The Role of Free Trade Agreements in Reducing Trade Costs: A Panel Data Analysis

Yixin Zhang*

School of Economics, Northwest University of Political Science and Law, Xi’an, China

*Corresponding Author Email: yixinzhang_zyx@163.com

Abstract. Since the second half of the 19th century, three waves of globalization have accelerated the process of trade liberalization, leading to a significant reduction in global trade costs. Meanwhile, the number of Free Trade Agreements (FTAs) signed worldwide has increased rapidly, and the proportion of "WTO-X" provisions in newly signed agreements has continued to rise. The correlation between these two phenomena has attracted widespread attention. This paper aims to explore the role of free trade agreements in reducing trade costs. It measures trade costs based on the gravity model framework and constructs a panel data model for analysis. The model takes bilateral trade costs (including total trade costs, agricultural trade costs, and manufacturing trade costs) as the explained variables, with the actual number of FTAs and core depth as the core explanatory variables, while incorporating relevant control variables. The research results show that the actual number and core depth of FTAs have a significant negative impact on total trade costs and manufacturing trade costs, but a significant positive impact on agricultural trade costs. Regarding control variables, the difference in per capita GDP and geographical distance are positively correlated with trade costs, while common currency and WTO membership are negatively correlated with trade costs. Endogeneity and robustness tests verify the reliability of the above results. This study provides a reference for countries to formulate trade policies and promote the development of free trade agreements to reduce trade costs.

Keywords: Free Trade Agreement; Trade Cost; Panel Data; Gravity Model.

1. Introduction

Since the second half of the 19th century, the world has experienced three major waves of globalization, and the process of trade liberalization has been accelerating. In this process, the trade costs of major countries have significantly decreased, and at the same time, the number of Free Trade Agreements (FTAs) signed has increased rapidly worldwide [1]. It is worth noting that newly signed free trade agreements increasingly contain more high-standard "WTO-X" provisions, such as competition policies, capital flows, labor standards, and environmental protection. The simultaneous emergence of these two economic phenomena seems to imply that the signing of free trade agreements, especially those containing more "high-standard" provisions, is related to the reduction of trade costs.

From the perspective of traditional trade theory, trade costs were once ignored, regarded as similar to friction in physics, and it was believed that including them in the model would not produce substantial changes. Because even if trade costs restrict the equalization of factor prices and commodities and reduce trade flows, they do not change the determinants of the traditional trade model such as comparative advantage. However, with the development of international trade and its theories, the importance of trade costs has become increasingly prominent. For example, Samuelson [2] first proposed the concept of iceberg costs, emphasizing the costs of products in transportation between regions; Hummels et al. [3] and Yi [4] pointed out the core role of trade costs in vertical specialization; in the new-new trade theory initiated by Melitz [5], trade costs are a key assumption, and their existence makes firm heterogeneity play a role. In addition, in the new economic geography, trade costs are also a key factor in understanding enterprise location choices and the spatial agglomeration and diffusion of economic activities.

However, although a large number of literatures have studied the relationship between free trade agreements and macroeconomic indicators such as GDP and trade flows, trade costs, as an important intermediary between free trade agreements and many economic variables, few literatures have studied the direct relationship between free trade agreements and trade costs [1,6]. In addition, most previous studies regarded free trade agreements as binary dummy variables to examine their impact on trade costs, which implies the assumption that free trade agreements are completely homogeneous, which is inconsistent with reality. In fact, there are significant differences in the number and content depth of free trade agreements signed between different country combinations. In terms of quantity, some country combinations have signed more than one free trade agreement; in terms of content depth, different free trade agreements also have significant differences in the depth of provisions.

In view of this, by in-depth studying the relationship between free trade agreements and trade costs, this paper aims to provide a new perspective and empirical basis for understanding how free trade agreements promote trade growth by reducing trade costs, and provide targeted policy recommendations for the future development of free trade agreements.

2. Research Methods

2.1. Theoretical Mechanism and Research Hypotheses

The impact mechanism of free trade agreements on trade costs can be analyzed from three aspects: tariff reduction, regulatory integration, and the "spaghetti bowl" phenomenon.

