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Study on the Influence Factors and Potential of China's Export of Mechanical and Electrical Products to Brics Countries

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Abstract
Based on the panel data of China's export trade of mechanical and electrical products to other BRICS countries from 2011 to 2023, this paper empirically analyzes the factors affecting China's export of mechanical and electrical products to BRICS countries by constructing an extended gravity model, and studies the trade potential of China's export of mechanical and electrical products to these countries. The empirical results show that the GDP of China, the GDP of the importing country, the direct investment in China and the preferential trade system arrangement between the trading countries have a significant positive impact on China's export of mechanical and electrical products to other BRICS countries, while the geographical distance between the two countries and the landlocked country of the importing country have a negative impact. The analysis results of trade potential between China and BRICS countries show that China and other BRICS countries still have great potential in the trade of mechanical and electrical products, and can further explore the development space of trade. Finally, based on the results of model analysis, this paper puts forward some suggestions on promoting China's export of mechanical and electrical products to BRICS countries.

Keywords: BRICS countries, Mechanical and electrical products, Extended gravity model, Trade potential

1. Introduction

In recent years, under the background of complex and severe global economic and trade situation, the internal trend of high-quality development of China's foreign trade of mechanical and electrical products has not changed, and the export growth trend of mechanical and electrical products is obvious. According to the data of China's Ministry of Commerce, China's mechanical and electrical products have been the largest export category in China for 16 consecutive years, accounting for 60% of China's total foreign trade, and the total export has risen to the first place in the world. China's mechanical and electrical products export market to the United States, Hong Kong, Japan, South Korea, of which the United States occupied the largest market share, became China's largest export market for mechanical and electrical products, accounting for about 15% of China's total exports of mechanical and electrical products, but in 2023, China's mechanical and electrical products to the United States decreased 13.8% year-on-year. While exports to other emerging market countries, including BRICS countries, are rising year by year, these emerging market countries on the demand for mechanical and electrical products continues to expand, the market potential can not be underestimated. The United States Goldman Sachs introduced the concept of "BRICS" in 2001, which is derived from the English initials of the four emerging economies of Brazil, Russia, India and China. In 2011, South Africa officially joined the BRICS, and the English name was changed to BRICS. On January 1, 2024, Saudi Arabia, Egypt, the United Arab Emirates (hereinafter referred to as the "UAE"), Iran and Ethiopia became full members of BRICS, bringing the number of BRICS members to 10. According to customs statistics, in the first quarter of this year, China's import and export to the other nine BRICS countries totaled 1.49 trillion yuan, an increase of 11.3% year-on-year, accounting for 14.7% of China's total import and export value. The BRICS countries account for about 20 percent of the world's global trade in goods, but their trade with each other only accounts for 10percent of their respective total foreign trade, indicating that the market is not yet saturated and still has great potential for trade growth. As representatives of emerging markets, BRICS countries, with their

increasingly close trade exchanges, have provided a good opportunity for China to further tap the export market of mechanical and electrical products, especially to the BRICS markets. In this context, it is particularly necessary to make an in-depth analysis of the factors affecting China's export of mechanical and electrical products to BRICS countries and their trade potential. Therefore, this paper uses the extended gravity model to analyze the influencing factors and trade potential of China's export trade of mechanical and electrical products to BRICS countries, and draws relevant conclusions based on this, and provides suggestions for releasing the export potential of China's mechanical and electrical products and enhancing its international competitiveness.

