A study on the trade complementarity and competitiveness of mechanical and electrical products between China and RCEP member countries

TAN Fen

Digital Economy School, Dongguan City University, Dongguan, Guangdong, China 523000

tanfen@dgcu.edu.cn

Abstract. After the official implementation of the RECP agreement, it will provide more import and export cooperation opportunities and development space for China's trade in mechanical and electrical products. Using the UN Comtrade database, this paper collates the trade situation of mechanical and electrical products between China and RCEP member countries from 2012-2021, and conducts an indexical analysis of the trade structure between China and each RCEP member countries. The results show that China's trade in mechanical and electrical products with developed economies such as Japan, South Korea and Singapore is weak and stable in terms of competitive relations and strong in terms of trade complementarities, and has greater trade potential; its trade relations with Philippines, Indonesia, Australia and New Zealand is low in terms of both competitiveness and complementarities. Based on this study, recommendations are made to further promote China's trade in mechanical and electrical products with RCEP countries to improve its quality.

Keywords: RCEP, mechanical and electrical products, trade relations

1 Introduction

Since its official entry into force on 1 January 2022, the Regional Comprehensive Economic Partnership Agreement (RCEP) has become an important contributor to the steady growth of China's trade in goods in terms of total volume. According to relevant data, China's total imports and exports with other RCEP members reached RMB 12.95 trillion in 2022, up 7.5% year-on-year, accounting for 30.8% of China's total foreign trade. ASEAN has become China's top trading partner, with growth rates of more than 30% for Malaysia and Singapore, and more than 20% for Indonesia and Australia, all of which are higher than the overall growth rate of China's foreign trade during the same period; growth rates for Thailand, the Philippines, South Korea and New Zealand also exceed the overall growth rate of China's exports of goods.

At the same time, mechanical and electrical products are an important trading product between China and RCEP member countries, with their import and export accounting for more than 40% of the overall import and export share. However, there are large

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differences between countries in the import and export of mechanical and electrical products. It is of some practical significance to analyze the trade relations between China and the RECP member countries in terms of trade dependence, competition and complementarity. [4]

2 Trade in mechanical and electrical products between China and RCEP member countries

In recent years, the scale of import and export of several products between China and RCEP member countries has been expanding, but the commodity structure and country structure are widely different and too concentrated. Overall, bilateral trade cooperation in mechanical and electrical products is becoming closer and there is more room for development.

In terms of export scale, China's trade in mechanical and electrical products with RCEP member countries has steadily increased from 2012 to 2021, with the total bilateral import and export trade increasing from US$478.999 billion in 2012 to US$735.448 billion in 2021, with an average annual growth rate of 5.35%. Among them, China's trade in electromechanical products to RCEP member countries is mainly export-oriented, with China's total export trade in electromechanical products to RCEP member countries increasing from USD 253.477 billion in 2012 to USD 430.152 billion in 2021, an average annual growth rate of 6.79%. China's imports in electromechanical products from RCEP member countries are relatively low and the growth rate is not high, the total import trade increased from USD 225.521 billion in 2012 to USD 305.296 billion in 2021, with an average annual growth rate of 3.54%. From 2012 to 2021, China's trade in electromechanical products to RCEP member countries has been showing a surplus, and the margin of surplus has been expanding. The bilateral trade surplus rose from US$27.956 billion in 2012 to US$124.857 billion in 2021, an increase of as much as three times.

From the perspective of market distribution, as shown in Table 1, in 2021, ASEAN countries are the main import and export markets for China's electromechanical products with total imports of US$111,178 million and total exports of US$208,114 million, which is the largest trading country for China's electromechanical products in terms of export scale. Japan is the first destination market for China's exports of electromechanical products among RCEP countries, and South Korea is the largest country of origin for China's imports of electromechanical products from RCEP countries. In contrast, China's trade volume of electromechanical products with New Zealand and Australia is very small.

