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Study on the Impact of BRICS Trade Facilitation on China's Exports and Export Potential

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Abstract: With Saudi Arabia, Egypt, the UAE, Iran, and Ethiopia officially joining BRICS, the organization has once again become the focus of global attention. Will BRICS cooperation grow into a more influential organization on the world stage? What impact might this have on China's export trade? Following this expansion, BRICS has evolved into an economic bloc accounting for 28% of global GDP, 45% of the world's population, and 21% of global trade volume. Enhancing trade facilitation within BRICS can further integrate member economies, allowing them to leverage comparative advantages and achieve mutual benefits. This study constructs a trade facilitation framework and applies the Analytic Hierarchy Process (AHP) to evaluate trade facilitation levels among the ten BRICS countries. The findings reveal significant disparities in trade facilitation levels, with most countries showing relatively low performance. China, India, and South Africa maintain relatively stable and moderate facilitation levels, while Saudi Arabia fluctuates between moderately facilitated and relatively facilitated levels. The UAE exhibits the highest facilitation, oscillating between relatively facilitated and highly facilitated. The other five countries remain at low facilitation levels. An extended gravity model is then employed to empirically analyze the impact of trade facilitation on China's export trade and to estimate China's export trade potential. With the historic expansion of BRICS, this may signal a new era of closer cooperation in trade facilitation and economic collaboration, fostering shared development among BRICS nations.

1. Introduction

Initially known as the "BRIC countries," this term was coined by Goldman Sachs economist Jim O'Neill in his 2001 report, Building Better Global Economic BRICs. The report highlighted the remarkable performance of these economies—Brazil, Russia, India, and China—within the global economy in the aftermath of the financial crisis, giving rise to the term BRIC to represent these countries [1].This report not only introduced the BRIC concept but also spurred real-world cooperation among these nations.

On January 1, 2024, Saudi Arabia, Egypt, the United Arab Emirates, Iran, and Ethiopia officially join the BRICS group. These five nations represent some of the most significant emerging markets and developing countries in the world today. Following this expansion, the combined GDP of BRICS countries increases from 25.77% to 28.99% of the global total. Therefore, the influence of these nations, both economically and geopolitically, is substantial and cannot be underestimated.

A considerable number of studies have examined BRICS and trade facilitation, often utilizing indicator data from the Global Competitiveness Report published by the World Economic Forum prior to 2019. Among these, the study by Wilson, Mann, and Otsuki (2003) [2] is particularly representative. Their research establishes a trade facilitation framework based on four key indicators: port efficiency, customs environment, regulatory environment, and e-commerce. This framework was subsequently applied to assess the level of trade facilitation among APEC members.

Generally, two methods are employed to measure trade facilitation: the Analytic Hierarchy Process (AHP) and Principal Component Analysis (PCA). Zeng Zheng et al. (2008)[3] divided the indicator system into five primary dimensions: port efficiency, tariff environment, regulatory environment, e-commerce, and business mobility. These were further broken down into 16 secondary indicators. Using AHP, they calculated the weights of each indicator at various levels to evaluate the trade facilitation levels of 49 countries and regions. In contrast, Zhai Kun [4] applied PCA to assess the trade facilitation levels of BRICS countries. The calculated trade facilitation indicators were then used as the main explanatory variable in a model. Additional explanatory variables, including population, urbanization level, education level, internet penetration, and FDI, were incorporated to analyze the impact of trade facilitation on service trade exports.

Current research on trade facilitation within BRICS countries faces two significant limitations. First, nearly all existing studies focus exclusively on the original five BRICS members, with little to no assessment of trade facilitation levels for the five countries that joined in 2024. As a result, research on trade facilitation in the expanded BRICS group remains insufficient. Second, since the World Economic Forum ceased publishing the *Global Competitiveness Report* after 2020, most studies rely on pre-2020 data, lacking analyses based on the latest available information. These two shortcomings undermine the persuasiveness of current studies on trade facilitation in BRICS countries.

In this paper, we follow the common practice of extracting data from the *Global Competitiveness Report* and employ the Analytic Hierarchy Process (AHP) to calculate trade facilitation indices for BRICS countries. However, unlike most previous studies, we adopt the method proposed by Gao Yiping (2024) [20] and utilize Monte Carlo simulation to generate indicator data for the ten BRICS countries for the period 2020–2023, thereby completing the dataset.

Our analysis begins by examining the current state of trade development among BRICS countries, tracing the trade trajectories of all ten members using data from 2014 to 2022 (or 2021). Based on this foundation, we establish a trade facilitation indicator system for BRICS, incorporating "port efficiency," "customs environment," "institutional environment," and "business environment" as the primary indicators, all linked to trade facilitation. Each primary indicator is associated with 3–4 secondary indicators, resulting in a total of 15 secondary indicators under four primary dimensions.

We then determine the relative importance of these indicators by consulting additional sources, constructing both primary and secondary indicator judgment matrices. Using MATLAB, we calculate the weights for each indicator. Finally, the weighted values are multiplied by the standardized data and summed to derive the Trade Facilitation Index (TFI) for the ten BRICS countries.

The results reveal significant disparities in trade facilitation levels among BRICS members, with

overall facilitation remaining relatively limited. To enhance trade interactions among member countries, further policy initiatives may be required.

To evaluate the impact of trade facilitation levels on China's exports to BRICS countries, we extend Tinbergen's classic gravity model by incorporating TFI as the core explanatory variable, alongside GDP, POP (population of the trading country), and DIST (distance between the trading country and China) as additional explanatory variables. Using panel data on trade flows between China and the other nine BRICS countries from 2013 to 2023, we conducted regression analyses with mixed effects, random effects, and fixed effects models. The mixed-effects model provided the best fit, showing that the GDP (lnGDP) of BRICS countries has a significantly positive impact on China's export trade flows at the 1% level. Although an increase in a country's population is associated with higher Chinese export volumes, the effect is not statistically significant.

Subsequently, we employed two methods to estimate the trade potential of BRICS countries.The first is estimating trade potential by examining the ratio of actual bilateral trade (E) to the theoretically fitted trade (E*), based on this ratio, BRICS member countries can be divided into three categories:potential for reconstruction potential for expansion significant potential.The second is increasing the TFI of all BRICS countries by 1% to estimate the resulting increase in trade volume.

Our findings reveal that China has substantial trade potential with nearly all BRICS countries. However, improving trade facilitation levels no longer significantly boosts trade volumes, as the current levels of trade facilitation appear to have reached a point where they no longer drive substantial increases in trade flows.The use of two methods to estimate China's trade potential with other BRICS countries is crucial for formulating policies to promote trade growth. Only by integrating the results from both approaches can we determine whether trade facilitation remains a primary barrier to further trade expansion.

The final goal is to furnish a comprehensive picture of the causal relationship between TFI and trade growth.This can guide policymakers in crafting interventions that harness the potential of improved TFI to foster trade development.

2. Current status of development in the BRICS countries

2.1 Current Status of China's Trade Development

In recent years, China has significantly increased its openness to foreign trade, continually shifting its economic growth model and implementing various policies to promote international exchange and cooperation. Coupled with its abundant labor resources, this has led to substantial development in its import and export trade. As illustrated in the chart, China's total foreign trade experienced a gradual decline from 2014 to 2016; however, since 2017, the total value of imports and exports has shown a steady upward trend. Even following the impact of the pandemic in 2020, China’s foreign trade has continued to demonstrate robust growth[4]. In 2022, the total value of China’s goods and services trade reached 41.6728 trillion yuan, representing a year-on-year increase of 7%, and accounting for 69% of total imports and exports among BRICS countries. China's trade performance among the BRICS nations is notably prominent. Below is an overview of China's foreign trade development over the past decade.

