

Research on the Impact of the Trade Facilitation Level of Yemen along the “Belt and Road” on China’s Export Diversification

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Abstract

With economic globalization, tariff reduction has become very limited, and non-efficiency and non-convenience factors in trade have become more prominent. Thus, international multilateral, regional, and bilateral economic cooperation has increasingly focused on trade facilitation, which reduces procedural and administrative barriers, lowers trade costs, and improves trade efficiency. This paper first reviews the literature on trade facilitation’s definition and connotation, quantification and measurement, impact on international trade, and policy research. This paper explains how trade facilitation affects trade flows using transaction cost and regional economic integration theories. Second, it examines China-Yemen trade and facilitation. Third, this paper establishes a trade facilitation evaluation system with four first-level and 22 second-level indicators. It compares China-Yemen trade facilitation in 2012-2022 using principal component analysis.

Keywords

Economic Globalization, Regional, and Bilateral Economic Cooperation, International Trade and Policy, Yemen, The Belt and Road

1. Introduction

A government’s international trade policy is based on national conditions. For protection, countries at a trade disadvantage often use tariff or non-tariff barriers. Global trade grew 8% annually from 1983 to 2018, compared to 2.4% for the global economy. This is because global tariff reductions have benefited import and export trade (Trade, 2023). Statistics show that the world tariff level has dropped from 33.96% to 2.69%, near the trough. In the “post-tariff era”, state-owned

enterprises can no longer reduce tariffs to improve trade welfare. China is a “big country” in the international market due to its second-largest economy. Big countries lead the international market, according to international economic theories. Tariffs reduce a large country’s demand, lowering the international market price. Tariffs are more obvious and cause trade friction than technical and green barriers. Thus, non-tariff barriers have entered international trade. Bilateral trade is inefficient and cannot proceed due to customs clearance procedures. Trade facilitation can reduce non-tariff barriers and trade frictions in bilateral and multilateral trade, lowering trade costs and improving efficiency. Thus, all governments and non-governmental organizations are committed to market openness and free trade with trading partners.

The Trade Facilitation Agreement is crucial to global trade development. Trade facilitation involves simplifying procedures, coordinating laws and regulations, improving infrastructure, accelerating cross-border factor flow, and ensuring effective, transparent, and predictable trade between countries. If the World Economic Cooperation and Development Organization implements this agreement, trade costs will fall by 14.3%, developing countries’ export volume will increase by 20%, and their market share will increase by 33%. China has pioneered trade facilitation measures and always pursued win-win cooperation, common development, and prosperity. In 2013, the State Council prioritized trade facilitation to improve China’s foreign trade quality and scale and address the issue of insufficient foreign investment and foreign trade enterprises’ foreign demand. Yemen along “the Belt and Road” will use trade facilitation measures to boost foreign trade, develop emerging countries’ development potential, and open trade channels with trade partners to benefit both developed and developing countries.

Yemen along “the Belt and Road” serves as the backdrop for this study, which examines the countries’ levels of trade facilitation and the diversity of their exports before using a two-way fixed effect model to analyze the relationship between the two. The goal is to provide more focused solutions for raising countries’ levels of trade facilitation and boosting their export product diversity. To comprehend the structure of China’s international trade with Yemen: first, the current state of trade facilitation and export diversity with Yemen along “the Belt and Road” is analyzed; secondly, this paper will propose countermeasures and suggestions to support China’s export diversification to Yemen based on the development differences in trade facilitation levels among nations and various aspects of trade facilitation indicators.

2. Literature Review

(Cai, Zhang, & Yang, 2023) believe that although the definition of trade facilitation is not consistent, its basic core is unified, that is, to simplify and coordinate the transaction process and promote the free flow of elements between countries. Trade facilitation covers all processes of trade activities and focuses on cross-

border trade. Studies show the cost and free trade theory in bilateral trade transactions and make contributions to practice. (Calabrese & Wang, 2023) believed that the supervision and maintenance of national government departments are closely related to the level of trade facilitation. (Calabrese & Wang, 2023) believed that trade facilitation, as a topic of high international concern, plays a key role in future international trade and economic growth, and its connotation and extension are expanding.

