Study On Trade Efficiency and Influencing Factors Between China and CPTPP Member Countries

Ziyi Ding *, Hongbing You

School of Economics and Management, Nanjing University of Science and Technology, Nanjing, China

* Corresponding Author Email: dingziyii0105@163.com

Abstract. Based on the current development situation of economic and trade cooperation between China and CPTPP countries, this paper summarizes the bilateral trade between China and eleven member countries, describes the scale of bilateral trade, trade trend and trade balance, describes the trade structure and analyses the market structure. Using the stochastic frontier gravity model to analyze the trade efficiency, trade inefficiency, and influencing factors between China and CPTPP member countries, it is found that the trade between China and CPTPP member countries develops rapidly, the scale is increasing, and the main import and export products are machinery and transport equipment; secondly, the economic scale of China and CPTPP member countries has a positive impact on the trade efficiency, and it is important to strengthen the connectivity of liner shipping, signing FTAs, and to enhance the trade efficiency of China and its member countries. Secondly, the economic scale of China and CPTPP member countries has a positive impact on trade efficiency, strengthening liner shipping connectivity and signing FTAs can reduce trade barriers, which is conducive to trade exports and improve trade efficiency. Finally, there is a large difference in trade efficiency between China and CPTPP member countries, and the Asia-Pacific region has a greater trade potential. Given the above findings, the article puts forward relevant suggestions, to improve trade efficiency, docking international high standards of trade norms, should optimize the commodity structure, strengthen the construction of logistics, and actively promote the FTA negotiations.

Keywords: CPTPP; Stochastic Frontier; Trade Efficiency.

1. Introduction

In March 2018, 11 member countries held a negotiation on the CPTPP agreement in Chile and held a signing ceremony, and the CPTPP officially entered into force in December of the same year. In recent years, China has joined the Regional Comprehensive Economic Partnership Agreement (RCEP), and the negotiations on the China-Eu Comprehensive Investment Agreement (CAI) have also been completed. On September 16, 2021, China took an important step toward a high-standard international free trade area and formally submitted a written letter applying to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership.

CPTPP has always been widely concern by academics, and since its introduction, some scholars have analyzed the differences between CPTPP and other agreements as well as the impact on China, for example, Fan [1] puts forward the impact of the agreement on China's role in the global economic and trade pattern by analyzing the characteristics of the CPTPP rules and says that China should actively promote the strategy of the FTA to cope with the new trade pattern; Bai and Su [2] compare the differences between CPTPP and TPP through textual analysis method, analyze and illustrate the possible trade and investment transfer effects of CPTPP on China, and show that joining CPTPP will be beneficial for China to further deepen reforms and regulate trade friction from the level of trade rules and strategies. Yu, Liao and Du [3] analyze the agreement's scope and the dispute settlement's ability to indicate that China should carry out reforms and explore the rules to achieve a higher level of standards. Some scholars also analyze China's path to joining the CPTPP by comparing the rules and provisions of the agreement. For example, Yu and Jiang [4] compare the RCEP and the CPTPP, summarize the rules and put forward the countermeasures China needs to take in the face of the new rules in the four aspects of trade, investment, property rights protection and enterprise reform. Liu and Yu [5] show that China can join CPTPP by analyzing the provisions and should seize the strategic

window to use the APEC platform to upgrade the provisions of the first trade agreement and establish a domestic high-standard trade provisions system from shallow to deep. Zhou and Huang [6] illustrate that China's accession to the CPTPP is necessary from the aspects of changes in trade patterns, investment benefits, and rule systems.

There are also scholars using empirical studies, for example, Guan and Liang [7] assessed the situation after China's accession to the CPTPP based on a general equilibrium model, and the results showed that the accession to the agreement would promote the development of China's traditional advantageous industries and accelerate regional integration. Peng and Jiang [8] use a computable general equilibrium model to demonstrate that joining the CPTPP can bring geopolitical as well as economic benefits to China. Ge, Yan and Zhao [9] find that China's overall agricultural products are at a competitive disadvantage by joining the CPTPP through an ARIMA model, and that China's agricultural products have strong export complementarities for CPTPP member countries. Zhao and Lang [10] simulate tariff shocks by constructing GTAP model to analyze China's welfare level and trade in services after China's accession to the CPTPPP and suggests the adoption of the Belt and Road policy to implement the "going out" strategy. There are also foreign scholars to study CPTPP, for example, Eugene [11] said that in the context of the new Crown Pneumonia epidemic, Singapore has to push forward the domestic reform and further open up to the outside world, to benchmark the CPTPP's high standards of rules. Petry and Plummer [12] concluded through empirical research that the country can gain $298 billion if it joins the CPTPP, and if it does not join the CPTPP, then the likes of Japan, Australia.