In terms of commodity structure, China's trade in electromechanical products with RCEP member countries is mainly concentrated in Chapter 84 (nuclear reactors, boilers, machines, mechanical apparatus and parts thereof, etc.), Chapter 85 (electric motors, electrical equipment, etc.), while the import and export trade of electromechanical products in Chapter 87 (vehicles and their parts and accessories) and Chapter 90 (precision instruments and equipment, etc.) is relatively small. Chapter 86 (Railway and tramway locomotives, vehicles and parts thereof, etc.), Chapter 88 (Aircraft, spacecraft

and parts thereof) and Chapter 89 (Ships and floating structures) have the lowest import and export values.

Overall, China's trade in electromechanical products with RCEP member countries shows a surplus in 2021 and a slight deficit with Japan (deficit of US$4,919 million), indicating China's strong international competitiveness in electromechanical products and its increasing export capacity in electromechanical products. [2]

Table 1. China's trade in major electromechanical products exported from RCEP member countries, 2021

HS Code	Japan		Korea		Australia		New Zealand		ASEAN	
	Import	Export	Import	Export	Im-port	Export	Im-port	Ex-port	Import	Export
84	377.1	351.73	175.21	183.75	2.1	141.54	0.71	21.55	208.1	618.79
85	299.04	541.03	679.43	510.36	1.92	148.95	0.31	21.6	794.72	1283.70
86	0.62	1.22	0.64	2.04	0.06	4.94	0.002	0.46	0.08	4.84
87	150.79	46.29	15.29	25.84	0.32	37.96	0.02	6.56	26.55	84.74
88	0.26	0.66	0.49	0.29	0.38	0.17	0.01	0.01	8.56	4.36
89	0.01	1.47	0.43	8.54	0.05	0.93	0.009	0.16	0.87	5.82
90	121.44	56.05	110.67	37.23	1.64	13.71	0.76	2.69	72.9	78.89

Data source: UN Comtrade Database

3 Indexical analysis of the trade structure of electromechanical products between China and RCEP member countries

3.1 Trade Indicator Analysis

The Index of Indicated Comparative Advantage is a measure of a country's comparative advantage in a commodity exports as a share of its total export value to the share of total world exports of that commodity, expressed by the formula below:

$$RCA_k = \frac{X_{ik}/X_i}{X_k/X}$$

Where X_{ik} denotes the total amount of China's exports of product k to RCEP member country i (total exports of product j from RCEP member countries to China), and X_i denotes China's total exports to RCEP countries (total exports from RCEP member countries to China), and X_k denotes China's total exports of product k to the world (total exports of product k from RCEP member countries to the world), X denotes total exports of all products from China to the world (total exports of all products from RCEP member countries to the world). [1]

Table 2. Regional RCA indices for China's exports of E&E products to RCEP member countries, 2012-2021

Year	Japan	Korea	ASEAN	Australia	New Zealand
2012	0.28	1.32	1.97	0.07	0.01
2013	0.26	1.28	1.90	0.06	0.01
2014	0.26	1.26	1.88	0.06	0.01
2015	0.23	1.22	1.84	0.05	0.01
2016	0.24	1.21	1.98	0.05	0.01
2017	0.23	1.27	2.04	0.05	0.01
2018	0.22	1.16	1.98	0.05	0.01
2019	0.20	0.97	1.85	0.04	0.01
2020	0.19	0.89	1.81	0.04	0.01
2021	0.17	0.88	1.75	0.03	0.01

Data source: UN Comtrade Database

The Index of Indicative Comparative Advantage can reflect the competitive position of a country's products in world trade. If RCA > 2.5, it indicates that the country's export products are extremely competitive, if 1.25≦RCA≦2.5, it indicates that the country's export products are highly competitive internationally, if 0.8≦RCA≦1.25, it indicates that the country's product exports are moderately competitive internationally, if RCA < 0.8, it indicates that the country product export competitiveness is weak.

Table 2 shows the RCA indices of electromechanical products between China and RCEP member countries during 2012-2021. As can be seen from the table, the RCA indices between China and Japan, Australia and New Zealand are all less than 0.8, indicating that the electromechanical products of these two countries are less competitive in the international market. The RCA index for ASEAN is always greater than 1.25, indicating that the match between China's exports and the trade of imported electromechanical products from RCEP member countries is high, and Chinese electromechanical products have a strong comparative advantage and less resistance to export in the markets of RCEP member countries.