Firstly, tariff reduction is a traditional issue in free trade agreements, and almost all free trade agreements include provisions for tariff reduction on industrial and agricultural products. The reduction of tariffs directly reduces policy barriers in the trade process, thereby reducing trade costs. According to tariff theory, the reduction of tariffs can reduce the price of imported goods, increase the competitiveness of imported goods, and thus promote trade growth. In addition, the reduction of tariffs can also reduce uncertainty in the trade process and lower transaction costs for enterprises. Free trade agreements directly reduce tariff costs through clear commitments to tariff reduction. In addition, free trade agreements also further reduce trade costs by simplifying customs procedures and reducing export taxes.

Secondly, free trade agreements not only include traditional tariff reduction provisions, but also increasingly cover "WTO-X" provisions, such as competition policies, environmental protection, and labor standards. These provisions reduce transaction costs caused by differences in standards or systems by promoting policy coordination and regulatory integration among member states. According to the new-new trade theory, regulatory integration can improve the production efficiency of enterprises, reduce their operating costs, and thus reduce trade costs. Free trade agreements reduce policy uncertainty and shorten institutional distance by coordinating the policies and standards of member states.

However, with the increase in the number of free trade agreements, the cross and overlap between agreements have become increasingly serious, forming a "spaghetti bowl" effect. This effect increases the administrative costs of enterprises, reduces the utilization efficiency of free trade agreements, and thus inhibits the promotion effect of free trade agreements on reducing trade costs. According to the research of Cadot et al. [7], complex rules of origin and multi-layer tariff structures will increase the administrative costs of enterprises and reduce the utilization efficiency of free trade agreements. Under the "spaghetti bowl" effect, enterprises need to be familiar with the tariffs, rules of origin and other management requirements of multiple free trade agreements, which increases their administrative costs.

Based on the above mechanisms, the following research hypotheses are proposed:

H0: The increase in the number and the improvement in the depth of free trade agreements will significantly reduce trade costs. This impact is achieved through the mediating effects of tariff reduction and regulatory integration. Specifically, the more FTAs there are and the more comprehensive the coverage of core provisions, the more they can promote contracting parties to reduce tariff levels, shorten institutional distance, and thus reduce trade costs.

2.2. Measurement of Trade Costs

The measurement methods of trade costs are mainly divided into direct and indirect ones. Using some simple and directly observable indicators to replace trade costs cannot meet the needs of this paper. Indirect measurement mainly uses traditional or improved gravity models to derive trade costs through actual trade flows, which is a comprehensive trade cost including bilateral distance calculated ex post. The indirect measurement of trade costs based on the gravity model is as follows.

The gravity model is named because its equation is similar to the gravitational law in physics discovered by Newton, that is, the trade volume between two countries is proportional to their economic scale and inversely proportional to their geographical distance. Its basic form is as follows:

$$X_{ij} = A\frac{Y_i Y_j}{D_{ij}}$$

Where, X_{ij} is the bilateral trade volume, Y_i and Y_j respectively represent the GDP of country i and country j, and D_{ij} represents the geographical distance between the two countries. On this basis, the original gravity model has been continuously developed and improved according to the needs of research. The basic form of the traditional gravity model used for indirect measurement of trade costs is as follows:

$$x_{ij} = \alpha_1 y_i + \alpha_2 y_j + \sum_{m-1}^{M} \beta_m ln\left(Z_{ij}^m\right) + \varepsilon_{ij}$$

Where, x_{ij} is the logarithm of exports from country i to country j, y_i and y_j respectively represent the logarithms of GDP of exporting country i and importing country j, and Z_{ij}^m is a series of variables measuring trade barriers, including language, distance, historical ties, etc. The composition of trade costs is determined ex ante, and there may be omitted variables, which may lead to deviations in the results. In view of this, a general equilibrium model with a micro-theoretical basis is constructed by adding multilateral resistance to the gravity model, and its basic form is as follows:

$$x_{ij} = \frac{y_i y_j}{y^w}\left(\frac{\tau_{ij}}{\Pi_i P_j}\right)^{1-\delta}$$

Where, x_{ij} represents exports from country i to country $j; y_i$ and y_j respectively represent the GDP of country i and country $j; y^w = \sum_j y_j$, which is the sum of GDP of all countries in the world; τ_{ij} represents trade costs; Π_i and P_j are the price indexes of country i and country j respectively, representing multilateral trade resistance; $\delta > 1$ is the elasticity of substitution between products.