At present, most of the scholars' research on CPTPP is carried out by methods such as comparison of existing data and text analysis, and the research is mostly focused on the industrial level, with less research on the overall trade volume efficiency. This paper describes the current situation by analyzing China's trade data in the 11 member countries of the CPTPP, and, at the same time, adopts the stochastic frontier gravity model to study the trade efficiency. Finally, the relevant recommendations are summarized.

2. Status of China's Trade with CPTPP Member Countries

2.1. Analysis of the Scale of Trade

Between 2011 and 2022, China's total exports increased from US$189.8 billion to US$359.4 billion, and total imports increased from US$174.3 billion to US$271.6 billion, furthering the level of foreign trade development. China's trade with CPTPP countries is closely related. In 2022, China's export trade to CPTPP member countries will be US$750.89 billion, accounting for about 20.9% of China's total exports; and its import trade will total US$705.02 billion, accounting for about 25.96% of total imports.

In terms of import and export, the total import and export trade between China and CPTPP member countries shows a rising trend. Among them, China's export trade volume to Japan, Vietnam and Malaysia ranked the top three in 2022, and the year-on-year growth rates of Singapore, Vietnam and Malaysia's export trade volume ranked the top three, with 47%, 30% and 19%, respectively; Australia, Japan and Malaysia ranked high in import trade volume, and the year-on-year growth rates of Canada, Chile and Malaysia's import trade volume ranked the top three, with 39%, 13% and 12%.

In terms of trade balance, from 2011 to 2022, China consistently shows a trade surplus with Canada, Mexico, Singapore, and Vietnam, and a trade deficit with Chile, Peru, Japan, Malaysia, Australia, and New Zealand. compared to the growth in imports, China's exports to New Zealand grow faster, and the trade deficit is getting bigger and bigger.

In the past ten years, China and CPTPP countries have close trade relations, and the overall scale of the CPTPP countries maintained a rise. 2015 by the impact of international energy prices, the price of minerals fell, Mexico, Chile and Peru's trade volume declined in 2016 the international market crude oil prices fell as well as the decline in commodity prices caused by a significant reduction in

the volume of foreign trade, the epidemic on international trade imports and exports also have a certain impact.