Table 3 lists the RCA indices of RCEP member countries for China's electromechanical products during 2012-2021. As can be seen from the table, Japan's RCA indices for China's electromechanical products are greater than 1.15 during 2012-2019, and in 2020-2021, the RCA indices drop to 0.19 and 0.17 respectively. indicating that Japan's electromechanical products in Chinese market has a strong comparative advantage, due to the impact of the epidemic in 2020-2021, a large fluctuation; similarly, South Korea to China's mechanical and electrical products until 2019 are showing a strong advantage. Australia and New Zealand, on the other hand, have been showing weakness against China in electromechanical products; for ASEAN, it showed a trend of decline before growth. With the continuous promotion of trade relations between China and ASEAN, the competitiveness of trade in electromechanical products has been increasing.

Table 3. Regional RCA indices for exports of E&E products from RCEP member countries to China, 2012-2021

Year	Japan	Korea	ASEAN	Australia	New Zealand
2012	1.18	1.19	1.58	0.02	0.04
2013	1.15	1.06	1.12	0.01	0.01
2014	1.21	1.11	0.84	0.01	0.01
2015	1.17	1.15	0.85	0.02	0.02
2016	1.19	1.07	0.84	0.02	0.02
2017	1.18	1.26	0.81	0.01	0.01
2018	1.18	1.25	0.79	0.01	0.01
2019	1.17	1.20	0.77	0.01	0.01
2020	0.19	0.89	1.81	0.04	0.01
2021	0.17	0.88	1.75	0.03	0.01

Data source: UN Comtrade Database

3.2 Export similarity analysis

The export similarity index is mainly used to measure the economic structural characteristics or commodity competition relationship between two countries, with a value ranging from 0 to 100，it is expressed by the formula below:

$$\mathrm{ESI}(ij,w)=\left\{\sum_{k}\frac{\frac{X_{iw}^{k}}{X_{iw}}+\frac{X_{jw}^{k}}{X_{jw}}}{2}*\left(1-\left|\frac{\frac{X_{iw}^{k}}{X_{iw}}-\frac{X_{jw}^{k}}{X_{jw}}}{\frac{X_{iw}^{k}}{X_{iw}}+\frac{X_{jw}^{k}}{X_{jw}}}\right|\right)\right\}*100$$

Respectively, X_{iw}^{k} and X_{jw}^{k}denotes the total exports of category k products (in this case, electromechanical products) from China and RCEP member countries to market w; X_{iw} and X_{jw} denote the total amount of all products exported by China and RCEP member countries to third country w markets, respectively. In general, the ESI index ranges from 0 to 100, and the larger the value, the more specialized China and RCEP member countries are in the third-party w market and the more moderate the competition; conversely, the more similar the commodity structure of China and RCEP member countries in the w market, the more intense the competition between the two countries. [1]

Table 4. ESJ index for exports of E&E products from China and RCEP member countries to the US, 2012-2021

Year	Japan	Korea	Australia	New Zealand	Singapore
2012	52.47	52.69	31.21	16.88	52.59
2013	52.12	51.82	39.44	17.10	52.31
2014	52.79	52.83	31.06	15.51	52.90
2015	50.64	50.16	30.80	15.81	50.43

2016	51.75	51.53	33.68	16.57	50.65
2017	52.72	52.90	34.72	16.98	52.97
2018	53.62	53.45	32.61	17.37	53.42
2019	52.77	52.26	32.29	18.41	52.74
2020	52.19	52.03	21.88	24.02	51.80
2021	49.79	49.93	28.63	21.40	49.87

Data source: UN Comtrade Database

In this paper, the US market is chosen as the reference object. As can be seen from Tables 4 and 5, the ESJ indices of Japan, Korea, Singapore, Thailand, the Philippines and Malaysia all exceed 50, indicating that China is more competitive with these countries in the US market; while the indices of Vietnam, Indonesia and the four ASEAN countries (Laos, Cambodia, Brunei and Myanmar combined) are lower, indicating that China is hardly competitive with these countries in terms of exports of electromechanical products. There is little competition between China and these countries in terms of exports of E&E products. It is worth noting that the ESJ index for Vietnam's exports of E&E products to the US has increased in recent years, indicating an upward trend in its competitiveness with China's E&E products.