Table 1: Overview of China's Goods and Services Import and Export Trade (2014-2023) (Unit: 100 million RMB).

Indicators	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total Import and Export	264242	245503	243386	278099	305010	315627	322215	387392	416728	417568
Total Imports	120358	104336	104967	124790	140881	143254	142936	173137	180391	179842
Total Exports	143884	141167	138419	153309	164129	172374	179279	214255	236337	237726
Export-Import Ratio	119.5	135.3	131.9	122.9	116.5	120.3	125.4	123.7	131.0	132.2

Source: General Administration of Customs of the People's Republic of China

2.2 Current Status of Russia's Trade Development

Russia, having undergone an economic transition, has experienced an evolution in its foreign trade development through strategies such as "import substitution," "shock therapy," and an "energy-oriented" approach. As the world's third-largest producer and consumer of energy—after China and the United States—Russia contributes 10% of global energy production and accounts for 4% of energy consumption. It is also the largest energy exporter, with its resource exports including oil, natural gas, coal, iron, cobalt, gold, and silver[5]. Leveraging these resources, Russia has achieved improved economic growth and is often referred to as the "world's gas station."

Table 2: Overview of Russia's Goods and Services Import and Export Trade (2014-2022) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Import and Export	8046.8	5344.4	4732.0	5913.3	6927.7	6736.0	5730.2	7979.5	8505
Total Imports	3078.8	1930.2	1914.9	2383.8	2488.6	2538.8	2396.4	3039.3	2950.4
Total Exports	4968.1	3414.2	2817.1	3529.4	4439.1	4197.2	3333.7	4940.3	5914.6
Export-Import Ratio	161.3	176.9	147.11	148.1	178.4	165.3	139.1	162.5	200.5

Source: UN Comtrade

Between 2014 and 2016, Russia experienced a year-on-year decline in the total value of goods and services imports and exports. This decline can be attributed to fluctuations in international oil prices and the sanctions imposed on Russia across multiple sectors due to the Crimea incident. Starting in 2017, the total value of Russian goods and services imports and exports has generally shown an upward trend, with the exception of 2020, when a decrease likely occurred as a result of the pandemic. Despite facing sanctions following the Russia-Ukraine conflict, Russia's total foreign trade continues to grow, reaching $850.5 billion in 2022. Compared to 2021, imports decreased by 2.9%, while exports increased by 19.7%.

According to Table 2-2, Russia maintained a trade surplus from 2014 to 2022, with the surplus amount consistently remaining substantial. In 2022, Russia recorded its highest trade surplus, reaching $296.42 billion.

2.3 Current Status of India's Trade Development

As of March 2023, India's real GDP growth has reached 7.2%, compared to a growth rate of 9.1% in the previous fiscal year. According to data from the World Bank, India is expected to maintain the fastest economic growth rate this year. Furthermore, projections from the International Monetary Fund (IMF) suggest that by 2028, India may surpass Germany and Japan, becoming the world's third-largest economy, following the United States and China. This anticipated growth is

closely linked to India's deep integration into global trade. With a high prevalence of English proficiency and strong computer skills, India has emerged as the leading country for business process outsourcing worldwide.

From 2014 to 2022, India consistently maintained a trade deficit, with the deficit amount fluctuating but remaining relatively stable. The import-to-export ratio has been maintained between 0.60 and 0.75. The total value of goods and services imports and exports did not exhibit a steady upward trend between 2014 and 2020; instead, it experienced variations within a certain range. However, significant increases were observed in 2021 and 2022, with the total value surpassing $100 billion in 2022.

Table 3: Overview of India's Goods and Services Import and Export Trade (2014-2022) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Import and Export	7856.0	6620.8	6261.9	7491.7	8392.4	8104.0	6496.1	9679.3	11844.8
Total Imports	4629.1	3941.3	3616.5	4499.3	5144.6	4860.6	3732.0	5725.2	7306
Total Exports	3226.9	2679.5	2645.4	2992.4	3247.8	3243.4	2764.1	3954.1	4538.8
Export-Import Ratio	0.697	0.680	0.731	0.665	0.631	0.667	0.741	0.691	0.621

Source: UN Comtrade

2.4 Current Status of Brazil's Trade Development

Brazil, the largest country by area and population in South America, possesses advantageous conditions, including a coastal location, beautiful environments, and abundant resources such as iron ore and oil. Brazil's economic rise was once considered a miracle; however, this growth has not been sustained, and the economy now faces significant challenges, often referred to as the "middle-income trap."[6].

Table 4: Overview of Brazil's Goods and Services Import and Export Trade (2014-2023) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total Import and Export	4616.9	3672.4	3247.7	3808.4	4247.3	4142.9	3755.2	5155.1	6077	5805
Total Imports	2407.6	1804.6	1452.5	1658.6	1928.4	1931.6	1663.4	2346.9	2727	2408.3
Total Exports	2209.2	1867.8	1795.3	2149.9	2318.9	2211.3	2091.8	2808.2	3350	3396.7
Export-Import Ratio	0.918	1.035	1.236	1.296	1.202	1.145	1.258	1.197	1.228	1.410

Source: UN Comtrade

After 2011, Brazil's economy ceased its previous rapid growth and entered a steep decline, with GDP contracting by -3.8% in 2015 and -3.6% in 2016. As shown in Table 2-4, the total value of Brazil's foreign trade in 2015 and 2016 reached its lowest level in nearly a decade, though it gradually improved thereafter. The country faced a period of trade deficit prior to 2015 due to political instability, falling prices of international commodities, and excessively high government public spending. It was not until 2015 that Brazil achieved a trade surplus, amounting to $6.32 billion, and has maintained a surplus position since then.

2.5 Current Status of South Africa's Trade Development

South Africa, known as the "Golden Country," is the most economically developed region in Africa and is the largest producer and exporter of gold in the world. According to World Bank classifications, South Africa is categorized as an upper-middle-income country, with well-developed infrastructure and a sound legal system. It is the most industrialized nation in Africa and the only African member of the G20. China is South Africa's largest trading partner, while South Africa ranks as China's biggest trade partner in Africa and one of the largest investment destinations for Chinese enterprises on the continent[7]. Overall, South Africa's foreign trade development status is relatively low among BRICS countries, with total imports and exports surpassing $200 billion in 2021.

Table 5: Overview of South Africa's Goods and Services Import and Export Trade (2014-2022)
Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Import and Export	1908.8	1673.4	1514.5	1726.6	1873.3	1780.4	1543.6	2170.7	2354
Total Imports	997	856.8	751.7	834.2	931.7	880.7	689	933.2	1116.5
Total Exports	911.8	816.6	762.8	892.4	942.3	899.7	854.6	1237.5	1237.5
Export-Import Ratio	0.914	0.953	1.015	1.070	1.011	1.022	1.240	1.326	1.108

Source: UN Comtrade

2.6 Current Status of Saudi Arabia's Trade Development

Saudi Arabia's economy is predominantly driven by oil exports, which account for approximately 40% of the country's gross domestic product (GDP). Oil trade generates 80% of government revenue and 90% of foreign exchange earnings. Leveraging its advantageous natural resources, Saudi Arabia is able to distribute wealth "top-down" among its citizens, thereby maintaining a relatively high level of affluence and sustaining its monarchical rule[8].