As trade facilitation has become an important topic in the field of international trade, relevant research on how to measure the level of trade facilitation has also tended to diversify. (Gao, Li, Shi, & Wang, 2020) found that as an alternative indicator of logistics efficiency, import and export time can significantly improve the efficiency of trade between countries. (Han, Lao, Yao, Zhang, & Meng, 2020) added indicators such as the level of communication technology to the indicator system and used the factor analysis method to analyze the factors affecting the level of trade facilitation. At the domestic level, based on Wilson's research results, enterprise personnel mobility in the evaluation system and classified by level. The customs port to Wilson's calculation method to analyze foreign trade barriers and e-commerce to measure the role of added information technology in facilitation. Considering the characteristics of bilateral trade activities, chose the government and financial environment to replace the regulatory environment, emphasized the role of financial services in promoting border trade, and used the principal component analysis method to rank the trade facilitation level of six neighboring countries. Wilson's research incorporated the business environment and market access into the evaluation system and adopted the entropy weight method to determine the weight of each index (Blanchard, 2017). This paper expounds on the factors that affect trade facilitation from five aspects and calculates the convenience of China and 50 countries and regions with close trade relations with China using the arithmetic average method. The Silk Road Economic Belt as the background constructed an evaluation system from five aspects, calculated the degree of trade facilitation of 25 countries and found that the spatial distribution of the level of facilitation showed a trend of "high at both ends, low in the middle" (Hoskisson, Eden, Lau, & Wright, 2000).

(Song, Zhu, & Han, 2021) calculated the trade facilitation index based on the weighted average of potential trade barriers and unreasonable payments. In addition, taking the import and export cost, import and export time, and the number of import and export approvals required in the global business environment report as the influencing factors, the trade facilitation index is constructed using the gravity model. And use the two-step analysis method of Hausman to deal with zero-value trade. The study found that if the facilitation measures are improved, the exports will increase by 5%, especially the improvement of infrastructure can promote export growth by 8%. The level of trade facilitation has a significant impact on the regional trade flow. (Ullah, Wang, Stokes, & Xiao, 2019) used panel data to establish a gravity model to study the impact of foreign trade lag and

multilateral trade resistance on imports and exports. Research shows that when the import and export time increases by 1 day, the import and export volume decreases by 1%.

(Guo, Li, & Wang, 2020) conducted empirical research on relevant data of ASEAN countries. The results show that in the context of the difficulty in lowering the tariff level, the importance of trade facilitation has become increasingly prominent. (Yu, Qian, & Liu, 2019) took the time of trade inspection as the main variable, and the volume of foreign trade as the dependent variable, excluding trade friction, and drew the conclusion of the negative relationship between the two. (Ziying, 2014) adopted the GTAP model to simulate the impact of various levels of trade facilitation on China's primary, secondary, and tertiary industries, and found that trade facilitation can achieve economic growth and consumer welfare level improvement by improving China's industrial structure. (Azam, Haseeb, & Samsudin, 2016) studied the impact of the trade facilitation level of OECD member countries and India on China's primary products (agricultural products), intermediate products, and industrial products based on the endogenous growth theory. Through horizontal comparison, it is found that the level of trade facilitation has the greatest impact on intermediate goods. The level of foreign trade of G20 countries as the background, concluded that every 1% increase in trade facilitation of G20 countries will increase China's export trade volume by 0.618%, and the variety of export products will increase by 0.18%, which is conducive to the development of China's export diversity.

(Blanchard, 2017) illustrated the existence of various political and economic narratives concerning the MSRI. This further signifies Beijing's intentions to utilize the MSRI to attain various economic and political objectives. Brown (2017) asserted that despite this remarkable concentration of intellect, the issue of global poverty has evidently not been resolved or sufficiently delineated. (Chandio, Yuansheng, & Magsi, 2016) analyzed the performance of agricultural sub-sectors by examining their respective contributions to agricultural GDP in Pakistan, utilizing secondary data from 1998 to 2015. The Ordinary Least Squares (OLS) econometric method was utilized to estimate the model parameters. (Chen, Sui, Liu, Liu, & Huang, 2019) posited that urbanization and poverty alleviation are two essential components for global sustainable and healthy development. In the future, nations participating in the Belt and Road Initiative will assume a more significant role in global urbanization and poverty alleviation. (Dollar & Kraay, 2002) discovered that the average incomes of the lowest quintile increased in proportion to average incomes in a sample of 92 countries over the past four decades. The income share of the lowest quintile does not exhibit a consistent correlation with average income. (Fan, Zhang, Liu, & Pan, 2016) delineate the geographical boundaries of the Belt and Road, thereby validating the use of the stochastic frontier gravity model for foreign direct investment (FDI) analysis, and subsequently develop a frontier regression model to evaluate China's outward FDI efficiency and