Table 5. ESJ index for exports of E&E products from China and RCEP member countries to the US, 2012-2021

Year	Thailand	Philippines	Vietnam	Indonesia	Malaysia	Four other Countries
2012	48.18	52.57	13.64	12.90	52.60	1.44
2013	51.40	52.24	16.28	12.37	52.07	1.01
2014	52.66	52.98	12.19	12.80	52.83	0.30
2015	50.36	50.62	16.87	12.74	50.43	2.60
2016	51.66	51.68	27.27	12.95	51.68	1.44
2017	53.21	52.92	27.17	10.96	53.01	1.14
2018	52.51	53.14	27.68	9.11	53.43	2.32
2019	46.56	52.43	35.81	11.15	52.46	1.26
2020	52.13	51.99	43.91	15.39	51.92	2.73
2021	50.12	49.93	28.63	21.40	49.93	49.87

Data source: UN Comtrade Database

3.3 Trade complementarity analysis

The Trade Complementarity Index measures the complementarity of a product between two countries, it is expressed by the below formula:

$$C_k = RCA_{xik} * RCA_{mjk}$$

$$RCA_{xik} = \frac{X_{ik}/X_i}{W_{xk}/W_X}$$

$$RCA_{mjk} = \frac{M_{jk}/M_j}{W_{mk}/W_m}$$

RCA_{xik}denotes the demonstrated comparative advantage of exports of product k (in this paper, electromechanical products) from country i, and RCA_{mjk} denotes the demonstrated comparative disadvantage of imports of category k products (hereinafter referred to as electromechanical products) in country j. X_{ik} and X_i denote the total amount of all exports of category k products from China (RCEP member countries) and the total amount of all exports of products from China (RCEP member countries), respectively. W_{xk} and W_X denote the total amount of world exports of category k products and the total amount of world exports of all products respectively. M_{jk} and M_j denote total imports of category k products by China (RCEP member country) and total imports of all products by China (RCEP member country) respectively. W_{mk} and W_m denote total world imports of category k products and total world imports of all products respectively. [3]

Trade complementarity index greater than 1, i.e. $RCA_{xik}*RCA_{mjk}$ is greater than 1, then China has a comparative advantage over RCEP countries in electromechanical products, indicating that China's trade in electromechanical products with RCEP countries is more complementary; if $RCA_{xik}*RCA_{mjk}$ value is between 0 and 1, it indicates that China's trade in E&E products with RCEP member countries is not complementary.

As can be seen from Tables 6 and 7, China's trade in electromechanical products is most complementary to Japan, Korea and Singapore, the $RCA_{xik}*RCA_{mjk}$ values are all greater than 1; with Australia, New Zealand, Indonesia and the four ASEAN countries (Laos, Cambodia, Brunei and Myanmar) $RCA_{xik}*RCA_{mjk}$ with Australia, New Zealand, Indonesia and the four ASEAN countries (Laos, Cambodia, Brunei and Myanmar), the value is less than 0.1, indicating that the two sides do not have complementarity in electromechanical products; while trade with Thailand, the Philippines and Malaysia is more complementary, if $RCA_{xik}*RCA_{mjk}$ value is close to 1, with the TCI value with Vietnam being greater than 1 in 2020-2021, indicating the increasing complementarity of trade in E&E products between the two countries.

Table 6. Trade complementarities between China and selected RCEP member countries, 2012-2021

Year	Japan	Korea	Australia	New Zealand	Singapore
2012	1.04	1.24	0.02	0.02	1.14
2013	1.05	1.36	0.01	0.01	1.04
2014	1.17	1.40	0.02	0.02	0.99
2015	1.12	1.47	0.02	0.02	1.01

2016	1.13	1.35	0.02	0.02	1.02
2017	1.11	1.28	0.02	0.01	0.89
2018	1.09	1.26	0.01	0.01	0.80
2019	1.09	1.23	0.01	0.01	0.86
2020	1.05	1.18	0.01	0.01	1.02
2021	1.04	1.13	0.01	0.01	1.14