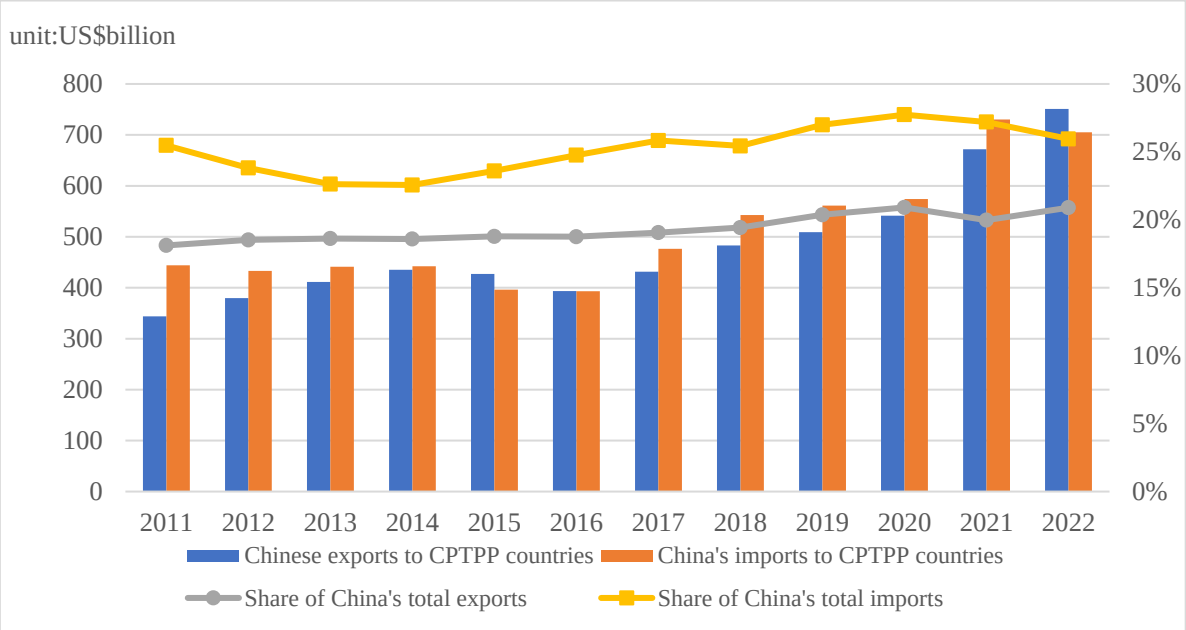

Fig. 1 China's Trade Volume and Share with CPTPP Member Countries

2.2. Analysis of the Structure of Trade

Trade by product between China and CPTPP members in 2022 is shown in Table 1. machinery and transport equipment are the main trade products, reflecting the importance of capital - and technology-intensive products in China's foreign trade. In second and third place are miscellaneous manufactured articles and manufact goods classified chiefly by material, which are labor-intensive products, while the trade volume of crude materials, inedible, except fuels, animal and vegetable oils and fats, beverages, tobacco and other resource-intensive products is significantly smaller. The value of exports of machinery and transportation equipment, miscellaneous products and finished raw materials was much greater than the value of imports, while the value of imports of other products was greater than the value of exports, indicating that China is more dependent on imports for resource-intensive products.

As the first major category of China's foreign trade exports, in 2022, China's exports of machinery and transport equipment products reached a total of $ 320.3 billion, but China's exports of this category of goods are mainly labor-intensive products on the commodity value-added is low, the quality of the goods is not high, compared with the mastery of high-tech countries, in the competitiveness of the country, there is still a certain gap. Miscellaneous products in the textile products are mainly involved in China's traditional labor-intensive export products, due to China's textile industry chain development being perfect, the competitive advantage is very obvious.

Table 1. 2022 China's Trade Volume and Share by Product with CPTPP Member Countries

Product Category	Trade volume (US$billion)			Proportion		
	Export	Import	Balance of trade	Export	Import	Balance of trade
Machinery and transport equipment	320.30	217.10	103.2	42.66%	30.79%	3203.03
Miscellaneous manufactured articles	170.39	59.37	111.02	22.69%	8.42%	1703.90
Manufact goods classified chiefly by material	135.90	47.10	88.8	18.10%	6.68%	1358.96
Chemicals	62.83	63.14	-0.31	8.37%	8.96%	628.31
Food and live animals	23.43	39.90	-16.47	3.12%	5.66%	234.27
Mineral fuels, lubricants and related materials	19.62	68.21	-48.59	2.61%	9.67%	196.23
Commod&transacts.Not class.Accord.To kind	10.10	30.41	-20.31	1.34%	4.31%	100.99
Crude materials, inedible,except fuels	7.11	175.71	-168.6	0.95%	24.92%	71.05
Animal and vegetable oils and fats	0.88	3.15	-2.27	0.12%	0.45%	8.79
Beverages and tobacco	0.34	0.95	-0.61	0.05%	0.13%	3.39

Source: UNCOMTRADE

2.3. Analysis of Market Structure

CPTPP member countries consist of 11 countries - Japan, Australia, Canada, Singapore, Brunei, Malaysia, Vietnam, New Zealand, Chile, Mexico, and Peru - which together cover a population of 510 million people and a combined GDP of more than US$13.5 trillion, accounting for about 13% of the world's total economy. Among the CPTPP member countries, China's exports to Japan, Vietnam, and Malaysia ranked highly, and the imports to Japan, Australia and Malaysia ranked high.

3. Model Setting and Variable Selection

The above shows that China has a close trade relationship with CPTPP member countries, and based on the above facts, this chapter will draw on scholars' empirical models to further explore China's trade efficiency and potential with CPTPP member countries.