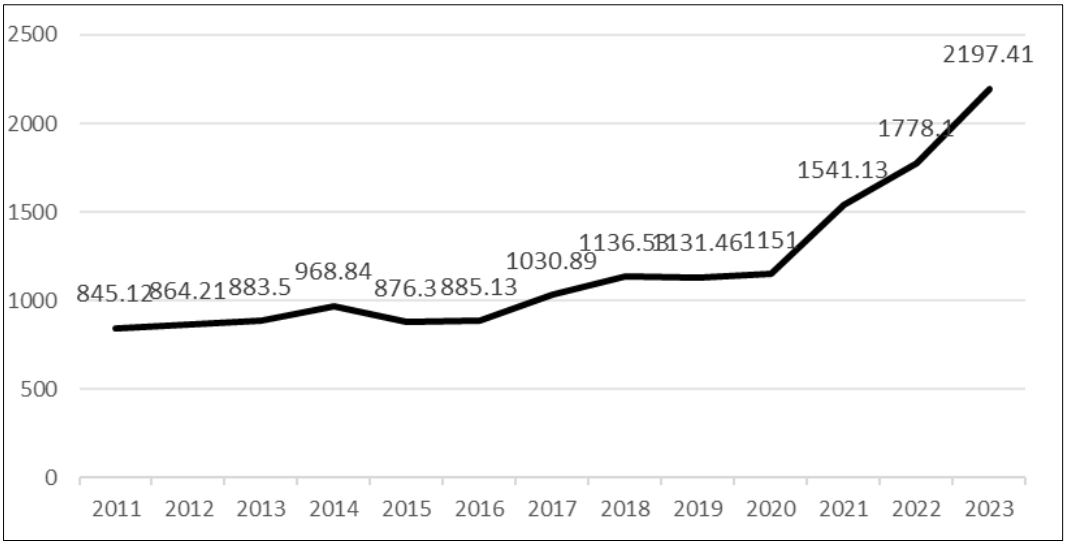
2. Literature Review

In recent years, the export volume of China's mechanical and electrical products has accounted for an increasing proportion of China's total foreign trade exports, which has attracted extensive attention from many domestic scholars. Many scholars have used the extended trade gravity model to make an empirical analysis of the influencing factors and potential of China's export of mechanical and electrical products. Zhang Zhibin and Chen Zhuo (2023) [1] analyzed the current situation of China's export of mechanical and electrical products to countries along the Belt and Road, and empirically studied the influencing factors and export potential of China's export of mechanical and electrical products to countries along the Belt and Road through the extended gravity model. Huang Hong and Chen Jun (2023) [2]selected the export trade data of China's mechanical and electrical products from 2012 to 2021, and used two empirical methods, the extended gravity model and the GTAP model, to analyze the factors affecting China's export trade of mechanical and electrical products to RCEP member countries and the trade potential of both sides. Zhe Ru and Wang Chuying (2020) [3] Based on the panel data of China's export volume of mechanical and electrical products to ASEAN countries from 2010 to 2018, empirically analyzed the factors affecting China's export of mechanical and electrical products to ASEAN countries through the trade gravity model, and calculated the trade potential of China's export of mechanical and electrical products to ASEAN countries on this basis. Focusing on the research of electromechanical products between China and BRICS countries, Based on the HS 6-digit code of UN Comtrade database, Yang Fengmian and Wu Mengyi (2019) [4] used the trade data of electromechanical products between China and other BRICS countries from 2001 to 2017 to empirically analyze the competitive situation of China's electromechanical products in the target market through the export similarity index. Through the trade integration index, the closeness of China's trade with other BRICS countries was measured; Through the static and dynamic intra-industry trade index and trade complementarity index, the paper examines the trade complementarity between China and other "BRICS" electromechanical products. However, existing literature lacks research on the influencing factors and trade potential of China's export of electromechanical products to other BRICS countries. Based on this, this paper uses panel data of China and other BRICS countries from 2011 to 2023, and constructs an extended gravity model to analyze the influencing factors of China's export of electromechanical products to other BRICS countries. On this basis, To estimate China's export trade potential to other BRICS countries. Finally, according to the research conclusions, this 即 paper puts forward some countermeasures to promote the export of China's mechanical and electrical products to other BRICS countries.

3. Current situation of China's export of mechanical and electrical products to other BRICS countries.

1. General situation of China's export of mechanical and electrical products to other BRICS countries

   Figure 1 shows that in 2011, China's export volume of mechanical and electrical products to other BRICS countries was 84.512 billion US dollars, and in 2023, its export volume increased by 1.6 times to 219.741 billion US dollars, with an average annual growth rate of 8.3%. From 2011 to 2016, China's export volume of mechanical and electrical products to other BRICS countries remained at around 90 billion US dollars. In 2017, China assumed the rotating presidency of BRICS and successfully hosted the BRICS Summit. China and other BRICS countries agreed to establish a closer, broader and more comprehensive strategic cooperative partnership. From 2017 to 2023, China's exports of mechanical and electrical products to the other BRICS countries have increased rapidly, from 103.089 billion US dollars in 2017 to 219.741 billion US dollars in 2023, with an average annual growth rate of 13.4 percent.