its determinants in Belt and Road countries. (Fardella & Prodi, 2017) examined the influence of new railway and port infrastructures on bilateral trade. Our analysis indicates that the establishment of new railway connections will advantage the majority of Northern and Central European nations. (Feiock, 2013) examined the externalities of choice within fragmented systems, synthesizing various research traditions into a conceptual framework to comprehend and analyze collective dilemmas prevalent in modern governance structures. (Ferriss, 2006) examined the impact of demographic, economic, familial, and health factors on child poverty using models of overall, black, and white child poverty. (Hannan, 2014) elucidated a framework for comprehending the connections between cooperative governance and poverty alleviation in developing nations. This elucidates the relationships among various internal and external stakeholders in cooperative governance, as well as the distinct processes involved. (Koizumi & Kopecky, 1980) posited A comprehensive evaluation of the trade-offs between conservation and other values is essential for making informed decisions regarding each project and site under development, which may involve altering segments of the route to mitigate impacts. Alteration or abandonment of infrastructure may be necessary if stakeholders deem the conservation expenses excessively high. (Kolev, 2005) examined the correlation between foreign direct investment and domestic employment prospects in the context of a multinational corporation engaged in the transfer of technology from its domestic to foreign operations. (Lewis, Yang, Moise, & Roddy, 2021) aimed to identify the determinants of poverty in Bulgaria and to profile groups susceptible to unfavorable labor-market outcomes. Kolev's methodology relies on a comprehensive analysis of both income and non-income aspects of poverty, as well as perceptions of well-being in the workplace. (Lewis et al., 2021) analyzes the evolving synergies between the UN's Sustainable Development Goals (SDGs) and China's Belt and Road Initiative (BRI). This study is one of the initial analyses to provide a comprehensive comparative assessment of these significant change-oriented initiatives, focusing on their interconnections, complementarities, and synergistic potential to influence and reshape public policy and managerial decision-making for sustainable development. (Mao, Liu, Zhang, & Muhammad Atif, 2019) primarily analyzed the Belt and Road Initiative (BRI) in relation to its effects on China's trade and foreign direct investment, while the influence on the export performance of node countries to China remains unexamined. This article examines the mechanism and impact of the Belt and Road Initiative (BRI) on the exports of node countries to China by treating the BRI as an external policy shock and integrating the "Five Connection" indicators into the model.

3. Model Setting

3.1. Benchmark Regression Model

This empirical analysis model mainly learns from Kancs' (2007) framework of

enterprise heterogeneity trade model. Based on calculating the relationship between export diversity and trade facilitation, it simulates the impact of fixed and variable export costs on export diversity. This paper adopts an extended Gravity model, which includes the trade facilitation index (ETI), bilateral relative economic scale (GDP), income difference (per GDP), variable trade cost (dis), fixed trade cost (free), and dummy variables: whether it borders China, whether it signs a free trade agreement (FTA) with China Whether there is a common official language (lang) and economic crisis (shock) with China as explanatory variables. The explained variable is the product export diversity index of China to Yemen, that is, the expansion margin measured above. To reduce the impact of data heteroscedasticity, variables are mostly entered into the equation in logarithmic form, and finally, the following expanded Gravity model is constructed:

$$\ln(1 + em_{odt}) = \beta_0 + \beta_1 \ln ETI_{odt} + \beta_2 \ln GDP_{odt} + \beta_3 \ln perGDP_{odt} + \beta_4 \ln dis_{od} + \beta_5 \ln free_{dt} + \beta_6 \ln Z_{ot} + D_d + D_t + \varepsilon_{odt} \quad (1)$$

Among them, the subscript o represents the importing country, d represents the exporting country, and t represents the time.

3.2. Variable and Data Analysis

The samples of all variables above are based on Yemen along the “Belt and Road” from 2012 to 2022.

1. Export diversity (em): is the dependent variable of the equation, measured by the extension margin. The measurement of export diversity can be carried out from three perspectives: product perspective, enterprise perspective, and country perspective. This article uses the CEPII-BACI database 1996 version HS-6 encoded customs data. Therefore, it is more reasonable to define the extension margin from a product perspective and represent the extension margin with the types of exported products.