3.1. Theoretical Models

Nilsson [13] and Egger [14]proposed to use the fitted value of trade estimated by the traditional gravity model as the "trade potential" and to measure trade efficiency by the ratio of the actual trade volume to the trade potential, but this approach ignores trade resistance, Meeusen [15] and Aigne et al. [16] are the first group of scholars to put forward the stochastic frontier analysis method, initially used in the analysis of technical efficiency, the stochastic perturbation term will be decomposed into the "immediate shocks" and "technical inefficiency term". ". The general functional form of the model is:

$$Y_{it} = f(x_{it}, \beta)\exp(v_{it} - \mu_{it}) \quad (1)$$

$$Y_{it}^{*} = f(x_{it}, \beta)\exp(v_{it}) \quad (2)$$

$$TE_{it} = \frac{Y_{it}}{Y_{it}^{*}} = \exp(-\mu_{it}) \quad (3)$$

Where Y_{it} represents the actual trade volume between country i and country j during period t, Y_{it}^{*} represents the level at which trade is maximized, and TE_{it} represents trade efficiency. ν_{it} is the random error term, μ_{it} is the trade inefficiency term, representing the trade resistance that is not included in the gravity model but can be changed, and β is the parameter to be estimated.

Battese and Coelli [17] proposed a time-varying model on this basis because trade inefficiencies change with time. The specific model is as follows:

$$\mu_{it} = \{exp[-\eta(t - T)]\}\mu_i \qquad \mu_{it} \geq 0 \tag{4}$$

Where, μ_{it} follows a semi-normal truncated distribution, η is the parameter to be estimated, $\eta > 0$ means that the trade inefficiency item increases with time, $\eta < 0$ means that the trade inefficiency item decreases with time, and does not change with time when $\eta = 0$.

After estimating the value of trade efficiency, it is also necessary to establish an inefficiency model to analyze the influencing factors of trade efficiency. The two-step method used in the early stage had inconsistent assumptions. Battes proposed a one-step method to regress non-efficiency items in the stochastic frontier gravity model, overcoming the defects of the two-step method. The application of stochastic frontier model in China focuses on the analysis of economic efficiency, and the results are elementary. Wu [18] used this method for the first time to determine the export potential of various regions in China and analyze the influence of the system on the export.

3.2. Empirical Models

The stochastic frontier gravity model is evolved from the traditional gravity model. Referring to the model design of Armstrong [19], the stochastic frontier gravity model designed in this paper is as follows:

$$lnY_{it} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDis_{ij} + \beta_4 Lang_{ij} + \nu_{ijt} - \mu_{ijt} \tag{5}$$

After calculating the trade efficiency, the one-step method is used to construct the non-efficiency model, which is as follows:

$$\mu_{ijt} = \delta_0 + \delta_1 TAF_{jt} + \delta_2 SHP_{jt} + \delta_3 GI_{jt} + \delta_4 GS_{jt} + \delta_5 TF_{jt} + \delta_6 FTA_{ij} + \delta_7 RECP_{ij} + \varepsilon_{ijt} \tag{6}$$

The variables are described in Table 2.

Table 2. Descriptions of Article Variables

Expression	Variable Description
Y_{it}	China's trade exports to CPTPP member countries in period t
GDP_{it}	GDP of exporting countries in period t (measured in current US dollar purchasing power parity)
GDP_{jt}	GDP importing country in period t (measured in current US dollar purchasing power parity)
Dis_{ij}	The distance between the capital of China and the capital of the CPTPP member countries
$Lang_{ij}$	Whether China and the member states have a common language
TAF_{jt}	Tariff levels of CPTPP member countries in period t
SHP_{jt}	Liner transport connectivity index of CPTPP member countries in period t
GI_{jt}	The degree of government integrity of CPTPP member countries in period t
GS_{jt}	The extent of government spending in CPTPP member countries in period t
TF_{jt}	Trade freedom for CPTPP members in period t
FTA_{ij}	Dummy variable: Whether to sign a free trade agreement
$RCEP_{ij}$	Dummy variable: Whether the importing country joins the RCEP organization

3.3. Variable Selection and Data Sources

In this paper, GDP is chosen to reflect the economic scale of China and the member countries, and the distance between the two countries capitals is chosen to reflect the trade cost brought by distance. The spatial distance is transformed into the economic distance by using the product of distance and international crude oil price. Tan and Zhou [20] pointed out in their research that trade volume is also a function, which is affected by variables such as economic scale, geographical distance, and culture among countries. Therefore, the stochastic frontier method can be applied to analyze trade potential. The stochastic frontier gravity model, on the other hand, more carefully divides the stochastic disturbance terms into human and natural factors. Thus, in selecting variables with non-efficiency conditions, tariff levels, liner connectivity, economic freedom, government efficiency and the status of trade agreements are selected as trade barriers that can be changed through human resources.