Source: Calculated based on UN Comtrade Datebase (SITC, Rev3) data.

Fig 1: China's export volume of Mechanical and electrical products to other BRICS countries, 2011-2023 (unit: USD billion)

In terms of BRICS countries, from 2011 to 2023, China's exports of mechanical and electrical products to the other eight BRICS countries except Iran showed an overall growth trend. Among them, Russia is the BRICS country with the largest growth rate. In 2011, China's export value of mechanical and electrical products to Russia was 14.826 billion US dollars, and in 2023, the export value reached 65.407 billion US dollars, an increase of 4.4 times. From the point of view of the concentration of export market distribution, China's export market of mechanical and electrical products to other BRICS countries is mainly distributed in India, Russia, Brazil, the United Arab Emirates and Saudi Arabia, with exports of more than 100 billion US dollars. In 2023, China's exports of mechanical and electrical products to these five countries account for 89% of China's total exports of mechanical and electrical products to other BRICS countries. From the perspective of average annual growth rate, the average annual growth rate of China's exports of mechanical and electrical products to Russia and Saudi Arabia is higher, both of which are more than 10%, respectively 13.2% and 11.2%. The average annual growth rate of China's exports to Russia, Saudi Arabia and the United Arab Emirates was higher than that of China's total exports to other BRICS countries (8.3%). The average annual growth rate of China's export to other BRICS countries was lower than that of China's export to other BRICS countries (8.3%), among which, the average annual growth rate of China's export of mechanical and electrical products to Iran showed a negative growth rate of -1.1%.

On the whole, China's export volume of mechanical and electrical products to other BRICS countries shows a good development trend, but the export potential of China to other countries is different.

2. Analysis of China's export structure of mechanical and electrical products to other BRICS countries

In accordance with the commodity classification standard of SITC (Rev.3), the code of mechanical and electrical products is 71-79. There are nine categories: 71 is power generation machinery and equipment; 72 category is special industry special machinery; 73 is metal processing machinery; Class 74 is general industrial machinery and equipment and machine parts; Class 75 is office machines and automatic data processing machines; Category 76 is telecommunications, sound recording and reproduction equipment; Class 77 is electrical machinery, instruments and appliances and their electrical components; Class 78 are road vehicles; Class 79 is other transport equipment. As shown in Table 1, China's exports of various mechanical and electrical products to BRICS countries during 2011-2023 show significant differences. The export categories of electromechanical products are mainly concentrated in electrical machinery, instruments and electrical parts (77), telecommunications, recording and reproduction equipment (76), general industrial machinery and equipment and machine parts (74), and road vehicles (78), accounting for about 73% of China's total exports of mechanical and electrical products to other BRICS countries. The export volume of the nine categories of mechanical and electrical products showed an upward trend. Among them, electrical machinery, instruments and appliances and their electrical parts (77) category of mechanical and electrical products increased the most, with an increase of 34.061 billion US dollars, rising from 16.175 billion US dollars in 2011 to 54.35 billion US dollars in 2023, about 2.36 times; Followed by road vehicle mechanical and electrical products, an increase of about 4.05 times; The two categories of mechanical and electrical products with the smallest growth rate were 71 and 79 categories of mechanical and electrical products, which increased by 951 million US dollars and 771 million US dollars respectively.

Table 1: Trade volume of various types of mechanical and electrical products exported from China to BRICS countries, 2011-2023 (unit: USD 100 million)

	71	72	73	74	75	76	77	78	79
2011	75.01	66.19	15.22	136.12	107.20	173.96	161.75	84.15	25.53
2012	57.04	67.20	15.47	141.21	126.01	173.22	162.84	89.83	31.40
2013	55.81	70.80	14.18	145.84	119.79	182.68	186.19	83.96	24.25
2014	53.62	75.36	15.18	164.71	118.11	231.02	194.24	98.62	17.97
2015	46.71	63.47	12.50	150.11	98.70	215.36	181.55	82.58	25.31
2016	44.10	64.58	11.27	163.04	83.55	234.50	186.05	77.48	20.57
2017	43.25	69.63	13.08	167.32	104.07	296.67	232.11	90.54	14.21
2018	45.27	74.04	15.93	166.04	114.63	317.48	260.04	98.60	44.50
2019	45.54	81.08	18.25	171.83	118.79	296.48	267.37	89.83	42.28
2020	48.19	79.83	16.93	175.93	132.63	315.58	265.70	100.63	15.56
2021	64.13	110.44	22.55	230.57	188.48	350.41	402.51	156.39	15.65
2022	69.70	153.60	29.12	257.26	193.71	350.73	480.21	230.25	13.52
2023	84.52	184.94	46.29	315.35	183.78	381.33	543.50	424.76	32.94