Since multilateral resistance cannot be directly observed, and representing it with implicit functions of trade costs and income shares will have errors, the existence of errors will affect income shares, which in turn will affect multilateral resistance. In order to make up for the defects of using price indexes to represent multilateral resistance and presupposing that bilateral trade costs are symmetric, an equation for calculating trade costs using an improved gravity model is constructed, and its basic form is as follows:

$$\tau_{ij} \equiv \left(\frac{c_{ij}c_{ji}}{c_{ii}c_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2(\sigma_k - 1)}} - 1$$

Where, τ_{ij} represents the geometric average trade cost between country i and country j, which represents the relative trade cost between the bilateral trade cost between country i and country j and the domestic trade cost of country i and country $j; c_{ij}\left(c_{ji}\right)$ represents the international trade cost from country $i(j)$ to country $j(i)$; $t_{ii}\left(t_{jj}\right)$ represents the domestic trade cost of country

$i(j); x_{ij}(x_{ji})$ represents the international trade flow from country $i(j)$ to country $j(i); x_{ii}(x_{jj})$ represents the domestic trade volume of country $i(j); \sigma_k$ represents the elasticity of substitution between goods within the sector. Its intuitive economic meaning is: if bilateral trade $x_{ij}x_{ji}$ increases relative to domestic trade $x_{ii}x_{jj}$, then trade between the two countries will become relatively easier, and under the condition that σ_k remains unchanged, trade cost τ_{ij} will decrease. This model relaxes the assumption that bilateral trade costs are symmetric and avoids the problems caused by using unobservable price indexes to represent multilateral resistance. In addition, continuous panel data can be formed for international trade analysis.

2.3. Model Construction and Variable Description

This paper constructs a panel data model based on the gravity model framework, incorporating Free Trade Agreements (FTAs) to examine the impact of FTAs on trade costs.

(1) Dependent Variables

Bilateral trade costs $(tc_{ij,t})$: Divided into three categories:Total trade costs ($tc\_total_{ij,t}$), Agricultural trade costs ($tc\_ag_{ij,t}$), Manufacturing trade costs ($tc\_ma_{ij,t}$), Data source: ESCAP-World Bank Trade Cost Database.

(2) Core Independent Variables

FTA stock ($FTAstock_{\mathrm{ij,t}}$): The number of effective FTAs between country pair ij in year t. Data are compiled from the WTO Regional Trade Agreement Information System (RTA-IS), with multilateral agreements split into bilateral relationships and counted based on their effective dates.

FTA core depth ($coredepth_{ij,t}$): Measured by the number of 18 core provisions (14 "WTO+" provisions and 4 "WTO-X" provisions) included in FTAs, following the method of Hofmann et al. (2017). Data source: World Bank Content of Deep Trade Agreements Database.

(3) Control Variables

Difference in per capita GDP ($\ln gdpcap_{\mathrm{ij,t}}$): Logarithm of the absolute difference in per capita GDP between country i and country j, reflecting disparities in economic development. Data source: CEPII Gravity Database.

Geographical distance ($\ln distw_{\mathrm{ij,t}}$): Weighted geographical distance between two countries, adjusted by international crude oil prices (weighted by the population share of the largest city). Original distance data from CEPII GeoDist Database; crude oil price data from U.S. Energy Information Administration (EIA).

Common currency ($comcur_{ij,t}$): Dummy variable (1 if the country pair uses a common currency, 0 otherwise). Data source: CEPII Gravity Database.

WTO membership ($WTO_{ij,t}$): Coded as 0,1 , or 2 based on the number of WTO members in country pair ij . Data source: CEPII Gravity Database.

(4) Model Specifications

Considering differences in the "quantity" and "quality" of FTAs, two benchmark models are constructed:

Model 1: FTA Stock as the Core Independent Variable .This model analyzes the impact of the number of FTAs on trade costs:

$$\ln tc_{ij,t} = \alpha_0 + \alpha_1 FTAstock_{ij,t} + \alpha_2 \ln gdpcap_{ij,t} + \alpha_3 \ln distw_{ij,t} + \alpha_4 comcur_{ij,t} + \alpha_5 WTO_{ij,t} + \mu_{ij} + \lambda_t + \varepsilon_{ij,t}$$

Where: i and j represent country pairs; t represents the year. $\mu_{ij} =$ country-pair fixed effects; $\lambda_t =$ time fixed effects; $\varepsilon_{ij,t} =$ random error term.