The panel data of trade between China and CPTPP member countries from 2011 to 2022 are from the UN-Comtrade database; GDP, and TAF data are derived from the World Bank's WDI database; Dis and Lang data used the CEPII database; SHP data from UNCTAD; GI, GS and TF data come from the Economic Freedom database published by the Heritage Foundation. FTA data come from the Free Trade zone service network.

4. Empirical Analysis

4.1. Results of Stochastic Frontier Gravity Model

In this paper, Stata17 software is used to estimate the above model. Firstly, the likelihood ratio test is carried out. Specifically, two tests are carried out: the time variability test of trade efficiency and the non-existence test of trade efficiency. The results show that the null hypothesis is rejected, and trade inefficiencies exist and change with time.

Table 3. Results of Likelihood Ratio Hypothesis Test for Stochastic Frontier Gravity Model

Null Hypothesis	Constraint Model	Unconstrained Model	LR Statistic	P-value	Test conclusion
Trade inefficiencies do not exist	7.04	10.44	6.80	0.0091	Reject
Trade inefficiency does not change	10.44	10.97	1.06	0.0302	Reject

After the model is tested, the stochastic frontier gravity model is used to estimate the trade between China and CPTPP member countries from 2011 to 2022. To compare the results, the estimation results of the time-varying model and the time-invariant model are made in this paper, as shown in Table 4. All explanatory variable symbols in the results of the two models are the same, indicating that the results are robust. In the time-varying model, the γ value is significant and close to 1, indicating that the coincidence error term originates from the trade inefficiency term. The specific analysis is as follows:

$lnGDP_{it}$ is significantly positive at 1% level, and an increase of 1% in China's economic scale can boost the trade volume by 1.247%. $lnGDP_{jt}$ is significantly positive at 5% level, indicating that an increase of 1% in the economic scale of member countries can boost the trade volume by 0.777%. To some extent, the economic scale reflects the consumption level of the people. The expansion of the economic scale means the expansion of demand at the consumption side, and also reflects the domestic productivity. The improvement of productivity promotes the development of commodity competitiveness at the supply side. Distance variable $lnDIS_{ij}$ has no significant effect on export value, which indicates that distance is not the main factor affecting China's trade with CPTPP member countries. The above shows that China has a close trade relationship with CPTPP member countries,

and based on the above facts, this chapter will draw on scholars' empirical models to further explore China's trade efficiency and potential with CPTPP member countries.

Table 4. Results of The Trade Inefficiency Model

VARIABLES	Time-varying model	Time-invariant model
$lngdp_{it}$	1.247***	0.620***
	(0.436)	(0.0707)
$lngdp_{jt}$	0.777**	1.005***
	(0.336)	(0.111)
$lndis_{ij}$	0.0465	0.0579
	(0.0573)	(0.0527)
Lang	1.344***	1.245**
	(0.419)	(0.537)
Constant	-32.44***	-20.68***
	(11.88)	(2.911)
Sigma	-0.736	-0.698
	(0.603)	(0.457)
Gamma	2.609***	2.658***
	(0.673)	(0.514)
Mu	3.195	2.028***
	(7.298)	(0.554)
eta	-0.0152	
	(0.0300)	
Observations	132	132
Number of id	11	11

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2. Results of the Trade Inefficiency Model

The trade inefficiency model is further estimated, and the results obtained are shown in Table 5, which shows that the sign of the coefficient of $Tariff_{ij}$ is negative, indicating that the tariff level has a positive impact on trade efficiency, but the indicator does not pass the test of significance, which suggests that the level of tariffs as well as is not the main factor that hinders trade, and the impact of tariffs is getting smaller and smaller with the development of regional economic integration. The coefficient of liner transport connectivity passes the test and is significant at 1% with a negative sign, indicating that strengthening liner transport connectivity is conducive to trade exports and improving trade efficiency. In terms of economic freedom, the indicators of government integrity and trade freedom have a significant impact and a positive sign, indicating that government integrity as well as trade freedom are negatively related to trade efficiency. Government expenditure did not pass the test, indicating that government out is not the main factor affecting trade. In today's complex trade background, a highly open economy represents a freer market, which will also lead to a market more vulnerable to external shocks and influences, such as the substitution effect of trade and other negative impacts, which will hinder the development of trade. The coefficients of the indicators of $FTA_{ij}$and $RCEP_{ij}$ are both negative, which indicates that actively signing FTAs can improve trade efficiency and reduce trade obstacles.