Source: Calculated based on UN Comtrade Database (SITC, Rev3) data collation.

From the perspective of the structure of mechanical and electrical products imported by BRICS countries from China, there are certain differences in the structure of various types of mechanical and electrical products imported from China. In addition to the 75 types of mechanical and electrical products imported by Brazil from China during 2011-2023, the trade volume of other 8 types of mechanical and electrical products has increased, among which the category of electrical machinery, instruments and appliances and electrical parts (77) accounted for the largest proportion of Brazil's imports of mechanical and electrical products from China in 2023, about 36%. In 2011, Ethiopia mainly imported special machinery (72) and road vehicles (78) from China for special industries, while in 2023, it mainly imported general industrial machinery and machine parts (74) and electrical machinery, instruments and appliances and their electrical parts (77). From 2011 to 2023, the electromechanical products imported by Iran from China have always been mainly imported road vehicles (78) electromechanical products, accounting for the largest proportion, metal processing machinery (73) and telecommunications, recording and reproduction equipment (76) electromechanical products imports increased slightly, and other types of electromechanical products have declined. Russia in 2011 electrical machinery, instruments and appliances and their electrical parts (77) this category of

imports is the largest, and in 2023 to road vehicles (78) mainly, accounting for the largest proportion, followed by electrical machinery, instruments and appliances and their electrical parts (77). In 2011, India imported mechanical and electrical products from China mainly in the category of reproduction equipment (76), and in 2023, it mainly in the category of electrical machinery, instruments and electrical par(77); The import structure of Saudi Arabia and South Africa is similar. The largest category of mechanical and electrical products imported by the
UAE from China has changed from office machines and automatic data processing machines (75) in 2011 to reproduction equipment (76) in 2023. The largest category of mechanical and electrical products imported from China by Egypt changed from general industrial machinery and equipment and machine parts in 2011 (74) to electrical machinery, instruments and appliances and their electrical parts in 2023 (77) (see Table2).

Table2: Trade volume of various types of mechanical and electrical products exported from China to BRICS countries, 2011-2023 (unit: USD 100 million)

		71	72	73	74	75	76	77	78	79
Brazil	2011	5.55	10.27	3.12	24.94	17.56	34.83	36.79	15.95	4.20
	2023	9.74	17.59	4.11	44.29	13.29	40.31	100.24	38.77	11.58
Ethiopia	2011	0.62	1.01	0.06	0.50	0.05	0.62	0.91	1.08	0.001
	2023	0.79	1.80	0.16	2.18	0.81	1.76	2.38	1.18	1.18
Iran	2011	6.09	8.71	1.25	11.70	1.14	7.40	11.10	16.42	8.00
	2023	5.66	3.90	1.46	11.46	2.04	5.65	7.65	24.91	0.04
Russia	2011	8.18	14.19	2.68	23.96	22.03	26.94	27.78	20.96	1.55
	2023	26.47	68.92	20.92	95.31	42.28	71.67	98.08	225.99	4.43
Arabia	2011	4.80	3.19	0.67	12.08	2.58	11.39	7.72	5.31	1.23
	2023	3.57	12.65	1.43	28.39	5.74	37.23	41.38	41.13	4.04
India	2011	42.56	19.12	5.47	37.13	26.56	52.11	46.26	9.96	2.67
	2023	18.75	53.53	13.23	75.85	72.36	124.67	194.60	20.77	4.69
South Africa	2011	2.39	3.66	0.77	6.86	7.03	11.94	9.41	4.81	0.27
	2023	5.75	7.35	1.24	11.28	7.80	17.64	46.33	14.65	0.22
United Arab	2011	3.56	4.12	0.95	13.81	29.41	24.96	17.77	5.41	4.37
	2023	10.18	13.58	2.62	35.48	38.02	77.33	39.60	48.83	6.28
Egypt	2011	1.25	1.93	0.25	5.14	0.83	3.78	4.01	4.25	3.24
	2023	3.61	5.62	1.12	11.12	1.44	5.07	13.23	8.54	0.47