Table 6: Overview of Saudi Arabia's Goods and Services Import and Export Trade (2014-2021)
Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021
Total Import and Export	5162.7	3782.2	3237.5	3563.5	4314.4	4147.7	3118.5	4134.1
Total Imports	1738.3	1746.8	1401.7	1345.2	1370.7	1531.6	1379.9	1550.1
Total Exports	3424.3	2035.5	1835.8	2218.4	2943.7	2616.0	1738.5	2584.0
Export-Import Ratio	1.97	1.17	1.31	1.65	2.15	1.71	1.26	1.67

Source: UN Comtrade

The reliance on a single economic model has led Saudi Arabia to face numerous challenges in recent years. Under the modern industrial framework, revolutionary changes in the international energy market have significantly impacted Saudi Arabia's oil-based economy. As shown in the table below, Saudi Arabia has maintained a trade surplus primarily based on oil exports, although the surplus amount has fluctuated considerably across different years. Between 2014 and 2021, the export-to-import ratio reached its peak of 2.15 in 2018, while it fell to a low of 1.17 in 2015. The

instability of the surplus further reflects that Saudi Arabia's economy is consistently affected by fluctuations in the international oil market.

2.7 Current Status of Egypt's Trade Development

In 2014, Abdel Fattah el-Sisi assumed the presidency of Egypt, and as the situation stabilized, he initiated economic reforms in the country. Unlike reforms in other nations, Egypt's economic reform is implemented along "two main lines": on one hand, it aims to restore the economy and maintain stability, while on the other hand, it also permits the development of the military economy. Since then, the Egyptian economy has generally operated smoothly and has gradually begun to recover positively[9].

Since the establishment of diplomatic relations between China and Egypt, trade between the two countries has gradually increased, with Egypt becoming an important trading partner for China and a major importer and exporter of oil. However, Egypt's foreign trade performance remains relatively low among BRICS countries. From 2014 to 2020, the total value of imports and exports hovered around $90 billion, surpassing $100 billion in 2021. The trade deficit is significant, with export values in most years maintaining an approximate ratio of 0.4 to imports.

Table 7: Overview of Saudi Arabia's Goods and Services Import and Export Trade (2014-2021) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021
Total Import and Export	936.4	849.2	812.5	872.3	996.2	999.1	864.7	1029.8
Total Imports	667.9	635.7	557.9	616.3	720.0	709.2	598.4	665.6
Total Exports	268.5	213.4	254.7	256.0	276.2	289.9	266.3	364.2
Export-Import Ratio	0.402	0.336	0.457	0.415	0.383	0.409	0.445	0.547

Source: UN Comtrade

2.8 Current Status of United Arab Emirates ' Trade Development

The United Arab Emirates (UAE) is one of the most powerful and dynamic economies in the Arab region, with a gross domestic product (GDP) of $375 billion in 2016 and a per capita GDP of $68,000, ranking eighth globally. Since 2017, the overall economic growth rate of the UAE has significantly declined due to the negative impacts of oil production cuts. However, thanks to the diversification of its industries and favorable operating conditions, the UAE has continued to demonstrate strong endogenous growth momentum in recent years[10].

The recovery of the domestic consumption market in the UAE has contributed to the increase in foreign trade volumes. As shown in the table, after 2018, the total value of goods and trade imports and exports in the UAE reached a new level, with the trade surplus reaching its highest point in recent years. In 2020, due to the impact of the pandemic, the total value of imports and exports in the UAE declined; however, in 2021, it rebounded to $744.4 billion. With the gradual realization of the effects of rising international oil prices, the continuous advancement of the Belt and Road Initiative, and the initiation of BRICS cooperation, the future outlook for the UAE's economic and trade development appears promising.

Table 8: Overview of United Arab Emirates' Goods and Services Import and Export Trade (2014-2021) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021
Total Import and Export	6190.6	5638.9	5616.1	5872.6	6494.5	6777.7	5820.9	7444.5
Total Imports	2760.2	2634.2	2665.8	2737.1	2615.4	2884.0	2468.8	3194.1
Total Exports	3004.8	3004.8	2950.3	3135.5	3879.1	3893.7	3352.1	4250.4
Export-Import Ratio	1.09	1.14	1.11	1.14	1.48	1.35	1.36	1.33

Source: UN Comtrade

2.9 Current Status of Iran's Trade Development

Iran's economic development path has been quite convoluted, having undergone various phases such as "total westernization," "Islamization," "limited liberalization," and strategies focused on the import of primary products and export-oriented development. However, none of these efforts have successfully achieved economic modernization[11].Iran's complex national conditions, coupled with structural contradictions in both its economy and politics, contribute to the numerous challenges facing the country's economic development[12].

As indicated in the table below, Iran's foreign trade is predominantly export-oriented. From 2014 to 2021, despite significant fluctuations in the total value of imports and exports, the country has consistently maintained a trade surplus. This stability can be attributed to the cooperation between China and Iran; since 2009, China has remained Iran's largest trading partner, and Iran has consistently held the position of China's third-largest trading partner in the Middle East.

Table 9: Overview of Iran's Goods and Services Import and Export Trade (2014-2021) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021
Total Import and Export	1502.7	1152.1	1159.8	1422.6	1527.8	1075.5	856.7	1213.2
Total Imports	551.1	449.3	430.8	495.0	493.5	418.3	387.6	489.8
Total Exports	951.6	702.8	729.0	927.6	1034.2	657.2	469.2	723.5
Export-Import Ratio	1.73	1.56	1.69	1.87	2.10	1.57	1.21	1.48

Source: UN Comtrade

2.1 Current Status of Ethiopia's Trade Development

Ethiopia boasts one of the most dynamic economies in Africa, having experienced rapid growth at an average annual rate of approximately 10% for over a decade prior to the outbreak of the NCRI. However, during the pandemic years, Ethiopia's economy faced significant setbacks, with an average growth rate of 6% from 2020 to 2022, marking the lowest record since 2004[13].Despite being the second-most populous country in Africa and one of the countries with the highest population growth rates, Ethiopia has not seen a corresponding prosperity in its trade. Instead, the total value of goods and services imports and exports has fluctuated between $10 billion and $20 billion, placing it among the lowest in the BRICS nations. The country’s foreign trade primarily

relies on imports, with an export-to-import ratio ranging from 0.15 to 0.25.

Table 10: Overview of Ethiopia's Goods and Services Import and Export Trade (2014-2021) Unit: US$ billion.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021
Total Import and Export	186.3	196.2	192.2	187.8	180.1	173.0	163.7	197.3
Total Imports	153.6	167.0	164.3	157.6	153.05	145.5	131.2	157.2
Total Exports	32.8	29.1	27.9	30.22	27.0	27.4	32.6	40.1
Export-Import Ratio	0.214	0.174	0.170	0.192	0.176	0.188	0.248	0.255