Table 5. Results of The Trade Inefficiency Model

VARIABLES	inefficiency
lTAF	-0.0146
	(0.124)
lSHP	-0.322***
	(0.0847)
lGI	0.689***
	(0.198)
lGS	0.153
	(0.273)
lTF	3.270***
	(1.203)
RCEP	-0.329***
	(0.0976)
FTA	-0.194
	(0.131)
Constant	-13.26**
	(5.352)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3. Measurement of Trade Efficiencies and Potentials

According to the results of the model to measure the trade efficiency, the results are shown in Table 6, the larger the value of trade efficiency represents the smaller the trade potential between the two sides, the trade potential is reflected by the ratio of the actual trade volume and trade efficiency. From the table, it can be seen that there is still a large trade potential between China and CPTPP member countries, especially New Zealand, Canada and Peru. The lower trade efficiency with Australia's member countries indicates that there is still room for further improvement in China's current level of cooperation with Australia and New Zealand. In addition, by observing the trade efficiency between China and the Asian member countries of CPTPP, it can be seen that China has a higher level of cooperation with Asian countries. The above conclusion also shows that China's accession to the CPTPP can improve trade efficiency and lead to a higher level of cooperation.

Table 6. Trade Efficiency Results

Countries	Trade Efficiency	Trade Potential	Trade Expansion of Growth
Canada	0.025	2179.51	39.58
Chile	0.047	478.92	20.27
Mexico	0.039	2007.26	24.89
Peru	0.028	478.96	34.39
Japan	0.053	3263.51	17.87
Singapore	0.036	2274.27	27.02
Brunei	0.028	29.34	34.30
Malaysia	0.035	2657.39	27.36
Vietnam	0.282	520.30	2.54
Australia	0.040	1955.78	23.81
New Zealand	0.020	448.92	47.93

5. Conclusions and Policy Recommendations

5.1. Conclusions

Unlike the inclusiveness and flexibility of the RCEP economic integration path, the CPTPP is an agreement characterized by a high level and high standards, dominated by the vertical path of the regional economy [21]. It links the content of all provisions to the dispute settlement mechanism, which ensures that the agreement is binding on member states. In terms of specific content provisions, CPTPP breaks through the level of liberalization of trade in goods to reach nearly 100% openness, while the agreement continues the high standard rule system in the core areas of the TPP.

Through the stochastic frontier gravity model, this paper measures the trade potential between China and CPTPP member countries and analyses its influencing factors, and draws the following conclusions:

First, the trade between China and CPTPP member countries is developing rapidly and increasing in scale, and the main import and export product categories are machinery and transport equipment.

Second, the economic scale of China and CPTPP member countries has a positive impact on trade efficiency, and strengthening liner shipping connectivity and signing FTAs can reduce trade barriers, favor trade exports and improve trade efficiency.

Third, there are big differences in trade efficiency between China and CPTPP member countries, with higher trade efficiency with Vietnam and Japan, and lower trade efficiency with Canada and New Zealand; and higher trade potential with CPTPP member countries in Asia, such as Japan, Malaysia and Singapore.

5.2. Policy Recommendations

Based on the above conclusions, the following recommendations are made:

First, strengthen trade cooperation, optimize trade structure, accelerate the transformation and upgrading of traditional industries such as manufacturing, and develop more new industries with higher technological level. Studies have shown that joining the CPTPP to buttress high-standard trade agreements will gain new market access opportunities for trade in goods and services [22], broaden trade import channels, tap more trade potential, strengthen cooperation with CPTPP member countries in the fields of agriculture, services, etc., and open up different forms of cooperation according to the factor endowment and degree of openness of different countries. Promote the sustainable development of trade cooperation.

Second, in addition to tapping the trade potential with CPTPP member countries, it is necessary to deepen the reform of state-owned enterprises, deeply tap the internal trade potential, actively promote the construction of the management system of state-owned enterprises and start from the enterprise level to improve the overall efficiency. We will encourage enterprises to innovate, narrow the gap in technology and improve the competitiveness of Chinese enterprises. Improve the review process and supervision management related to international cooperation and promote the process of unification of technical standards. [23]

Third, accelerate the construction and upgrading of the logistics system and improve the transport network. Efficient logistics and transport are a strong guarantee for the growth of trade in today's world. Promote the interconnection of trade between China and CPTPP member countries, pay attention to the construction of the logistics system in all aspects such as sea transport, land transport, air transport, etc., weakening the constraints of geographic distance on trade, which can reduce the cost of trade, and strengthen trade ties.