From the above analysis, it can be seen that in recent years, the export structure of China's mechanical and electrical products to most BRICS countries is mainly electrical machinery, instruments and appliances and their electrical parts (77). The structure of electromechanical products imported from China by BRICS countries varies to a certain extent and has changed over time. Therefore, it is necessary to conduct a more comprehensive analysis and research on the trade potential of China's export of electromechanical products to BRICS countries.

4. Empirical analysis of export potential of electromechanical products between China and other BRICS countries.

4.1. Selection of variables

This paper mainly analyzes the factors that affect China's export of mechanical and electrical products to BRICS countries. According to the theory of the trade gravity model, the GDP of the importing country and the geographical distance between the importing country and China are the basic variables of the gravity model. On this basis, referring to the studies of Zhang Jingzhong *et al*. (2017) and Ji Wenting *et al*. (2020) [5], the following factors are selected as explanatory variables for analysis:

1. **Gross Domestic product of China and the importing country:** Gross domestic product measures the overall economic scale of a country. As an important part of a country's national economic development, the larger the economic scale of a country, the stronger its economic strength and purchasing power, and the greater the import demand for mechanical and electrical products. As an exporter of mechanical and electrical products, China's economic growth has provided more production resources and financial support for the production of mechanical and electrical products, promoted the production supply of mechanical and electrical products, and expanded the scale of trade to better meet the needs of foreign markets.
2. The geographical distance between China and other BRICS countries: This paper takes the geographical distance between the capital cities of the importing country and the exporting country as a measurement index. The geographical distance has a direct impact on the transportation cost. The farther the geographical distance between two countries, the higher the cost of transporting goods. The high transportation cost will increase the trade cost of mechanical and electrical products, thus reducing the profit space of trade, and then hinder the import and export trade of mechanical and electrical products.
3. **Direct investment in China by importing countries:** direct investment in China is often accompanied by the investment and establishment of factories and manufacturers by multinational companies in China. At the same time, it brings advanced technology and management experience to China, improves the technical content and added value of China's mechanical and electrical products, and can also enhance the international competitiveness of China's mechanical and electrical products, thereby helping to increase the export of mechanical and electrical products.
4. **Does China have preferential trade system arrangements with other BRICS countries?** Preferential trade system arrangements usually involve tariff preferences for all or part of the commodities among the member countries, which can enjoy lower import tariff or duty-free treatment, reduce trade frictions and disputes caused by trade barriers, directly reduce the export cost of China's mechanical and electrical products, and have a positive impact on China's mechanical and electrical products export. This article mainly refers to the funds in the Asia-Pacific Trade

Agreement and the Shanghai Cooperation Organization.

5. Whether the importing country is a landlocked country: Landlocked countries usually do not have direct access to the sea and lack natural port facilities, which may lead to more transit delays when China exports mechanical and electrical products to landlocked countries, reduce logistics efficiency and increase transportation costs, which may lead to the export volume of China's mechanical and electrical products in the landlocked markets. Among the BRICS countries, only Ethiopia is a landlocked country.

4.2 Model setting and data explanation

1. Model Setting

According to the traditional trade gravity model, the trade volume between the two countries is directly proportional to the total economic volume of the two countries and inversely proportional to the distance between the two countries. The basic model is as follows:

$Tab=C(GDPa \times GDPb)/Dab$

Where Tab is the bilateral trade volume between country a (exporter) and country b (importer); C represents a constant; GDPa represents the gross domestic product of country a; GDPb represents the gross domestic product of country b; Dab represents the geographical distance between country a and country b, generally expressed as the distance between the capitals of the two countries. Taking the natural logarithm of the basic gravity model above gives you:

$LnTab = \beta0 + \alpha1LnGDpa + \alpha2LnGDpb + \alpha3LnDIsab + \mu ab$

Where0 β represents the constant term, α, α 1, and2 α represent3 the regression coefficients of the individual variables, and μab represents the random error term.