Source: UN Comtrade

3. Establishment and calculation of trade facilitation indicators in the expanded BRICS countries

3.1 Establishment of the BRICS Trade Facilitation Evaluation Indicator System

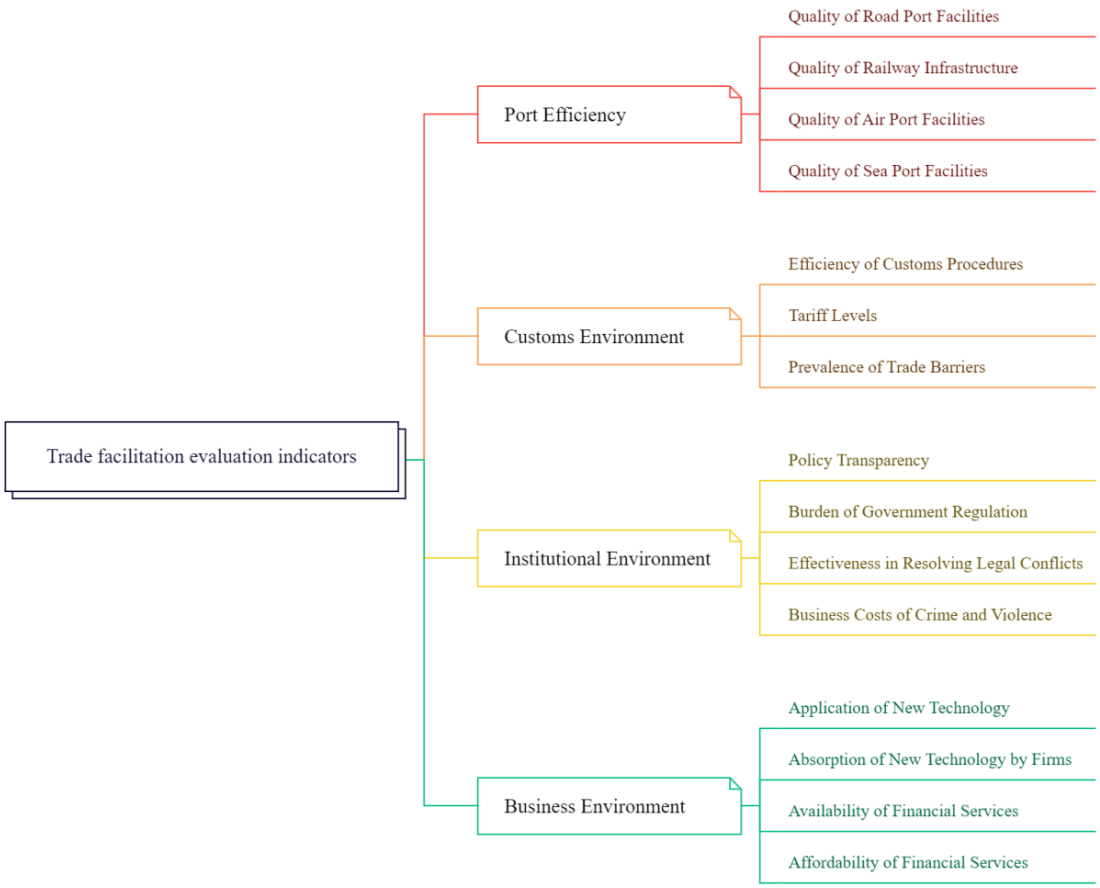

Figure 1: Trade facilitation evaluation indicators.

There is a significant amount of research both domestically and internationally on the measurement systems of trade facilitation, but definitions of trade facilitation measurement remain inconsistent. Most researchers utilize the trade facilitation measurement framework established by the World Economic Forum, with the most representative studies conducted by Wilson, Mann, and Otsuka. This article draws upon and expands the perspectives of Wilson et al., integrating the

characteristics and trade development status of BRICS countries. The study combines "port efficiency," "customs environment," "institutional environment," and "business environment" into the framework for assessing trade facilitation levels. Each of these primary indicators contains three to four secondary indicators, resulting in a total of 15 secondary indicators across the four primary indicators[14].Refer to Figure 1 for further details.

3.2 Using hierarchical analysis to determine the weights of the trade facilitation indicator system

This article employs the hierarchical analysis method proposed by American operations researcher Saaty to determine the weights of trade facilitation indicators. The first step involves establishing a hierarchical structure model, as illustrated in Figure 1. Next, a judgment matrix is constructed, followed by the calculation of the maximum eigenvector for each indicator in the judgment matrix. Finally, a formula for calculating trade facilitation is derived based on the eigenvector, with data substituted to yield results.

3.2.1Constructing a judgement matrix

The judgment matrix compares the importance of all indicators at a given level against a specific indicator from the preceding level [15].In the hierarchical structure model, the construction of the judgment matrix is derived from the comparison of the importance and relevance of any two indicators within each level concerning the related indicator from the previous level. The judgment matrix A satisfies the following conditions:

$$A = (a_{ij,})_{n\times n,}\, a_{ij} > 0, a_{ij} = \frac{1}{-} \tag{1}$$

The specific scaling method for a_{ij} is shown in Table 11:

Table11 Scaling Method for Indicators in the Judgment Matrix.

a_{ij}	meanings
1	equal importance between two indicators.
3	one indicator is moderately more important than the other.
5	one indicator is strongly more important than the other.
7	one indicator is very strongly more important than the other.
9	extreme importance of one indicator over the other.
2,4,6,8	The median value between the two adjacent judgments.
reciprocal	If the judgment of the comparison between factors i and j is represented as a_{ij}, then the judgment of the comparison between factors j and i is given by $a_{ij} = 1/a_{ij}$

First, a primary indicator is established by reviewing extensive literature related to trade facilitation and referencing the evaluation results of others. The conclusions drawn are as follows: relative to port efficiency, the customs environment is equally important, denoted as $a_{ij} = 1$; the institutional environment and the business environment are positioned between equally important

and slightly important, represented as a_{ij} = 2. Relative to the customs environment, the institutional environment is equally important, indicated by a_{ij} = 1; the business environment falls between equally important and slightly important, denoted as a_{ij} = 2. Relative to the institutional environment, the business environment indicator is equally important, marked as a_{ij} = 1. Based on the above information, the judgment matrix for the primary indicators has been constructed (see Table 12 for details).

Next, a judgment matrix for the secondary indicators corresponding to each primary indicator—namely, port efficiency, customs environment, institutional environment, and business environment—can be constructed. For the primary indicator of port efficiency, it is determined that relative to the quality of road port facilities, the quality of railway infrastructure and the quality of air port facilities are equally important, denoted as a_{ij} = 1. Relative to the quality of sea port facilities, the quality of road port facilities, railway infrastructure, and air port facilities fall between equally important and slightly important, represented as a_{ij} = 2. Based on this, the judgment matrix corresponding to the primary indicator of port efficiency, which includes secondary indicators such as the quality of road port facilities, railway infrastructure, air port facilities, and sea port facilities, is constructed (see Table 13)[15].

Table 12: Judgment Matrix for Primary Indicators.

Trade Facilitation Evaluation Indicators	Port Efficiency	Customs Environment	Institutional Environment	Business Environment
Port Efficiency	1	1	1/2	1/2
Customs Environment	1	1	1	1/2
Institutional Environment	2	1	1	1
Business Environment	2	2	1	1

Table 13: Evaluation Matrix for Secondary Indicators (1).

Port Efficiency	Road Port Facility Quality	Railway Infrastructure Quality	Air Port Facility Quality	Sea Port Facility Quality
Road Port Facility Quality	1	1	1	2
Railway Infrastructure Quality	1	1	1	2
Air Port Facility Quality	1	1	1	2
Sea Port Facility Quality	1/2	1/2	1/2	1

Following the same method, secondary indicator judgment matrices (2), (3), and (4) are constructed to correspond to the primary indicators of customs environment, institutional environment, and business environment, respectively. These matrices are detailed in Tables 14, 15, and 16.

Table 14: Evaluation Matrix for Secondary Indicators (2).

Customs Environment	Efficiency of Customs Procedures	Tariff Levels	Prevalence of Trade Barriers
Efficiency of Customs Procedures	1	1/2	1/2
Tariff Levels	2	1	2
Prevalence of Trade Barriers	2	1/2	1

Table 15: Evaluation Matrix for Secondary Indicators (3).

Institutional Environment	Policy Transparency	Burden of Government Regulation	Effectiveness in Resolving Legal Conflicts	Business Costs of Crime and Violence
Policy Transparency	1	1	2	2
Burden of Government Regulation	1	1	1	1
Effectiveness in Resolving Legal Conflicts	1/2	1	1	1
Business Costs of Crime and Violence	1/2	1	1	1

Table 16: Evaluation Matrix for Secondary Indicators (4).