2. Trade Facilitation Index (ETI): The Trade Facilitation Index is an index that measures a country’s level of trade facilitation under the policy factor of the Trade Facilitation Agreement. The implementation of trade facilitation will help simplify procedures and procedures, coordinate the application of laws and regulations, improve infrastructure construction, accelerate cross-border flow of factors, and enable import and export transactions to be carried out in a transparent and open information environment. Therefore, the expected symbol is positive. The data is sourced from the ‘The Enabling Trade Report’ published by WEF.

3. Domestic product of the importing country to the gross domestic product of China to measure the bilateral relative economic scale. In the imperfect competition market, under the condition of increasing scale, based on the theory of intra-industry trade, it can be seen that the assumption that the products between the two countries are homogeneous has been broken, at the same time, consumers’ demand for heterogeneous products has increased, and then manufacturers will

research and develop new products or innovate on the basis of the original products in order to meet more consumers' preference for greater producer surplus. When the value of this indicator is 1, it indicates that the economic scale of the importing country is equal to that of China; When the ratio is greater than 1, it indicates that the economic scale of the importing country is greater than that of China; On the contrary, it is smaller than China's economic scale. The larger a country's economy, the larger the consumer market, which is more conducive to the flow of goods into the country. Therefore, the expected sign of bilateral relative economic scale on export diversity is positive. The data is sourced from the WDI database.

4. Income gap (per GDP): Per capita gross domestic product, abbreviated as per capita GDP. This article uses the absolute value of the difference in per capita GDP between different countries to express the income difference between the two countries. Keynesian theory once pointed out that from a short-term perspective, demand creates supply; Say's law once pointed out that in the long run, supply creates demand. However, both supply and demand must be effective supply and effective demand in line with market requirements. Therefore, income differences between the two countries will also to some extent affect the diversification of export products. The expected impact of income differences between the two countries on export diversity is negative. The data source is the World Bank Database (WDI).

5. Variable Trade Cost (dis): This article uses the geographical distance between the two capitals as the proxy variable. According to Melitz's (2003) model of enterprise heterogeneity, an increase in trade costs will cause manufacturers with disadvantaged production efficiency to exit the import and export markets, indirectly affecting the level of export diversity of the country's enterprises. The closer China is to its trading partners, the lower the transportation and storage costs for short distances. Therefore, it is expected that the geographical distance between the two capitals will have a negative impact on the diversity of exports. Data source: CEPII-BACI database.

6. Fixed Trade Cost (free): This article uses the Economic Freedom Index to represent fixed trade costs. Fixed trade costs are divided into five aspects: government scale, laws and regulations, financial market regulation, international trade freedom, and policy regulations. The value range of the economic freedom index is (0100). The larger the value, the higher the level of economic freedom, the lower the fixed trade cost, and the more conducive it is to the entry and outflow of more types of goods. Therefore, the expected sign is positive. The data sources are The Wall Street Journal and The Heritage Foundation of the United States (Table 1).

The basic statistical characteristics of each variable are shown in Table 2 below, including the variables required for the benchmark regression, and the variables involved in the robustness test and further grouping measurement.

Table 1. Definition, measurement methods, and data sources of each explanatory variable in the model.

Variable name	Variable definition	Data sources
EDI	Export Diversity Index	CEPII-BACI database
ETI	Trade Facilitation Index	Global Trade Promotion Report
GDP	Relative economic scale	World Bank
perdgp	Income differences	World Bank
dis	Variable trade costs	CEPII-BACI database and International Monetary Fund
free	Fixed trade costs	The Wall Street Journal and the American Heritage Foundation
border	Whether it borders on China	CEPII-BACI database
FTA	Is there a free trade zone agreement with China	China Free Trade Zone Service Network

Table 2. Statistical characteristics of each variable.

Variable name	Variable Name	Average	Standard deviation	Maximum	Minimum
EDI	Export Diversity	0.7279	0.1417	0.9754	0.0949
ETI	Trade facilitation indicators	4.1907	0.5821	6.14	0.5821
GDP	Relative economic scale	0.0243	0.0452	0.3615	0.0001
perdgp	Income differences	8558.639	11686.55	78759.22	7.553391
dis	Variable trade costs	11.9307	0.5126	14.0701	10.2349
free	Fixed trade costs	61.17856	8.995565	89.4	8.995565

Source: CEPII-BACI database.