Based on the selection of the above variables and theoretical analysis, the extended gravitational regression model is established as follows:

$LnETab = \beta0 + \alpha1LnGDpa + \alpha2LnGDpb + \alpha3LnDIsab + \alpha4LnFDIb + GRoupab + Lockb + \mu ab$

Where, a represents China,b represents other BRICS countries; ETab stands for China's exports of mechanical and electrical products to other BRICS countries; GDPa stands for China's gross domestic product; GDPb represents the gross domestic product of the other BRICS countries; DISab represents the geographical distance between China and the other BRICS countries; FDIb refers to direct investment into China by other BRICS countries; GROUPab indicates whether BRICS countries have a dummy variable of preferential trade regime arrangement with China; LOCKb is the dummy variable of whether BRICS countries are landlocked; Beta0 is the constant term; μab is the random error term.

2. Data Description

This paper takes the other 9 BRICS countries except China as sample countries, covering a total of 13 years from 2011 to 2023. The explained variable is the trade volume of China's export of mechanical and electrical products to other BRICS countries, which is derived from UN Comtrade database and classified according to SITC(REV.3) standards. The GDP of China and other BRICS countries is derived from the IMF World Economic Outlook database; The geographical distance between China and other BRICS countries and the relevant data on whether BRICS countries are landlocked come from the French CEPII database; Data on BRICS direct investment in China are obtained from China Statistical Yearbook over the years; The relevant data of APTA and SCO member states are from their respective official websites. The theoretical explanations and expected symbols of the above variables are summarized in Table 3.

Table 3: Theoretical explanations and expected symbols of each explanatory variable

Name of variable	Theory description	Expected symbol
LnGDPa	The larger China's economy, the stronger its production and supply capacity, the more competitive its products, and the larger the scale of its export trade	+
LnGDPb	The larger the economy of the importing country, the stronger its economic strength and purchasing power, and the greater the import demand	+
LnDISa	Geographical distance affects transportation costs and trade efficiency, and the farther the geographical distance between two countries, the lower the transportation efficiency and thehigher the cost, which is not conducive to the import and export trade of mechanical and electrical products	- _
LnFDIb	Direct investment in China will bring the transfer of technology and management experience to China, enhance the international competitiveness of China's mechanical and electrical products,and thus promote the export of China's mechanical and electrical products	+
GROUPab	Through preferential trade system arrangements, China can establish closer trade ties with other BRICS countries, and a series of related preferential treatment helps China's exports of mechanical and electrical products	+
LOCKb	Due to geographical restrictions, landlocked countries have relatively low trade infrastructure and trade facilitation compared with coastal countries, which will increase trade costs and is not conducive to the export of China's mechanical and electrical products	-_

3. Measurement results and analysis

In this study, the panel data of China and other BRICS countries from 2011 to 2023 were adopted, and the Stata17.0 software was used to perform regression analysis on the extended gravity model. Considering the overall characteristics of the sample data and the overall effect of the model, a mixed regression model was adopted. Table 4 shows the model regression results.

Table 4: Regression results of China's export trade of mechanical and electrical products to other BRICS countries

Explanatory variables	Coefficient	Standard Error	T-value	P-value
LnGDPa	0.751 * * *	0.166	4.52	0.000
LnGDPb	0.516 * * *	0.071	7.26	0.000
LnDISab	-0.127	0.095	-1.33	0.186
LnFDIb	0.097 * * *	0.028	3.52	0.001
GROUPab	0.265 * *	0.132	2.01	0.048
LOCKb	0.651 * * *	0.235	-2.77	0.007
Constant term	12.799 * *	5.239	-2.44	0.017

The regression result of the model shows that F value is 65.2, and the regression equation passes F test, which means that all explanatory variables of the model combined have a significant impact on the explained variable as a whole. The revised R2 is 0.803, indicating that the model has a high degree of fitting to the entire sample data, which reflects that the model has a strong explanatory power for the relevant issues of China's electromechanical products export to other BRICS countries. Among the regression results of the model, China's GDP, the GDP of other BRICS countries, the direct investment of other BRICS countries to China, whether other BRICS countries have preferential trade system arrangements with China and whether the importing country is a landlocked country all have an impact on China's export of mechanical and electrical products, but there are differences in the degree of influence of each influencing factor. Specifically, the GDP of China and other BRICS countries, direct investment in China, and whether the importing country is a landlocked country pass the test at the significance level of 1%; Whether BRICS and China have a preferential trade regime arrangement passes the test at a significance level of 5%; The geographical distance between the two countries has a negative impact on China's export trade of mechanical and electrical products, but the impact is not significant. The regression coefficients of explanatory variables were consistent with expectations. The following conclusions can be drawn from the model results.