Business Environment	Application of New Technology	Absorption of New Technology by Firms	Absorption of New Technology by Firms	Affordability of Financial Services
Application of New Technology	1	2	1	2
Absorption of New Technology by Firms	1/2	1	1	1
Availability of Financial Services	1	1	1	2
Affordability of Financial Services	1/2	1	1/2	1

3.2.2 Calculation of the Principal Eigenvector of the Judgment Matrix

MATLAB software is utilized to derive the eigenvalues and weights for the primary indicators within the evaluation matrix. The calculated weights for the four primary indicators—port efficiency, customs environment, institutional environment, and business environment—are 0.1692, 0.2046, 0.2879, and 0.3383, respectively. For the secondary indicators associated with port efficiency, the weights for road port facility quality, railway infrastructure quality, and air port facility quality are each 0.2857, while the weight for sea port facility quality is 0.1429. Within the customs environment, the weights assigned to the efficiency of customs procedures, tariff levels, and prevalence of trade barriers are 0.1958, 0.4934, and 0.3108, respectively. Regarding the

institutional environment, the secondary indicators—policy transparency, the burden of government regulation, effectiveness in legal conflict resolution, and business costs of crime and violence—have weights of 0.3465, 0.2463, 0.2036, and 0.2036, respectively. For the business environment, the secondary indicators—application of new technology, absorption of new technology by firms, availability of financial services, and affordability of financial services—are weighted at 0.3383, 0.2046, 0.2879, and 0.1691, respectively. The aggregated weights for each level of indicators are summarized in Table 17.

Table 17: Weights of Trade Facilitation Indicators at Each Level.

	Primary Indicator	Weight	Secondary Indicator	Weight	Overall Weight	Weight Code	Value Code	Data Source
Trade facilitation evaluation indicators	Port Efficiency	0.1692	Quality of Road Port Facilities	0.2857	0.0483	W11	C11	GCR
			Quality of Railway Infrastructure	0.2857	0.0483	W12	C12	GCR
			Quality of Air Port Facilities	0.2857	0.0483	W13	C13	GCR
			Quality of Sea Port Facilities	0.1429	0.0242	W14	C14	GCR
	Customs Environment	0.2046	Efficiency of Customs Procedures	0.1958	0.0401	W21	C21	GCR
			Tariff Levels	0.4934	0.1009	W22	C22	GCR
			Prevalence of Trade Barriers	0.3108	0.0636	W23	C23	GCR
	Institutional Environment	0.2879	Policy Transparency	0.3465	0.0998	W31	C31	GCR
			Burden of Government Regulation	0.2463	0.0709	W32	C32	GCR
			Effectiveness in Resolving Legal Conflicts	0.2036	0.0586	W33	C33	GCR
			Business Costs of Crime and Violence	0.2036	0.0586	W34	C34	GCR
	Business Environment	0.3383	Application of New Technology	0.3383	0.1144	W41	C41	GCR
			Absorption of New Technology by Firms	0.2046	0.0692	W42	C42	GCR
			Availability of Financial Services	0.2879	0.0973	W43	C43	GCR
			Affordability of Financial Services	0.1691	0.0572	W44	C44	GCR

3.3 Calculation of trade facilitation levels in BRICS countries

The level of trade facilitation is typically measured using the Trade TFI. This index is calculated by taking the weighted sum of each indicator's weight W_{ij} (where i=1,2,…,4 for primary indicators, and j=1,2,…,5 for secondary indicators) and its corresponding valueC_{ij}. In formula form:

$$\begin{aligned}\mathrm{TFI} = {} & W_{11}C_{11} + W_{12}C_{12} + W_{13}C_{13} + W_{14}C_{14} + W_{21}C_{21} + W_{22}C_{22} + W_{23}C_{23} + \\ & W_{31}C_{31} + W_{32}C_{32} + W_{33}C_{33} + W_{34}C_{34} + W_{41}C_{41} + W_{42}C_{42} + W_{43}C_{43} + W_{44}C_{44}\end{aligned} \quad (2)$$

The values for C_{ij} are derived from the Global Competitiveness Report published by the World Economic Forum from 2013 to 2019, which provides data for each indicator. For certain countries, such as the UAE, some indicator values may be missing. Following the approach of Chen Jiyong and Liu Yishuang[16], missing data prior to 2018 are completed by taking the average of the values from two adjacent years. For missing data from 2018 onwards, the previous year's data is used for completion.

Since the Global Competitiveness Report was only published through 2019, this study uses the Monte Carlo simulation method to estimate data for the years 2020 to 2023. The performance of a given country in a specific area is assumed to be proportional to the corresponding indicator value. The trade facilitation values for each indicator are presented in Appendix 1 and Appendix 2.

Table 18: Trade Facilitation Index for BRICS Countries (2013-2023)

Country	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
China	0.65	0.64	0.61	0.66	0.61	0.65	0.67	0.66	0.66	0.66	0.65
Russia	0.58	0.58	0.58	0.58	0.60	0.60	0.58	0.57	0.57	0.55	0.53
Brazil	0.54	0.54	0.55	0.54	0.56	0.53	0.52	0.52	0.54	0.56	0.57
India	0.61	0.64	0.62	0.66	0.63	0.66	0.66	0.62	0.58	0.64	0.65
South Africa	0.64	0.66	0.65	0.66	0.65	0.62	0.68	0.67	0.68	0.67	0.68
Saudi Arabia	0.68	0.68	0.72	0.73	0.66	0.69	0.69	0.70	0.69	0.72	0.73
Egypt	0.56	0.57	0.56	0.60	0.61	0.61	0.54	0.54	0.53	0.53	0.55
UAE	0.77	0.77	0.80	0.79	0.76	0.75	0.82	0.81	0.82	0.80	0.79
Iran	0.53	0.55	0.55	0.53	0.50	0.53	0.53	0.59	0.51	0.52	0.54
Ethiopia	0.56	0.54	0.52	0.54	0.52	0.56	0.56	0.55	0.54	0.55	0.55

Due to space limitations, only the trade facilitation indicator values for the years 2018 to 2023 are listed here. Additionally, the data in the table has been standardized to ensure comparability. Let C_{ij} represent the actual value, C_{ijmax} denote the maximum value within the corresponding indicator range, and Y_{ij} be the standardized value. The calculation formula is as follows:

$$Y_{ij}=C_{ij}/C_{ijmax} \quad (3)$$

Finally, the previously calculated weight values W_{ij} are multiplied by the standardized data values Y_{ij} and summed to obtain the TFI values for the ten BRICS countries. The specific results are presented in Table 18.

3.4 Analysis of Trade Facilitation Levels in BRICS Countries

Trade facilitation levels are generally classified into four categories: below 0.6 indicates "not

conducive to trade," 0.6 to 0.7 signifies "moderately conducive," 0.7 to 0.8 represents "relatively conducive," and above 0.8 denotes "highly conducive."[17]

Table 20 shows significant disparities in trade facilitation levels among BRICS countries, indicating that overall, the environment is not very conducive to trade. China, India, and South Africa maintain relatively stable trade facilitation levels, consistently categorized as "moderately conducive." Saudi Arabia fluctuates between"relatively conducive" and "moderately conducive." The United Arab Emirates has the highest level of trade facilitation, oscillating between "relatively conducive" and "highly conducive," while the remaining five countries are categorized as "not conducive to trade."

BRICS countries have made long-term efforts to advance the trade facilitation process in various ways, such as actively promoting trade facilitation through the organization of meetings and the signing of agreements. However, as indicated by the aforementioned data, the trade facilitation levels among BRICS countries remain relatively low.

While the economic and trade cooperation achievements within the BRICS framework are significant, the pace of improvement in trade facilitation levels has been slow and unstable. This sluggish progress can be attributed to factors such as the political and economic instability within individual member countries, which continues to hinder the effectiveness of trade facilitation initiatives.

With the assistance of the "Belt and Road" initiative, BRICS countries have made remarkable advancements in infrastructure development in recent years, establishing a solid foundation for economic and trade exchanges among member nations. However, the earlier data reveals significant gaps between BRICS countries and developed nations in various areas, including customs efficiency, trade barriers, governmental policy transparency, and the promotion of new technologies[18].