Model 2: FTA Core Depth as the Core Independent Variable. This model analyzes the impact of FTA provision depth on trade costs:

$$\ln tc_{ij,t} = \beta_0 + \beta_1 coredepth_{ij,t} + \beta_2 \ln gdpcap_{ij,t} + \beta_3 \ln distw_{ij,t} + \beta_4 comcur_{ij,t} + \beta_5 WTO_{ij,t} + \mu_{ij} + \lambda_t + \varepsilon_{ij,t}$$

Variables are defined consistently with Model 1, except that the core independent variable is replaced with $coredepth_{ij,t}$.

3. Results

3.1. Benchmark Regression Results and Analysis

Pooled data model, fixed effect model and random effect model are three main forms for static panel data model selection. Firstly, the BP-LM test is used to judge the pooled regression and random effect. The P value reported by the BP-LM test is 0, so the null hypothesis of "no individual random effect" should be strongly rejected, indicating that the random effect is better than the pooled regression. Then, the Hausman test is used to judge the fixed effect and random effect model. The P value reported by the Hausman test is 0, and the fixed effect is significantly better than the random effect model. Therefore, this paper adopts the fixed effect model, and adds the time fixed effect at the same time. The benchmark regression results with the actual number of free trade agreements as the core explanatory variable are shown in Table 1.

Table 1. Benchmark regression results with actual quantity as explanatory variable

	(1) Total trade costs	(2) Manufacturing trade costs	(3) Agricultural trade costs
FTAstock	-0.0312*** (0.006)	-0.0256*** (0.006)	0.0224*** (0.008)
ln *gdpcap*	0.0037* (0.002)	0.0061*** (0.002)	0.0034* (0.003)
ln *dist*	0.0272*** (0.003)	0.0317*** (0.003)	0.0403*** (0.003)
comcur	-0.0668*** (0.018)	-0.0123 (0.018)	-0.1008*** (0.019)
WTO	-0.0562*** (0.006)	-0.0409*** (0.006)	-0.0654*** (0.008)
Constant term	4.9390*** (0.070)	4.7315*** (0.074)	4.7898*** (0.087)
Time fixed effect	Yes	Yes	Yes
Country pair fixed effect	Yes	Yes	Yes
Observations	144674	129286	80261
Within R^2	0.0801	0.0804	0.0949
Overall R^2	0.1563	0.1716	0.1473
Between R^2	0.1331	0.1518	0.1065

Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively, with clustered robust standard errors in parentheses.

Table 1 shows the benchmark regression results with the actual number of free trade agreements as the explanatory variable. At the 1% significance level, the number of free trade agreements has a significant negative impact on total trade costs and manufacturing trade costs. For each additional unit increase in the number, total trade costs decrease by 3.12% and manufacturing trade costs decrease by 2.56%. This is because free trade agreements shorten institutional distance through tariff reduction and regulatory integration, thereby reducing transaction costs. However, it has a significant positive impact on agricultural trade costs: each additional unit increase in the number leads to a 2.24% rise in agricultural trade costs. The reason lies in that agricultural products are often classified as "sensitive goods", and agricultural protection policies weaken the mechanism of reducing trade costs. Among control variables, a 1% increase in the difference in per capita GDP between country pairs leads to a 0.37% increase in trade costs (significant at the 10% level), which is due to the expanded income gap leading to increased differences in demand preferences and hindering trade. A 1% increase in geographical distance causes a 2.72% rise in trade costs (significant at the 1% level) because longer distances result in higher transportation and communication costs. The use of a common currency can reduce trade costs by 6.68% (significant at the 1% level) by reducing currency exchange costs. WTO membership also significantly reduces trade costs, benefiting from the most-favored-nation treatment principle and the role of dispute settlement mechanisms. All models pass the two-way fixed effect test, with within R^2 ranging from 0.0801 to 0.0949, indicating that the models have a certain rationality in explaining variables.

After examining the impact of differences in the "quantity" of free trade agreements on trade costs, we further study the impact of differences in the "quality" of free trade agreements on agricultural, manufacturing, and total trade costs. Table 2 presents the benchmark regression results when the core depth of free trade agreements is used as the explanatory variable in the gravity equation. It can be seen that the impact of core depth on manufacturing and total trade costs is significantly negative at the 1% level. On average, each additional unit in the core depth of free trade agreements leads to a 0.22% decrease in total trade costs and a 0.22% decrease in manufacturing trade costs. However, the impact of core depth on agricultural trade costs is significantly positive at the 5% level: each additional unit in the core depth of free trade agreements causes a 0.12% increase in agricultural trade costs. The impact direction and magnitude of each control variable on bilateral trade costs are almost the same as those in Table 1, which will not be repeated here. Of course, this also indicates the robustness of the model construction to a certain extent.