1. China's GDP and the GDP of other BRICS countries have a great impact on the export trade of China's electromechanical products to BRICS countries. The coefficient of China's GDP is 0.751, that is, when China's GDP increases by 1%, China's export volume of mechanical and electrical products to other BRICS countries will increase by 0.751%; The coefficient of GDP of other BRICS countries is 0.516, that is, for every 1% growth of its GDP, China's export volume of mechanical and electrical products to other BRICS countries will increase by 0.516%.
2. The coefficient of geographical distance between China and other BRICS countries is -0.127, which is in line with the expected sign judgment, but this explanatory variable is not significant. With the rapid development of the world economy and science and technology and the continuous improvement of infrastructure, various transportation systems such as sea transport and railway have gradually matured, and the geographical distance between trading countries has less and less impact on trade.
3. The variable coefficient of BRICS countries' direct investment in China is 0.097, and the significance is high, that is, every 1% increase in importing countries' direct investment in China, the export value of China's mechanical and electrical products to them will increase by 0.097%, indicating that direct investment in China can improve the export competitiveness of China's mechanical and electrical products and drive exports.
4. The coefficient of the GROUP variable is 0.265, which is positive and has high significance, indicating that if other conditions remain unchanged, if China has a preferential trade system arrangement with other BRICS countries, China's export volume of mechanical and electrical products will increase by 0.265%, which is conducive to the increase of China's export volume of mechanical and electrical products.
5. The coefficient of LOCK variable is negative with high significance, indicating that if other factors remain unchanged, if other BRICS countries are landlocked, the export volume of China's mechanical and electrical products to them will decrease by 0.651%, which hinders the export volume of China's mechanical and electrical products.
6. Estimation of the trade potential of mechanical and electrical products between China and other BRICS countries According to the regression results of the above gravity model of trade of mechanical and electrical products between China and other BRICS countries, the theoretical export equation of China's mechanical and electrical products to other BRICS countries can be expanded as follows:
   $LnETab = -12.799 + 0.751LnGDpa + 0.516LnGDpb - 0.127LnDIsab + 0.097LnFDIb + 0.265GRoupab - 0.651Lockb$

According to the research of Liu Qingfeng *et al*. (2002) [7], the formula for calculating the trade potential index is the ratio between the actual trade volume and the theoretical trade volume. The theoretical trade volume of China's export of mechanical and electrical products to other BRICS countries can be obtained by plugging relevant data into the expanded gravity model. Then the trade potential index can be calculated by dividing the actual trade volume of China's export of mechanical and electrical products to other BRICS countries with the theoretical trade volume. According to the research, the trade potential is divided into three types, corresponding to three different trade potential trading partners: when the trade potential index is less than 0.8, it is the type with great potential; When the trade potential index is between 0.8 and 1.2, it is potential pioneering type; When the trade potential index is greater than 1.2, it is potential re-modeling. In this paper, the theoretical value of China's exports of mechanical and electrical products to other BRICS countries in 2022 is calculated, and the ratio of actual exports to theoretical exports is calculated, and relevant data are sorted out, as shown in Table 5.

Table5: Trade potential index and type of China's export of mechanical and electrical products to other BRICS countries

Countries	Trade potential index	Type
Brazil	0.99	Potential Trailblazers
Ethiopia	0.93	Potential trailblazers
Iran	0.96	Potential Trailblazers
Russia	0.98	Potential Trailblazers
Saudi Arabia	0.96	Potential Trailblazers
India	1.01	Potential trailblazers
South Africa	0.97	Potential Trailblazers
UAE	1.01	Potential Trailblazers
Egypt	0.98	Potential Trailblazers

As can be seen from Table 5, the trade potential of China's mechanical and electrical products in other 9 BRICS countries is pioneering potential, which is in line with the development positioning of BRICS countries as emerging market countries, and also shows that the trade of mechanical and electrical products between China and other BRICS countries still has great potential, the trade potential has not been fully tapped, and the trade scale still has room for growth.