Data source: UN Comtrade Database

Table 7. Trade complementarities between China and selected RCEP member countries, 2012-2021

Year	Thailand	Philippines	Vietnam	Indonesia	Malaysia	Four other Countries
2012	0.60	1.32	0.27	0.05	0.84	0.03
2013	0.43	0.77	0.36	0.04	0.71	0.01
2014	0.48	0.76	0.43	0.05	0.86	0.01
2015	0.58	0.91	0.47	0.06	0.79	0.02
2016	0.63	0.85	0.55	0.05	0.82	0.03
2017	0.60	0.80	0.84	0.05	0.82	0.02
2018	0.53	0.83	0.87	0.04	0.86	0.02
2019	0.50	0.85	0.96	0.04	0.79	0.03
2020	0.53	0.79	1.09	0.04	0.80	0.02
2021	0.45	0.68	1.15	0.03	0.77	0.02

Data source: UN Comtrade Database

4 Conclusions and Recommendations

4.1 Conclusion

In general, China's trade with RCEP member countries of electromechanical products accounts for a large part of the total trade volume among all the RCEP countries. China's exports of electromechanical products are mainly electrical machinery and equipment, railway transport equipment, aircraft etc. While imports of electromechanical products from RCEP member countries are mainly computers and their parts, auto parts, digital cameras, etc. Among them, the scale of trade between China and traditional industrial powerhouses such as Japan and South Korea is large, while the scale of trade with ASEAN countries is also on a year-on-year growth trend.

Both China and the RCEP countries have strong comparative advantages in electromechanical products, but there is still a large gap between the international competitiveness of China's electromechanical products and some developed countries, such as Japan, South Korea and Singapore. At the same time, there are complementarities in China's trade in electromechanical products with these countries, and there is greater trade potential.

4.2 Recommendations

In recent years, the competitiveness of China's electromechanical products has been increasing, especially as the country vigorously supports the export of high-tech products. In order to promote the stable development of trade in electromechanical products between China and RCEP member countries, China needs to build on its own advantages, improve the investment environment and promote the transformation and upgrading of the electromechanical industry.

First, give full play to its comparative advantages and seek industrial upgrading. As the largest developing country, China has a large workforce and a comparative advantage in the international division of labor. Therefore, it should give full play to its comparative advantage in labor force and base on labor-intensive segments. On this basis, industrial development should be carried out according to the regional economic situation in the country. For the central and western regions, labor-intensive electromechanical products should continue to be developed; for the economically developed eastern regions, technology and capital-intensive industries can be vigorously developed, so that the country will eventually move towards a high-tech industrial structure.

Second, promote the transformation of direct investment and improve the direct investment environment. The development of China's industries needs the support of foreign direct investment in terms of capital, technology and management. China should attract investment in Chinese electromechanical products from countries such as Japan, South Korea and Singapore, and should actively introduce advanced foreign technology and management methods to promote foreign development towards horizontally integrated investment. At the same time, corresponding laws, regulations and policies need to be improved and the quality and technology of foreign investment introduced should be strictly controlled. Infrastructure development can also be strengthened to make transportation and communication, etc. more convenient to facilitate the introduction of high-quality foreign investment.

Third, adjust industrial structure and improve non-price competitiveness. The low prices of low value-added labor-intensive products exported by China to Japan will lead Japan to use anti-dumping investigations against China. Therefore, it is not a long-term solution for China to use price advantage to improve the export of electromechanical products. [5] Firstly, we should focus on market research and fully understand the needs of local consumers as well as the local cultural, economic and political environment. The second is to create competitive advantages by providing added value, for example, attractive product advertising, appropriate distribution channels and other sales conditions, perfect after-sales service, etc. Thirdly, it is necessary to improve the capacity for independent innovation. Science is without borders, but technology has borders, and core technology limits a country's scientific and technological development. As a catching-up country, China can only rely on its own core technology to develop, and only by innovation can it surpasses. Under the premise of respecting the intellectual property rights of other companies, cooperation and re-innovation will be developed to form electromechanical products with Chinese characteristics.

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