4. Results and Analysis

4.1. Benchmark Regression

This paper uses panel data of China and Yemen from 2012 to 2022 for empirical analysis. To examine the impact of trade facilitation indices on export diversity between China and Yemen, a two-way fixed effect is used for empirical testing.

Firstly, perform a stationarity test. Because the fixed effect model is used in this paper, the OLS (ordinary least squares) method is used to regress the parameter values of explanatory variables and control variables in this model. The premise of this method is that the data set is a balanced panel data, which aims to ensure the effectiveness of parameter estimation results and avoid the “pseudo regression” phenomenon. In panel data, there are many methods for unit root testing. This paper uses the same unit root test LLC test and the different unit root test Fisher ADF test. If the LLC test and Fisher ADF test have no reason to accept the original hypothesis, it is considered that there is no unit root, and the panel data is stable. On the contrary, panel data is unstable, and differential and cointegration

tests should be performed on the data in the future. The results of stationarity tests on ln GDP, free, and the dependent variable are listed in **Table 3**.

Table 3. Results of the stationarity test for each variable.

	LLC Test P Value	Stationarity	ADF test P-value	Stationarity
lnETI	0	stable	0	stable
lnGDP	0	stable	0	stable
lnpergdp	0	stable	0	stable
lnfree	0	stable	0	stable
ln(1+em)	0.0001	stable	0	stable

Source: Global trade promotion report.

It can be seen from **Table 3** that the P values of the LLC test and ADF test for ln GDP, free, and the first order lagging variable data of the explained variable em are all less than 0.05, so we have no reason to accept the original hypothesis, so the panel data is stable.

Secondly, the F-test and Hausman test are used to demonstrate which parameter estimation model is selected for short panel data. The first is the F-test, whose P value is $0.000 < 0.05$, indicating that panel data is more suitable for the fixed effect model than the mixed effect model. The second is the Hausman test, with a P-value of $0.0032 < 0.05$, indicating that the fixed effects model is superior to the random effects model. In summary, this article uses a fixed effects model to analyze the relationship between trade facilitation and overseas diversity. After determining the regression model selected for panel data, the static OLS analysis is carried out. This article first uses stepwise regression, and then uses a bidirectional fixed utility model to perform stepwise regression on the model. The results are shown in **Table 4**.

From **Table 4**, the regression results in column (1) show that, without adding other control variables, the impact of trade facilitation level on export diversity is positive and passes the 1% significance test, indicating that export diversity increases with the increase of trade facilitation level. Other conditions remain unchanged. The other control variables, such as relative economic scale and income differences, have shown a certain effect on export diversity, which is consistent with the previous research findings. Column (2) includes the relative economic scale of the importing and exporting countries. The sign is significantly positive, indicating that with the increase of the relative economic scale value, the greater the potential market demand for the products of the importing countries, the greater the export diversity of Chinese products. That is, on the premise that other conditions remain unchanged, every 1% increase in the relative economic scale of Yemen will increase the export diversity of Chinese products by 0.0064%. Column (3) includes the income difference of the importing and exporting countries, and

Table 4. Empirical analysis results of the model.

	(1)	(2)	(3)	(4)
Variable	ln(1+em)	ln(1+em)	ln(1+em)	ln(1+em)
ln (ETI)	0.148096 (0.0334143)	0.125007 (0.0349317)	0.122777 (0.0414522)	0.113067 (.0588984)
ln (GDP)	- -	0.006463 (0.5159608)	0.006767 (0.4072893)	0.006285 (0.0031339)
ln(pergdp)	- -	- -	-0.001446 (0.0094344)	-0.0165678 (0.0042295)
ln(dis)	- -	- -	- -	-5.39E-06 (2.58e-06)
ln(free)	- -	- -	- -	0.011288 (0.1574658)
FTA	- -	- -	- -	0.0805052 (0.0139153)
Border	- -	- -	- -	0.0434089 (0.0146099)
National fixed effect	-	-	-	Control
Time fixed effect	-	-	-	Control
Observations	560	560	560	560
R ²	0.805	0.831	0.843	0.873

Source: China Free Trade Zone database.

the sign is significantly negative, which means that the smaller the income difference between the two countries is, the closer the consumption is, and the more conducive to the export of goods between the two countries. The reduction of the income difference helps to improve the level of export diversity of a country, that is, under the premise that other conditions remain unchanged, the income difference of the importing and exporting between China and Yemen increases every time 1%, the diversity of Chinese product exports decreased by 0.0014%. The fourth column shows the estimation results of the bidirectional fixed effects model, indicating that the estimation results of trade facilitation for all country samples are consistent with the theoretical model. The trade facilitation level of Yemen increased by 1%, and export diversity increased by 0.1131%. There is a significant positive relationship between the relative economic scale of import and export countries and export diversity. The larger the economic scale, the more types of export products there are.