Fourth, actively promote regional economic development and FTA negotiations. some provisions of the CPTPP conflict with China's economic system, such as e-commerce, state-owned enterprises, designated monopolies, etc., and should be prepared for negotiation, in addition to the need for upgrading the existing FTAs to form a higher level of international economic and trade cooperation.

References

[1] Fan Ying. The characteristics and influence of CPTPP and China's countermeasures. Contemporary World, 2018(09):8-12.

[2] Bai Jie, Su Qingyi. CPTPP rules, Impacts and China's countermeasures: An analysis based on comparison with TPP. International Economic Review, 2019(01):58-76+6.

[3] Yu Peng, Liao Xianglin, Du Guochen. A comparative study of RCEP and CPTPP and policy suggestions. Intertrade, 2021(08):27-36.

[4] Yu Miaojie, Jiang Haiwei. Comparative study and policy recommendations of RCEP and CPTPP. International Economic Review, 2021(02):129-144+7.

[5] Liu Bin, Yu Jimin. The feasibility and path choice of China joining CPTPP. Asia-Pacific Economic Review, 2019(05):5-13+149.

[6] Zhou Hanmin, Huang Hua. Necessity and feasibility analysis of China joining CPTPP. Journal of Shanghai University of International Business and Economics, 2021, 28(03):5-17.

[7] Guan Bing, Liang Yixin. Should China join the CPTPP? —General equilibrium analysis based on GTAP. Journal of Nanjing University of Finance and Economics, 2019(03):71-82.

[8] Peng Lei, Jiang Yue. An empirical study on the feasibility of China' s accession to CPTPP and the alternative. International Economics and Trade Research, 2021, 37(08):99-112.

[9] Ge Ming, Yan Shili, Zhao Suping. Research on the competitiveness and complementarity of agricultural products trade between China and CPTPP. Issues in Agricultural Economy, 2022(12):121-135.

[10] Zhao Lingfei, Lang Lihua. From TPP to CPTPP: A simulation study on the internationalization of China manufacturing industry: Based on GTAP model analysis. International Business, 2018(05):61-72.

[11] Eugene K.B. Tan. Singapore in 2020: The "crisis of a generation"–Challenges, change and consequences. Southeast Asian Affairs, 2021.

[12] Petri P. A, M. G. Plummer. The Trans-Pacific partnership and Asia-Pacific integration, policy implication. Peterson Institute for International Economics Policy Brief, 2020.

[13] Nilsson L. Trade integration and the EU economic membership criteria. European Journal of Political Economy, 2000, 16(4):807-827.

[14] Egger P. An econometric view on estimation of gravity models and the calculation of trade potentia1. The World Economy, 2002, 25(2):297-32.

[15] Meeusen Wim, Van Den Broeck, Julien. Efficiency estimation from Cobb-Douglas production functions with composed error. International Economic Review, 1977(2):435-444.

[16] Aigner D, Lovell C A K, Schmidt P. Formulation and estimation of stochastic frontier production function models Jl. Journal of Econometrics, 1977,6(1): 21-37.

[17] Battese G E, Coelli T J. Frontier production functions, technical efficiency and panel data: with application to paddy farmers in India. Journal of Productivity Analysis, 1992(1).

[18] Wu. Export potential and determinants among the Chinese regions. Working Papers, 2003.

[19] Armstrong S. Measuring trade and trade potential: A survey. East Asian Bureau of Economic Research, 2007.

[20] Tan Xiujie, Zhou Maorong. Export potential of 21st-Century maritime silk road and lts determinants: an empirical research based on stochastic frontier gravity model. Journal of International Trade, 2015, 386(02):3-12.

[21] Hsieh, P L. New Asian regionalism in international economic law. Cambridge University Press, 2022:67-71.

[22] Suominen, K. CPTPP as a global "docking station" for free traders? prospective members and potential gains. Center for Strategic and international Studies, 2024, 1-15.

[23] Feng Anquan. Strategic considerations on China joining CPTPP under the new development pattern. Economic Review Journal, 2021(07):79-84.