct investment in China has made a positive contribution to the optimization of the bilateral trade structure between Germany and China. Through the trade creation effect, it promotes the upgrading of China's trade and industrial structure, brings advanced technology and management experience to the development of Chinese enterprises, indirectly promotes the growth and upgrading of Chinese enterprises, taps their potential advantages, and pushes forward the development of Sino-German bilateral trade.^[6]

3.3. Intra-industry trade index

From Figure 3, we can see that: firstly, on the whole, the total amount of import and export of China-Germany bilateral trade is dominated by intra-industry trade, and the analyzed results of TOTAL column are all over 0.5, and basically keep fluctuating around 0.8, and have been kept over 0.8 in the past 7 years. Secondly, from the analysis of the index results of primary products, the intra-industry trade index of SITC0 commodities is closer to 1, and its intra-industry trade is deeper; while the value of SITC1 is basically lower than 0.5, which can be seen that the degree of its intra-industry trade is lower, and it is more mainly manifested in the stronger level of inter-industry trade; the results of the indexes of SITC2 and SITC4 are higher in some years, reaching 0.7-0.8 SITC2 and SITC4 in some years the index results are higher, reaching 0.7-0.8, but most years are hovering around 0.5, which can be seen that the degree of intra-industry trade is general; but the value of SITC3 intra-industry trade index is basically greater than 0.5, and most years are 0.8-0.9, which can be seen from the fact that it has a high degree of intra-industry trade. Third, from the analysis of manufactured goods, the overall degree of intra-industry trade of manufactured goods is higher than that of primary products, and the degree of intra-industry trade of labor-intensive products is higher than that of capital- and technology-intensive products. For labor-intensive products SITC8, its intra-industry trade level is not less than 0.54, indicating that it has high competitiveness in terms of the degree of intra-industry trade; the degree of intra-industry trade of

SITC6 commodities is not less than 0.72, and in most years it is around 0.9, which is a very high level of intra-industry trade, reflecting the high level of intra-industry trade between China and Germany in labor-intensive commodities. This reflects the high level of intra-industry trade in labor-intensive goods between China and Germany.



Source: UN Comtrade database

Figure 3: Line graph of the change in the intra-industry trade index of China's exports of goods to Germany, 2012-2022

The author believes that the main reason is because of the following three major factors, which led to the rapid development of intra-industry trade between China and Germany: First, with the increase in the average income level of the people of China and Germany, the overlap of its needs to expand, which brings about the diversification of consumer demand of the two countries objectively prompted the development of the two countries of the differentiated products, and according to the theory of economies of scale and intra-industry trade theory, only the development of intra-industry trade. In order to meet the manufacturers to reduce costs and consumer demand for product diversity. Secondly, with the increase of economic and trade exchanges between the two countries, mutual investment between them is also increasing, and multinational corporations of the two countries have gradually become the backbone of bilateral trade between the two countries, and at the same time, through the multinational corporations of the two countries on the trade of commodities in various links of the industrial chain, also expanding the field of intra-industry trade between China and Germany. Thirdly, in the past 10 years, China's government has been promoting industrial upgrading, gradually transforming from "Made in China" to "Made in China", gradually shifting from the trade of traditional primary products to the trade of manufactured products, and upgrading the capital-intensity of China's production to cope with the gradual disappearance of the demographic dividend as well as the gradual increase of primary product industries. The demographic dividend is gradually disappearing and the primary products and labor-intensive industries are gradually shifting to Southeast Asia.^[7]

4. Conclusion

Bilateral trade between China and Germany is concentrated in capital- or technology-intensive products and labor-intensive products in SITC Category VII Machinery and Transportation Equipment and Category VIII Miscellaneous Manufactured Goods, which account for a significantly higher share of trade than other categories of products.

In the international market, the competitiveness of our primary products and labor-intensive products is on a declining trend, while the competitiveness of capital- and technology-intensive goods is increasing. SITC products 7 and 8 have the strongest complementarity, but their complementarity is also generally declining. Both inter-industry and intra-industry trade are important in Sino-German bilateral trade; however, intra-industry trade in capital- or technology-intensive goods is increasing in all subsectors, and the future trend in high-value-added industries will continue to be intra-industry trade.

Overall, the trade potential between China and Germany is large, but the potential has not been fully realized. The trade efficiency of China's exports to Germany still needs to be improved. Germany is more technologically advanced and has a great advantage in capital- or technology-intensive industries. However, China still has room for upward mobility, and the inefficiency of China's exports to Germany is

a more serious constraint on our country, and there is more room to increase trade potential.

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