4.2. Robustness Test

To test the robustness of benchmark regression in explaining research propositions,

this article adopts the method of replacing the core explanatory variable indicator system. The measurement indicator of trade facilitation is changed from ETI to TFI, and other variables remain unchanged. A bidirectional fixed effects model is adopted, and the stepwise regression results are shown in **Table 5**.

Table 5. Model robustness analysis results.

	(1)	(2)	(3)	(4)
Variable	ln(1+em)	ln(1+em)	ln(1+em)	ln(1+em)
ln (ETI)	0.148096 (0.0334143)	0.125007 (0.0349317)	0.122777 (0.0414522)	0.113067 (0.0588984)
ln (GDP)	- -	0.006463 (0.5159608)	0.006767 (0.4072893)	0.006285 (0.0031339)
ln(pergdp)	- -	- -	-0.001446 (0.0094344)	-0.0165678 (0.0042295)
ln(dis)	- -	- -	- -	-5.39E-06 (2.58e-06)
ln(free)	- -	- -	- -	0.011288 (0.1574658)
FTA	- -	- -	- -	0.0805052 (0.0139153)
Border	- -	- -	- -	0.0434089 (0.0146099)
National fixed effect	-	-	-	Control
Time fixed effect	-	-	-	Control
Observations	560	560	560	560
R ²	0.805	0.831	0.843	0.873

Source: CEPII-BACI database.

In benchmark regression, the ETI index is significant at a 5% confidence level. In the robustness test, the TFI index is significant at the 10% confidence level. Although the confidence level has dropped from 95% to 90%, it is consistent with the benchmark regression results. In the robustness test, the level of trade facilitation still shows a positive correlation with export diversity, that is, the improvement of the level of trade facilitation will help to improve the level of export diversity of a country. Therefore, it can be demonstrated that the benchmark regression model is set correctly and its parameter estimation results are reliable.

4.3. Endogenous Analysis

Based on the benchmark regression and robustness test above, it can be concluded that the improvement of a country's trade facilitation level will, to some extent,

promote the improvement of its export diversity level. However, since trade facilitation indicators measure policy factors, there is a possibility of lag to some extent. Based on the above ideas, this article uses the weak instrumental variable method as the endogeneity test method and incorporates the trade facilitation index (ETI) into the endogeneity model with a lag of one period. Lagging trade facilitation indicators by one period as a tool variable can effectively solve the problem of reverse causality caused by the increase in export diversity and trade facilitation. In addition, to eliminate the problem of data loss and variable omissions due to a lag of one period, the time effect has been added to column (2) of the endogeneity test. According to **Table 6**, the model does not have endogeneity issues, and there is still a positive correlation between trade facilitation indicators and export diversity indicators that lag for one period.

Table 6. Regression results of endogeneity analysis.

	Export Diversity	
Trade facilitation lags for one period	0.1678935 (0.0350884)	0.0657358 (0.0376392)
Other explanatory variables	Yes	Yes
Time effect	No	Yes
Constant term	-0.3205111 (-0.0498388)	-0.4642367 (0.0560077)

4.4. Regression Analysis

To further analyze the impact of different indicators of trade facilitation on China's export trade flow to YEMEN, four primary indicators, namely infrastructure and logistics (*I*), customs and border management (*C*), government and regulatory environment (*CG*), and finance and e-commerce (*F*), were introduced into the gravity model. The model is set as follows:

$$\ln EXP_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln OPEN_{jt} + \beta_5 \ln I_{jt} + u_{ijt} \quad (2)$$

$$\ln EXP_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln OPEN_{jt} + \beta_5 \ln C_{jt} + u_{ijt} \quad (3)$$

$$\ln EXP_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln OPEN_{jt} + \beta_5 \ln G_{jt} + u_{ijt} \quad (4)$$

$$\ln EXP_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln OPEN_{jt} + \beta_5 \ln F_{jt} + u_{ijt} \quad (5)$$

The regression analysis reveals variations in the effects of the four main indicators within the trade facilitation measurement system on China's export trade flow to YEMEN. However, all these indicators significantly contribute to promoting the trade flow. The regression coefficient for infrastructure and logistics (*I*),

Table 7. Regression results of primary indicators of trade facilitation.