For instance, Brazil, the largest economy in South America, has recognized the importance of trade facilitation in recent years and has implemented several measures, such as simplifying its tax system and improving infrastructure. Despite these efforts, Brazil's trade facilitation level remains relatively low, largely due to complex internal administrative procedures and the influences of trade protectionism.

Overall, most BRICS countries exhibit a somewhat sluggish pace in trade facilitation, facing common challenges such as weak infrastructure, slow domestic reforms, limited cooperation with foreign partners, and a lack of momentum. These issues serve as obstacles to the cooperation on trade facilitation among BRICS nations.

On one hand, with the historic expansion of the BRICS group, the infusion of new members is expected to invigorate cooperation within the bloc. On the other hand, the voices of developing countries are becoming increasingly prominent, leading to a rise in their influence. The deepening economic and trade cooperation between China and other BRICS countries suggests that the bloc may be entering a golden period characterized by enhanced trade facilitation, closer collaboration, and joint development.

4. Empirical Analysis of the Impact of Trade Facilitation Levels in BRICS Countries on China's Exports

4.1 Model Specification and Data Sources

Dingeburg utilized the gravity model to analyze trade flows between countries, generally finding a positive correlation between trade volume and the total economic size of the countries, and a negative correlation with the geographical distance between them. In this study, based on the original gravity model, we incorporate trade facilitation levels as a core explanatory variable,

constructing the following extended gravity model:

$$\ln EXP_{ijt} = \alpha_0 + \beta_1 \ln GDP_{jt} + \beta_2 \ln POP_{jt} + \beta_3 \ln DIST_{ijt} + \beta_4 \ln TFI_{jt} + \mu_{ijt} \quad (4)$$

In this model, i and j represent the BRICS countries, while t denotes the year. EXPijt indicates the value of China's exports to country j in year t. GDPjt represents the economic output of country j, and DISTjt reflects the geographical distance between the two BRICS countries. POPjt denotes the population of country j, and TFIjt indicates the trade facilitation index for country j. The term uijt is the random error term.The expected signs of each variable and their data sources are summarized in Table 19 as follows:

Table 19: Data Sources and Expected Signs for Explanatory Variables

Variable	Expected Sign	Data Source	Theoretical Basis
GDPjt	+	WDI	The economic scale of a country reflects its potential demand; the larger the potential demand, the greater the volume of imports.
POPjt	Not sure	WDI	Population growth can lead to deeper domestic division of labor, which may reduce trade. However, an increasing population also enhances consumer demand, thereby increasing trade.
DISTjt	-	CEPII	The greater the distance between two countries, the higher the trade costs.
TFIjt	+	calculated	The higher the level of trade facilitation, the greater the volume of trade flows.

4.2 Empirical Analysis of the Impact of Trade Facilitation Levels of BRICS Countries on China's Exports

This study employs an extended gravity model to conduct regression analyses on the trade flow panel data of the nine BRICS countries, excluding China, for the years 2013 to 2023. The analysis incorporates mixed effects, random effects, and fixed effects models. All variables are transformed using logarithmic functions,additionally, heteroscedasticity and autocorrelation robust standard errors are utilized to address potential issues related to heteroscedasticity and autocorrelation in the data. The detailed regression results are presented in Table 20.

Table 20: Regression Results of the Extended Gravity Model

	(1)	(2)	(3)
	ME	RE	FE
lngdp	0.681***	0.659***	0.459
	(0.126)	(0.143)	(0.606)
lnpop	0.035	0.032	-7.777***
	(0.116)	(0.134)	(1.950)
lndist	-0.703**	-0.694**	-0.969**
	(0.333)	(0.335)	(0.382)
lntfi	2.980***	2.897**	-0.332
	(1.059)	(1.186)	(2.374)
_cons	16.584***	17.085***	168.000***
	(5.898)	(6.056)	(29.444)

N	99	99	99
adj. R2	0.452		0.121

Note:(1)Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Equation (1) represents the mixed effects regression, while Equations (2) and (3) correspond to the random effects and fixed effects analyses, respectively. After comparing the model regression results with the data types, this study adopts the mixed effects regression approach.

Firstly,the impact of the GDP of BRICS member countries (lngdp) on China's export trade volume is significantly positive at the 1% level, consistent with the theoretical expectations outlined in Table 19. This indicates that the GDP of BRICS nations positively promotes China's exports; specifically, a 1% increase in a country's GDP is associated with a 0.681% increase in China's export volume to that country.

Second, the regression coefficient for the total population (lnpop) is positive but not statistically significant. This suggests that an increase in a country's total population is associated with a corresponding increase in China's exports to that country; however, the effect is not statistically significant.

Third, the regression coefficient for the distance between China and BRICS member countries (lndist) is significantly negative, consistent with theoretical expectations. This indicates that an increase in the distance between the two countries corresponds to a significant rise in trade costs, which is detrimental to trade relations. According to the regression results, a 1% increase in distance results in a 0.703% decrease in trade volume between the two countries.

Fourth, the trade facilitation index (lntfi) is significantly positive at the 1% level. Compared to the other three influencing factors, the level of trade facilitation has the strongest promoting effect on China's exports to other BRICS member countries, with a highly significant impact. Specifically, a 1% increase in a country's trade facilitation level is associated with a 2.980% increase in China's export volume to that country.

4.3 Robustness Check

Since the promotion effect of an increase in the level of trade facilitation on the growth of trade flows between countries takes a certain amount of time to complete, this paper uses the method of lagging the level of trade facilitation by one period and two periods, respectively, to carry out robustness tests. The regression results are shown in Table 21.

Table 21:Robustness Check Results

	(1)	(2)	(3)	(4)
lngdp	0.584***	0.555***	0.578***	0.555***
	(0.130)	(0.129)	(0.142)	(0.138)
lnpop	0.127	0.168	0.122	0.161
	(0.119)	(0.117)	(0.130)	(0.126)
lndist	-1.558***	-1.954***	-1.565***	-1.967***
	(0.369)	(0.353)	(0.371)	(0.354)
lnLtfi	4.206***		4.121***	
	(1.082)		(1.165)	
lnL2tfi		4.698***		4.603***
		(1.043)		(1.102)
_cons	29.445***	34.905***	29.740***	35.137***
	(6.394)	(6.115)	(6.477)	(6.166)
N	90	81	90	81
adj. R2	0.523	0.592		

The analyses denoted as (1), (2), (3), and (4) represent the following regression models:

Model (1): First-order lagged mixed effects regression analysis of the core variable.

Model (2): First-order lagged random effects regression analysis of the core variable.

Model (3): Second-order lagged mixed effects regression analysis of the core variable.

Model (4): Second-order lagged random effects regression analysis of the core variable.

From Table 21, it is evident that the core variable, lntfi, along with the other explanatory variables, lngdp, lndist, are all significant at the 1% level. Moreover, the direction of the effects for all explanatory variables is consistent with the previous findings. This consistency indicates that the results of the original regression model are robust, thereby reinforcing the reliability of the research conclusions.

5. Analysis of China's Export Potential to BRICS Countries

Based on the analysis above, this paper continues to estimate the trade potential of BRICS countries, utilizing two primary measurement methods.

The first method is a direct calculation approach. Following the methodology proposed by Liu Qingfeng and Jiang Shuzhu (2002)[19], we can estimate trade potential by examining the ratio of actual bilateral trade (E) to the theoretically fitted trade (E*). Based on this ratio, countries can be categorized into three types: if $E/E^*>1.2$, the country is classified as having "potential for reconstruction"; if $0.8<E/E^*<1.2$, the country is categorized as having "potential for expansion"; and if $E/E^*<0.8$, the country is considered to have "significant potential."