Table 2. Benchmark regression results with core depth as explanatory variable

	(1) Total trade costs	(2) Manufacturing trade costs	(3) Agricultural trade costs
coredepth	-0.0022*** (0.000)	-0.0022*** (0.000)	0.0012** (0.001)
ln *gdpcap*	0.0037* (0.002)	0.0061*** (0.002)	0.0033* (0.003)
ln *dist*	0.0275*** (0.003)	0.0318*** (0.003)	0.0400*** (0.003)
comcur	-0.0663*** (0.018)	-0.0127 (0.018)	-0.1021*** (0.019)
WTO	-0.0561*** (0.006)	-0.0410*** (0.006)	-0.0655*** (0.008)
Constant term	4.9307*** (0.070)	4.7287*** (0.074)	4.8007*** (0.087)
Time fixed effect	Yes	Yes	Yes
Country pair fixed effect	Yes	Yes	Yes
Observations	144674	129286	80261
Within R^2	0.0801	0.0805	0.0946
Overall R^2	0.1538	0.1706	0.1491
Between R^2	0.1301	0.1506	0.1086

3.2. Endogeneity Analysis

This paper selects the lagged one-period data of the actual number (core depth) of free trade agreements as the instrumental variable for the actual number (core depth) of free trade agreements to further address the endogeneity issue. Firstly, the correlation between the two is obvious, but current trade conditions cannot affect past free trade agreements (whether in quantity or depth). Thus, using the lagged one-period data of free trade agreements as the instrumental variable meets the exogeneity and correlation tests of instrumental variables. Tables 3 and 4 show the regression results of the instrumental variable two-stage least squares (IV-2SLS) with the actual number and core depth of free trade agreements as explanatory variables, respectively.

Table 3. IV-2SLS regression results with actual quantity as explanatory variable

	(1) Total trade costs	(2) Manufacturing trade costs	(3) Agricultural trade costs
FTAstock	-0.0386*** (0.004)	-0.0348*** (0.004)	0.0230*** (0.004)
Control variables	Yes	Yes	Yes
Constant term	4.9211*** (0.031)	4.7037*** (0.034)	4.7416*** (0.039)
Time fixed effect	Yes	Yes	Yes
Country pair fixed effect	Yes	Yes	Yes
Observations	141563	126476	78542
Within R^2	0.0766	0.0762	0.0945
Overall R^2	0.1606	0.1772	0.1488
Between R^2	0.1389	0.1591	0.1085

Table 4. IV-2SLS regression results with core depth as explanatory variable

	(1) Total trade costs	(2) Manufacturing trade costs	(3) Agricultural trade costs
coredepth	-0.0029*** (0.000)	-0.0022*** (0.000)	0.0012** (0.001)
Control variables	Yes	Yes	Yes
Constant term	4.9126*** (0.031)	4.9307*** (0.070)	4.8007*** (0.087)
Time fixed effect	Yes	Yes	Yes
Country pair fixed effect	Yes	Yes	Yes
Observations	141563	144674	80261
Within R^2	0.0765	0.0801	0.0949
Overall R^2	0.1577	0.1538	0.1491
Between R^2	0.1357	0.1301	0.1086

It can be seen that after further addressing the endogeneity issue using lagged one-period data as instrumental variables, both the actual number and core depth of free trade agreements still have the same impact direction on agricultural, manufacturing, and total trade costs as the benchmark regression results. In addition, the impact coefficients of core explanatory variables on bilateral trade costs have slightly increased, indicating that ignoring the endogeneity issue of free trade agreements will underestimate their impact on bilateral trade costs to a certain extent.

3.3. Robustness Analysis

In the benchmark regression, this paper uses the number of core provisions included in free trade agreements (referred to as core depth) as the explanatory variable to examine the impact of the depth of free trade agreements on trade costs. Here, a total depth indicator (totaldepth) constructed by the total number of provisions covered by free trade agreements is used to replace the core depth for robustness testing. The regression results are shown in Table 5. It can be seen that although after replacing core depth with total depth, the impact of free trade agreements on total trade costs and manufacturing trade costs no longer has the heterogeneity as in the benchmark regression results, their impact on both is still significantly negative at the 1% level, and the coefficients are not much different from those in the benchmark regression results. In addition, the impact of the depth of free trade agreements on agricultural trade costs is still significantly positive. Overall, the conclusions are basically consistent with the benchmark regression results.