Variable	$\ln EXP_{ijt}$			
$\ln GDP_{it}$	1.0769*** (5.99)	0.8721* (5.1)	1.0589* (5.84)	1.0238*** (6.42)
$\ln GDP_{jt}$	0.5679*** (5.32)	0.5984*** (5.8)	0.6172*** (6.21)	0.6192*** (6.6)
$\ln DIS_{ijt}$	-3.1930*** (-4.48)	-2.7500*** (-3.96)	-2.8709*** (-4.25)	-2.7867*** (-4.39)
$\ln OPEN_{jt}$	0.7411*** (9.56)	0.8517*** (14.69)	0.7703*** (10.09)	0.8169*** (9.86)
$\ln I_{jt}$	0.2629** (2.28)			
$\ln C_{jt}$		0.8829* (7.21)		
$\ln J_{jt}$			0.2305** (2.4)	
$\ln F_{jt}$				0.6080* (3.1)
Constant	46.3448 (1.39)	10.8708 (0.37)	45.3215 (1.32)	49.4569* -1.7

Note: The values in bracket () are z values; *, **, *** Significantly at confidence levels of 1%, 5%, and 10%, respectively (Table 7).

customs and border management (C), government and regulatory environment (G), and finance and e-commerce (F) are statistically significant at the 5%, 1%, 5%, and 1% levels, respectively, with coefficients of 0.2629, 0.8829, 0.2305, and 0.6080. Upon comparing the regression coefficients of the four initial level indicators, it is evident that customs and border management (C) has the most significant positive impact on China's export trade volume. Assuming all other factors remain constant, a 1% improvement in customs efficiency in the importing country will result in a 0.8829% increase in China's export volume. Hence, to enhance regional trade facilitation, it is crucial to prioritize the enhancement of customs and border management standards. This will effectively decrease trade expenses and stimulate the growth of trade volume. The following topic is finance and e-commerce (F). China's export volume will increase by 0.6080% for each 1% increase in this indicator in importing countries. The ongoing advancement of international trade modalities and transportation methods, along with the utilization of network technology to facilitate diverse business and financial operations, as well as the enhancement of associated comprehensive service standards, will

greatly influence China's export to YEMEN trade. Once again, the topic at hand is infrastructure and logistics. China's export volume will experience a 0.2629% increase for every 1% rise in infrastructure level. Enhancing connectivity between facilities is a crucial focus of the "the Belt and Road" initiative, as it plays a pivotal role in promoting regional economic integration. China and the YEMEN enjoy a strong partnership in infrastructure development, with significant potential for further growth in the future. The government and regulatory environment (G) have the least significant impact on China's export trade flow. Central Asian countries will experience a 2305% increase in their import trade volume for every 1% increase in regulatory environmental conditions. The limited impact of this indicator on trade promotion may stem from the fact that administrative reforms typically require coordination and collaboration among multiple departments. Additionally, the effectiveness of policies often needs to be observed and tested over an extended period, making it challenging to demonstrate immediate results. Thus, its contribution to facilitating the growth of trade volume is exceedingly restricted.

To examine the effect of trade facilitation levels on China's export structure to YEMEN, it is essential to perform regression analysis on the export volume of various product categories. This analysis will help identify the varying degrees of impact that trade facilitation levels have on different types of products. The model configuration is as outlined below:

$$\ln PP_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln OPEN_{jt} + \beta_5 \ln TWTFI_{jt} + u_{ijt} \quad (6)$$

$$\ln MP_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln DIS_{ij} + \beta_4 \ln OPEN_{jt} + \beta_5 \ln TWTFI_{jt} + u_{ijt} \quad (7)$$

Table 8. Product structure regression results.