The second method involves increasing the level of a particular important explanatory variable and incorporating this modified value into the gravity model. This approach allows for an analysis of trade potential by examining the increase in trade volume resulting from the adjusted value[20].

This study first employs the first method to estimate China's export trade volume E∗to other BRICS countries using the previously estimated extended gravity model. The export trade potential of China to other BRICS countries is then assessed by calculating the ratio of actual trade volume E to the estimated trade volume E*. The results are presented in Table 22.

Subsequently, this study increases the trade facilitation level (TFI) of all BRICS countries by 1% to estimate the resulting increase in trade volume. The findings are also detailed in Table 22.

Based on the two methods utilized to calculate China's trade potential with the BRICS countries, the following conclusions can be drawn:

First, with the exception of Russia, China possesses significant trade potential with all other BRICS nations, indicating that there remains considerable room for exploration in the BRICS trade market. The ratio of actual trade volume to estimated trade volume (E/E*) suggests a negative correlation with the level of national development. This may be attributed to the lower trade openness, minimal foreign direct investment, infrequent trade interactions, and high reliance on domestic markets in less developed countries, implying substantial opportunities for China to enhance cooperation with other BRICS members.

Second, after a 1% increase in the Trade Facilitation Index (TFI), the projected trade volume increase is notably substantial for India and the UAE; however, trade volumes for other countries exhibit negative growth. This indicates that improvements in the trade facilitation levels of BRICS countries have yielded limited growth in China's export volumes, suggesting that the TFI may no longer significantly enhance trade flow. These results imply the necessity of exploring alternative avenues to tap into trade potential, such as enhancing China's economic standing and increasing foreign direct investment.

Table 22: Trade Potential of China to BRICS Countries in 2023

Country	Method one				Method two
	E(RMB)	E*(RMB)	E/E*	type	Increase in TFI by 1 per cent, value added of trade volume (RMB)
Russia	110,434,775,941	128,154,191,886	0.861733622	potential for expansion	-51,251,426
Brazil	58,732,343,632	109,621,570,146	0.535773603	significant potential	-10,961,609
India	116,923,229,369	172,817,161,047	0.676571867	significant potential	51,852,926
South Africa	23,453,090,320	34,807,544,632	0.673793299	significant potential	-13,920,234
Saudi Arabia	42,563,289,162	95,873,936,116	0.443950576	significant potential	-47,924,986
Egypt	14,831,351,818	32,337,713,931	0.458639465	significant potential	-6,466,896
UAE	55,309,419,881	79,888,679,793	0.692331129	significant potential	23,970,199
Iran	9,961,194,622	30,659,242,389	0.324900221	significant potential	-3,065,771
Ethiopia	2,567,716,333	15,153,539,925	0.169446634	significant potential	-1,515,278

Third, China can leverage the categorization of trade potential among BRICS nations to prioritize its trade collaborations. For instance, since Ethiopia's E/E* value is lower than that of Iran, it would be prudent to prioritize trade development with Ethiopia, followed by Iran.

6. Conclusion

This study constructs a trade facilitation framework, measures the trade facilitation levels of BRICS countries, and employs an extended gravity model to investigate the impact of trade facilitation on China's exports and to forecast trade potential. The findings are as follows:

First, the overall trade facilitation level among BRICS countries is low, with half of the nations classified as having inconvenient trade environments. The UAE exhibits the highest trade facilitation level, highlighting the trend that developed countries may not always have high trade facilitation levels, while underdeveloped countries invariably do not.

Second, there is a positive correlation between GDP, total population, and trade facilitation levels of BRICS countries and China's export trade flow to these nations. Among these factors, the influence of total population is relatively modest, whereas the effect of trade facilitation on promoting exports is the most significant.

Third, for China, there remains substantial untapped trade potential with BRICS countries. Although the model regression results indicate that trade facilitation significantly affects trade flow, the actual increase in exports to most BRICS countries following improvements in trade facilitation levels is not substantial. Therefore, alternative strategies, such as enhancing China's economic capacity and accelerating supply chain development, should be pursued to boost export trade flow to BRICS nations.

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Appendix

Appendix 1: Trade Facilitation Indicator Values for BRICS Countries.

Year	Countries	Port Efficiency				Customs Environment		
		Quality of Road Port Facilities	Quality of Railway Infrastructure	Quality of Air Port Facilities	Quality of Sea Port Facilities	Efficiency of Customs Procedures	Tariff Levels	Prevalence of Trade Barriers
2023	China	3.5	4.6	3.3	4.8	4.3	6.2	4.4
	Russia	3.4	4.7	4.4	3.9	3.5	6.5	3.9
	Brazil	2.9	2.1	3.3	2.9	3.1	6.2	3.5
	India	3.6	4.6	4.4	4.3	4.2	6.0	4.3
	South Africa	4.4	3.7	5.1	4.5	3.9	6.6	4.6
	Saudi Arabia	5.0	3.1	4.9	5.2	3.9	6.6	4.6
	Egypt	3.9	3.0	4.9	4.1	3.5	5.8	4.4
	UAE	6.1	4.2	6.1	5.4	4.3	6.7	5.4
	Iran	4.1	3.6	3.3	3.8	3.5	5.2	3.8
	Ethiopia	3.8	2.2	5.2	3.0	3.4	6.0	3.5
2022	China	3.8	4.3	4.5	4.6	4.5	6.2	4.3
	Russia	3.3	4.4	3.9	4.6	3.5	6.6	3.9
	Brazil	3.0	2.1	3.7	2.8	3.3	6.2	3.7
	India	4.1	4.2	4.4	4.5	4.5	6.1	4.2
	South Africa	4.8	3.4	5.1	5.0	4.3	6.5	4.6
	Saudi Arabia	6.0	3.1	5.7	5.2	3.7	6.7	4.7
	Egypt	5.0	3.4	5.0	4.6	2.7	5.9	3.6
	UAE	6.5	4.5	6.2	6.0	4.9	6.6	5.4
	Iran	4.1	3.6	3.3	3.8	3.5	5.2	3.8
	Ethiopia	3.0	1.6	4.6	3.2	3.2	6.1	3.6
2021	China	4.0	4.7	4.2	4.5	4.6	6.3	4.3
	Russia	2.9	4.5	4.9	4.0	3.5	6.6	3.6
	Brazil	3.0	1.8	3.7	2.6	3.5	6.2	3.9
	India	3.9	4.5	4.4	4.4	4.2	6.2	4.0
	South Africa	4.4	3.6	4.7	4.7	4.3	6.5	4.6
	Saudi Arabia	5.9	4.1	5.6	5.2	4.0	6.7	4.7
	Egypt	4.2	3.5	4.6	4.4	3.4	5.8	3.7
	UAE	6.1	4.3	6.4	5.6	4.6	6.7	5.3
	Iran	4.0	3.5	3.2	4.0	3.7	5.0	4.2
	Ethiopia	3.2	2.0	5.0	2.7	3.5	6.1	3.1
2020	China	4.5	4.5	4.2	4.8	4.3	6.3	4.2
	Russia	2.4	4.7	4.9	3.8	3.4	6.6	3.9
	Brazil	3.0	2.2	3.2	3.0	3.3	6.2	3.8
	India	4.4	4.7	4.5	4.1	4.1	6.1	4.6
	South Africa	4.4	3.2	3.8	5.8	4.4	6.5	4.6
	Saudi Arabia	5.6	3.3	5.3	5.0	4.0	6.6	5.1
	Egypt	5.1	3.0	4.6	4.0	2.7	6.0	4.1
	UAE	6.5	4.6	6.4	6.4	4.4	6.7	5.5
	Iran	4.0	3.7	3.4	3.8	3.5	5.1	3.8
	Ethiopia	3.5	3.0	5.0	3.4	2.8	6.0	3.5
	China	4.6	4.5	4.6	4.5	4.6	6.2	4.5
	Russia	3.5	4.9	5	4.7	3.4	6.7	4.1
	Brazil	3	2.5	4.4	3.2	3.4	6.1	3.4
	India	4.5	4.4	4.9	4.5	4.2	6.0	4.5