5. Conclusions and suggestions

5.1 Conclusion

Based on the panel data of China and other 9 BRICS countries from 2011 to 2023, this paper adopts the extended gravity model to empirically analyze the influencing factors of China's export of mechanical and electrical products to other BRICS countries, and analyzes the trade potential. The following conclusions are drawn.

1. The GDP of China and other BRICS countries, the direct investment of BRICS countries into China and the preferential trade system arrangement between the two countries have a significant positive impact on China's export of mechanical and electrical products to other BRICS countries, among which the greater impact is the GDP of China and other BRICS countries and the direct investment of BRICS countries into China.
2. The geographical distance between China and other BRICS countries and the fact that BRICS countries are landlocked have a negative impact on China's exports of mechanical and electrical products, among which the fact that BRICS countries are landlocked has a greater impact on impeding exports.
3. In terms of trade potential, China's export potential of mechanical and electrical products to the other nine BRICS countries belongs to the pioneering potential, its export trade has not reached the saturation state, and its export potential needs to be further fully tapped.

5.2 Suggestions

1. Enhance the competitiveness of mechanical and electrical products and optimize the export structure of mechanical and electrical products As emerging markets, BRICS countries enjoy fast economic growth, strong potential and growing economic scale. China's rapid economic growth meets the needs of BRICS countries. To promote the export of China's mechanical and electrical products, it is necessary to improve the scientific and technological content and added value of products, and promote the application of new technologies, new processes and new materials, so as to improve the core competitiveness of China's mechanical and electrical products. Enterprises should be encouraged to increase investment in research and development, establish a sound quality management system, strengthen quality control and testing, and increase the export of emerging products such as high-end equipment, intelligent manufacturing equipment and green environmental protection equipment, so as to promote the optimization and upgrading of the export product mix.
2. Improve the investment environment and strengthen cooperation with foreign capital
   The empirical results show that BRICS countries' direct investment in China can have a positive impact on China's export of mechanical and electrical products. Therefore, China should expand the investment fields, include the production of mechanical and electrical products in the encouraged investment fields, give preferential investment policies to attract more foreign investment, and cancel or reduce the restrictions on foreign investment in the field of mechanical and electrical products, so that foreign-funded enterprises can enjoy broader investment choices and more favorable investment conditions in China. The introduction of foreign capital, especially technology-intensive foreign capital projects, will promote the occurrence of technology spillover effect. In the process of investment in China, foreign-funded enterprises will bring their advanced technology, management experience and market channels into China, so as to improve the overall technical level of China's mechanical and electrical industry and accelerate its own transformation and upgrading. At the same time, foreign enterprises are encouraged to establish upstream and downstream cooperative relations with local enterprises in the industrial chain to form industrial synergies, and enhance the competitiveness and anti-risk ability of the entire mechanical and electrical industry through the integration of the industrial chain.
3. Develop emerging industries, optimize the trade environment and services, and further strengthen cooperation between countries
   According to the analysis results of trade potential, there is still room for further exploration and exploitation of the trade potential of China's export of mechanical and electrical products to BRICS countries. China's mechanical and electrical products industry should actively cultivate and develop new driving forces, cultivate new growth points of export trade of mechanical and electrical products, encourage mechanical and electrical enterprises to expand service trade, and extend the value chain of mechanical and electrical products. It is necessary to support green trade, actively respond to the new trend of global green and low-carbon development, promote green exports, and expand new market space. The preferential trade system arrangement in the empirical results has also promoted the export of China's mechanical and electrical products to a certain extent. China should improve the level of trade facilitation, strengthen communication and

coordination with customs, taxation and other departments, and optimize export processes and services. At the same time, China should establish and improve the early warning mechanism of trade barriers, pay close attention to the changes and trends of the international trade environment, actively deal with trade barriers and take countermeasures, strengthen trade negotiations and consultations with BRICS countries, sign agreements and clauses conducive to bilateral trade with more countries, and constantly improve the cooperation mechanism to promote the high-quality development of China's mechanical and electrical products export.

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