Variable	$\ln PP_{ijt}$	$\ln MG_{ijt}$
$\ln GDP_{it}$	0.1887** (2.46)	1.0495*** (4.14)
$\ln GDP_{jt}$	1.2796*** (43.76)	0.5810* (2.86)
$\ln DIS_{ij}$	-1.8293 (-9.40)	-2.6181 (-2.03)
$\ln OPEN_{jt}$	0.5221*** (6.35)	0.8932*** (6.18)
$\ln TWTFI_{jt}$	0.7797 (1.6)	0.8024*** (3.28)
Constant	-4.665 (-1.11)	33.6432 (0.75)

Note: The values in bracket () are z values; *, **, *** Significantly at confidence levels of 1%, 5%, and 10%, respectively (Table 8).

China's exports to YEMEN are categorized according to the United Nations Standard Classification of International Trade (SITC) method, specifically in Chapter 4. These exports are further divided into two groups: primary products (SITC0-4) and industrial manufactured goods (SITC5-8). These categories represent the volume of primary products and industrial manufactured goods that China exports to country j during period t . The regression results indicate a positive correlation between the level of trade facilitation and the trade volume of primary and industrial products exported by China to YEMEN. However, the impact on industrial products is greater than that on primary products. The coefficient of impact of trade facilitation level on primary products is 0.7797. A 1% increase in the trade facilitation level of Central Asian countries will result in a 0.7797% increase in the export value of primary products. China primarily exports Class 0 food and activity products, along with Class 3 mineral fuels, lubricants, and related raw materials to YEMEN. These products are particularly susceptible to the effects of transportation, energy infrastructure, and border efficiency. Therefore, the overall trade facilitation indicators may not exert a substantial influence on them. The trade facilitation level has a significant impact on industrial manufactured goods trade, with a coefficient of 0.8024, passing the 1% significance test. Under constant conditions, a 1% increase in trade facilitation level in Central Asian countries will result in a 0.8024% increase in the export value of industrial manufactured goods. Over 80% of the trade volume exported to YEMEN consists of industrial manufactured goods, which are the primary products that China exports to YEMEN. These products encompass transportation equipment, electrical machinery, and other goods that necessitate not only a comprehensive hardware infrastructure but also impose stringent demands on the business environment of the export destination country. The enhancement of trade facilitation has a direct impact on China's export trade by decreasing trade expenses and enhancing trade efficiency. Additionally, it can indirectly influence the volume of trade through the specialization of tasks in the global value chain and the impact of foreign direct investment. Therefore, it plays a crucial role in promoting the trade of industrial manufactured goods exported by China to Yemen.

5. Conclusion

This paper analyzes the impact of the level of trade facilitation on export diversity between China and Yemen. First, we make a preliminary observation on the relationship between the core explanatory variable ETI and the explained variable export diversity index and find that the level of trade facilitation is positively correlated with export diversity. Secondly, based on the results of scatter plot, the stability of panel data is tested. The parameter estimation methods of panel data are divided into fixed effect regression and random effect regression. Through the Hausman test, the benchmark model is further determined to use the fixed effect model. These two exhibit a proportional relationship. In addition, other indicators in the expanded Gravity model are consistent with expectations and pass the

robustness test.

Using ETI and TFI indicators to describe the level of trade facilitation between China and Yemen, there is still some room for improvement in China's trade facilitation level. As is well known, the level of trade facilitation has a certain impact on export diversity. However, this article concludes through empirical analysis that there is a positive correlation between the two. The logic behind it should be that the improvement of a country's trade facilitation level will reduce the variable and fixed costs of exports between the country and its trading partners, promote free trade between international trade, thereby enhancing the country's trade welfare, inject capital into domestic enterprise research and development, and improve the country's export diversity. The improvement of the trade facilitation level can increase the scale of import and export trade, increase relations with trading countries, and obtain the dividends of industrial chain transfer to the domestic market and cost reduction through technology in free trade. The second is to help other countries export goods to their own countries, and partner country enterprises profit. Therefore, the improvement of trade facilitation not only enhances the level of export diversity but also helps to improve the quality and complexity of national export products and is also a path to achieve a "win-win" trade cooperation between the two countries. Therefore, we need to learn from the experience of other countries in developing trade facilitation, choose the essence, remove the dross, and strengthen the construction of China's trade facilitation. The impact of port construction, customs environment, regulatory environment, and e-commerce on trade facilitation is the focus of this study based on China's national conditions.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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