2019	South Africa	4.5	3.0	5.5	4.5	4.5	6.5	4.3
	Saudi Arabia	5.2	4.5	5.4	4.8	3.8	6.6	4.7
	Egypt	5.1	3.8	5.1	4.8	3.6	6.0	4.5
	UAE	6.0	4.6	6.0	5.5	5.0	6.6	5.3
	Iran	3.9	3.7	3.1	3.7	3.6	5.1	4
	Ethiopia	3	3	3.3	2.8	3.6	6.1	3.6
2018	China	3.5	4.8	4.7	4.6	4.5	6.7	4.5
	Russia	3.3	4.9	4.9	4.6	3.4	6.7	3.9
	Brazil	3	2.5	4.4	3.1	3.4	6.1	3.4
	India	4.4	4.5	4.8	4.6	4.2	6.0	4.5
	South Africa	4.3	3.3	5.3	4.5	4.5	6.5	4.2
	Saudi Arabia	5	3.9	5.2	4.6	3.8	6.6	4.5
	Egypt	4.5	3.6	5.1	4.6	3.6	5.9	4.3
	UAE	5.9	4.6	5.9	5.4	5.0	6.6	5.3
	Iran	3.9	3.8	3.3	3.9	3.6	5.0	3.9
	Ethiopia	3.3	2.9	4.0	2.8	3.6	6.0	3.8

Appendix 2: Trade Facilitation Indicator Values for BRICS Countries.

Year	Countries	Institutional Environment				Business Environment			
		Policy Transparency	Burden of Government Regulation	Effectiveness in Resolving Legal Conflicts	Business Costs of Crime and Violence	Application of New Technology	Absorption of New Technology by Firms	Availability of Financial Services	Affordability of Financial Services
2023	China	4.3	4.5	4.2	4.9	4.5	4.4	3.9	4.7
	Russia	3.8	3.1	3.4	4.6	4.1	4.2	3.1	3.8
	Brazil	3.9	2.0	3.0	3.5	4.4	4.1	3.3	6.0
	India	3.6	3.6	3.9	4.4	4.9	4.7	2.9	4.3
	South Africa	5.5	2.9	4.9	3.1	4.4	3.9	3.2	5.5
	Saudi Arabia	3.4	4.3	4.5	5.8	5.6	4.2	3.4	6.2
	Egypt	2.9	3.0	3.7	2.3	4.5	4.5	3.3	4.4
	UAE	5.0	5.1	5.3	6.2	6.1	4.8	4.3	5.7
	Iran	3.2	2.4	3.4	4.0	4.9	3.5	2.7	3.7
	Ethiopia	3.7	3.8	3.5	4.5	3.8	3.8	3.3	4.3
2022	China	3.8	4.8	4.5	4.2	4.4	4.6	3.7	4.7
	Russia	4.1	2.8	3.4	4.7	4.4	4.2	2.6	3.9
	Brazil	3.5	1.7	3.0	3.2	4.4	4.4	3.2	6.2
	India	3.4	3.7	4.3	4.3	4.5	5.1	4.5	5.4
	South Africa	4.8	2.7	5.3	2.5	4.5	5.3	3.7	6.5
	Saudi Arabia	2.2	3.9	4.7	6.2	4.7	5.5	4.2	6.1
	Egypt	3.5	3.3	3.9	4.4	3.8	3.4	2.6	4.9
	UAE	5.1	5.1	4.9	6.1	5.1	4.5	4.6	5.6
	Iran	3.2	2.4	3.4	4.0	4.9	3.5	2.7	3.7
	Ethiopia	3.4	3.5	3.3	4.9	3.8	3.7	3.1	4.0
2021	China	1.7	4.2	4.7	4.2	4.4	4.6	3.8	4.6
	Russia	4.1	2.9	3.4	4.6	4.2	4.0	2.6	4.0
	Brazil	5.0	1.9	3.0	3.0	4.5	3.8	2.9	5.7
	India	3.6	3.8	4.3	4.4	5.0	4.9	3.2	4.0
	South Africa	5.6	3.2	4.9	3.1	4.5	4.2	3.0	6.5
	Saudi Arabia	3.6	3.9	5.0	5.9	5.4	4.9	4.3	6.2
	Egypt	3.2	2.9	3.5	3.9	4.5	4.6	2.4	4.2
	UAE	5.0	4.9	5.5	6.2	6.3	5.9	4.5	5.5

	Iran	3.8	2.5	3.4	4.3	4.6	4.5	2.6	3.8
	Ethiopia	3.4	3.5	3.9	4.2	3.8	3.6	2.3	3.7
2020	China	4.6	4.5	4.2	4.8	4.4	4.2	4.0	5.1
	Russia	4.5	3.2	3.0	4.6	4.1	4.0	2.6	3.8
	Brazil	4.0	2.0	2.8	2.8	4.4	4.1	3.2	6.0
	India	4.1	4.3	4.4	4.3	4.4	4.6	4.6	4.8
	South Africa	6.0	2.8	5.0	2.6	5.2	4.1	3.7	6.0
	Saudi Arabia	4.2	4.6	5.0	5.7	5.6	5.7	4.1	5.9
	Egypt	3.9	3.1	3.9	4.0	4.4	4.3	3.1	5.5
	UAE	5.2	4.8	5.5	6.3	5.9	5.4	4.1	5.4
	Iran	3.6	2.7	3.5	4.4	4.0	4.8	2.4	2.9
	Ethiopia	3.4	3.5	3.5	5.2	3.4	3.5	2.2	4.6
2019	China	0.91	4.4	4.1	4.6	4.4	4.2	4.4	4.5
	Russia	5.04	3.2	3.5	4.6	3.7	3.6	2.8	3.9
	Brazil	5.39	1.7	2.7	3	4.2	3.8	3.1	5.9
	India	3.36	4.1	4.1	4.3	4.6	4.1	4.2	4.6
	South Africa	6.23	3.0	4.6	3.2	4.4	4.0	3.1	5.7
	Saudi Arabia	0.07	4.7	5.1	5.9	5.2	4.2	4.4	6
	Egypt	2.87	3.4	3.9	5.3	4.6	3.4	3.1	5.9
	UAE	4.5	5.2	5.5	6.1	5.2	4.7	4.8	5.5
	Iran	3.8	2.4	2.7	3.9	3.8	3.3	2.2	2.8
	Ethiopia	3.7	3.2	3.5	3.4	3.4	3.4	3.3	3.7
2018	China	4.5	4.0	4.1	4.2	4.3	4.2	4.4	4.5
	Russia	4	3.3	3.5	4.7	4.2	3.6	3.3	3.7
	Brazil	3.2	1.6	2.7	3.5	4.1	3.8	3.3	5.7
	India	4	4.5	4.5	4.4	4.7	4.6	4.8	4.6
	South Africa	4.5	3.2	4.2	3.4	4.2	3.9	3.7	5.2
	Saudi Arabia	4.4	4.3	4.9	5.7	4.7	4.0	4.2	5.7
	Egypt	3.9	3.2	3.7	5.3	4.2	3.1	3.6	5.6
	UAE	4.5	5.0	5.3	5.9	5.0	4.3	4.7	5.3
	Iran	3.8	3.1	3.1	4.4	3.9	3.5	2.9	3.1
	Ethiopia	3.7	3.8	3.7	4.5	3.7	3.6	3.7	3.6