Table 5. Robustness test results with total depth as core explanatory variable

	(1) Total trade costs	(2) Manufacturing trade costs	(3) Agricultural trade costs
totaldepth	-0.0012*** (0.000)	-0.0012*** (0.000)	0.0005* (0.000)
ln *gdpcap*	0.0037* (0.002)	0.0061*** (0.002)	0.0033 (0.003)
ln *dist*	0.0273*** (0.003)	0.0317*** (0.003)	0.0399*** (0.003)
comcur	-0.0666*** (0.018)	-0.0129 (0.018)	-0.1029*** (0.019)
WTO	-0.0558*** (0.006)	-0.0407*** (0.006)	-0.0658*** (0.008)
Constant term	4.9328*** (0.070)	4.7301*** (0.074)	4.8040*** (0.087)
Time fixed effect	Yes	Yes	Yes
Country pair fixed effect	Yes	Yes	Yes
Observations	144674	129286	80261
Within R^2	0.0803	0.0807	0.0945
Overall R^2	0.1532	0.1699	0.1498
Between R^2	0.1296	0.1499	0.1094

4. Conclusions

Through panel data analysis, this paper conducts an in-depth study on the role of Free Trade Agreements (FTAs) in reducing trade costs. The research results show that the increase in the number and the improvement in the depth of free trade agreements have significant differences in their impact on trade costs. Specifically, the number and core depth of free trade agreements have a significant negative impact on total trade costs and manufacturing trade costs, that is, with the increase in the number and the improvement in the depth of provisions of free trade agreements, total trade costs and manufacturing trade costs significantly decrease. However, for agricultural trade costs, the number and core depth of free trade agreements show a significant positive impact, which may be related to the sensitivity and protection policies in the agricultural sector.

From the results of endogeneity analysis and robustness tests, the conclusions of this paper have certain robustness. The two-stage least squares (IV-2SLS) regression results using lagged one-period free trade agreement quantity and core depth as instrumental variables further verify the conclusions of the benchmark regression. In addition, after replacing core depth with the total number of provisions for robustness testing, the results still support the conclusions of the benchmark regression. Based on the above research results, this paper puts forward the following policy recommendations:

(1) Strengthen the depth and breadth of free trade agreements: Countries should actively promote the signing of free trade agreements and include more high-standard "WTO-X" provisions in the agreements to promote policy coordination and regulatory integration and further reduce trade costs.

(2) Optimize free trade agreement provisions in the agricultural sector: In view of the positive response of agricultural trade costs to the number and depth of free trade agreements, countries should

adopt more flexible policies in the agricultural sector, reduce excessive protection of agriculture, and give full play to the role of free trade agreements in reducing agricultural trade costs.

(3) Improve the transparency and operability of free trade agreements: Reduce the complexity and uncertainty caused by the "spaghetti bowl" phenomenon, lower the administrative costs of enterprises, and improve the utilization efficiency of free trade agreements.

References

[1] Yang Y, Liu W. Free trade agreements and domestic value added in exports: An analysis from the network perspective[J]. Economic Modelling, 2024, 132: 106656.

[2] Samuelson P A. Spatial Price Equilibrium and Liner Programming[J]. American Economic Review, 1952, 42(3): 283 - 303.

[3] Hummels D, Ishii J, Yi Kei - Mu. The Nature and Growth of Vertical Specialization in World Trade[J]. Journal of International Economics, 2001, 54(1): 75 - 96.

[4] Yi Kei - Mu. Can Vertical Specialization Explain the Growth of World Trade[J]. Journal of Political Economy, 2003, 111(1): 52 - 102.

[5] Melitz M J. The Impact of Trade on Intra - industry Reallocations and Aggregate Industry Productivity[J]. Econometrica, 2003, 71(6): 1695 - 1725.

[6] Jin Y. The impact of FTAs on export duration: Evidence from China's agricultural firms[J]. The Journal of International Trade & Economic Development, 2023, 32(5): 793-823.

[7] Cadot O, Ing L Y. How Restrictive are ASEAN's Rules of Origin[J]. Asian Economic Papers, 2016, 15(3): 115 - 134.