Study on Trade Influencing Factors and Trade Efficiency between China and Countries along “One Belt And One Road”

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Abstract: From 2010 to 2017, 58 countries along the “One Belt and One Road” were selected as research samples. Firstly, this paper analyzes China's export to countries along the “One Belt and One Road” route, establishes a Stochastic Frontier Gravity Model, studies the influencing factors and trade efficiency between China and these countries, and classifies and analyzes the trade efficiency of these countries. The study finds that China's export and export proportion in the countries along the “One Belt and One Road” increased steadily. Among them, the export proportion to ASEAN and Central and Eastern Europe was larger and grew steadily. The economic scale of China and countries along the Routes and population of countries along the Routes all positively affect China's export. China's OFDI and the customs efficiency of countries along the routes respectively have significant hindering and promoting effect on China's export efficiency respectively. The overall trade efficiency between China and countries along the belt and road is only 26.2%, and 32 countries are lack of trade. The trade efficiency with 4 countries in Central Asia is relatively high, while the overall trade efficiency with 10 countries in ASEAN and 14 countries in West Asia is the lowest.

1. Introduction

The Silk Road Economic Belt was first proposed in September 2013.In March 2017, the report on the work of the government at the fifth session of the 12th National People's Congress (NPC) put forward the strategic task of steadily promoting the "One Belt and One Road" development. Countries along the "One Belt and One Road" are playing an increasingly important role in China's export trade. Under the background of "One Belt and One Road" strategy, what are the main factors influencing the export between China and countries along "One Belt and One Road"? What is the efficiency of China's export with countries along “One Belt and One Road”? What are the factors and degree of influence on the inefficiency of export trade between China and these countries?

In terms of trade influencing factors, Sun-Jinyan and Liu-Haiyun (2016) [1] found that the tariff level of the importing country, the customs clearance time of the importing country, the regime index and the logistics performance index are the key factors affecting China's trade potential. Tang Chunling et al. (2018) [2] studied the influence of the population of countries along the "One Belt and One Road", GDP of China and countries along the "One Belt and One Road", degree of trade liberalization, distance between the two countries and other factors on China's export. And relevant literatures mainly use Trade Gravity Model to analyze the influence degree of the factors. For example, Xu Juan et al. (2016) [3] used the Trade Gravity Model to analyze the trade substitution or complementary effect of the CAFTA establishment .Liu Hongman and Wang Mengxing (2017)[4] used the Trade Gravity Model to study the impact of environmental regulations on the efficiency of agricultural products trade between China and countries along the "One Belt And One Road".

In the study of potential trade or trade efficiency, the factors which are more intuitive and easy to obtain are usually considered by scholars, such as the GDP of two countries, population and geographical distance, etc. However, due to the inclusion of all other unmeasurable factors in the unobservable random disturbance term, the measured trade potential value appears a certain degree of deviation (Armstrong, 2007) [5]. Kalirajan (1999) [6] proposed that if the observable factors of trade between two countries are given, such as per capita GDP, population and geographical distance, etc., then the study on how to obtain the maximum trade benefits with the minimum trade cost is like solving the production efficiency of enterprises. So, the Stochastic Frontier Approach for the analysis of enterprise production efficiency can be applied to the trade gravity model, to analyze the efficiency of trade between the two countries. Li Ping (2018) [7] introduced Stochastic Frontier Analysis into the Trade Gravity Model to find out factors affecting trade resistance, explore non-efficiency terms and put forward feasible suggestions. Zhang Huiqing (2017) [8] established Stochastic Frontier Models from export and import trade angles respectively, and analyzed the influencing factors from two aspects. Fu Shaojun (2016) [9] studied the trade efficiency between China and countries along the "One Belt and One Road" by using Stochastic Frontier Gravity Model. Fang Ying and Ma Rui (2018) [10] conducted an empirical analysis on the cultural trade potential and influencing factors between China and countries along the "One Belt and One Road" based on Stochastic Frontier Gravity model.

To sum up, existing literatures mainly use traditional trade gravity model and from the positive perspective to analyze the resistance to trade development, while non-efficiency factors are often ignored. In addition, existing literatures generally select a small number of sample countries for analysis, and few literatures can make a comprehensive analysis of the trade situation between China and countries along the "One Belt and One Road" route.

Based on the trade data from 2010 to 2017 between China the 58 countries along “One Belt And One Road” and Stochastic Frontier Gravity Model, this paper analyzes the trade influencing factors, degree of influence and trade efficiency between China and countries along the "One Belt And One Road" route, classifies them and then proposes corresponding policy suggestions for different trade efficiency regions.

2. Current Situation of China's Export to Countries along the "One Belt and One Road"

There are 65 "One Belt and One Road" countries (including China). Considering the relevant data of the countries along the area is lack, this paper selects 58 countries, except Egypt, Iraq, Syria, Palestine, Turkmenistan and Macedonia, as the research object. These 58 countries are divided into six regions as shown in Table 1.

Total export *and export ratio.* China's exports to countries along the routes totaled US $357.26 billion in 2010, accounting for 22.64% of China's total exports. In 2014, it increased to US $617.88 billion, accounting for 26.38% of China's total exports, with a year-on-year growth of 12.18%. China's total exports to the world declined in 2016, which also affected China's total exports to countries along the Belt and Road, which decreased by 4.02% on a year-on-year basis. However,

the proportion of China's exports to countries along the Belt and Road rose instead of falling. In 2017, China's exports reached US $617.75 billion, accounting for 27.29 percent of China's total exports, with 9.05 percent increase year-on-year. In the whole research interval from 2010 to 2017, the total exports and the proportion of exports between China and the countries along the "One Belt and One Road" have grown steadily, and the countries along the "One Belt and One Road" are playing an increasingly important role in China's export trade.

Structure of *export area.* Among the six regions along the "One Belt and One Road", China's exports to 10 ASEAN countries and 15 Central and Eastern European countries accounted for the largest proportion, both accounting for about 7%, and the growth rate was very stable. In 2017, China's exports to 10 ASEAN countries reached 173.66 billion US dollars, and its exports to 15 Central and Eastern European countries reached 169.501 billion US dollars. From 2010 to 2017, China's exports to the four Central Asian countries increased the most, from 1.67% to 3.41%. By

2017, China's exports to the four Central Asian countries reached 83.291 billion US dollars. Among the countries along the "One Belt and One Road" route, the seven CIS countries account for the smallest proportion of China's exports, only accounting for about 1%, indicating that China still need to further enhance the export volume of this region.

Table 1 classification of countries along "One Belt and One Road"

Area	countries
Ten ASEAN countries	Singapore, Indonesia, Brunei, Cambodia, Philippines, Vietnam, Malaysia, Myanmar, Laos, Thailand
Fourteen West Asian countries	Iran, Turkey, Lebanon, Saudi Arabia, Yemen, Oman, Qatar, Bahrain, Greece, Cyprus, Jordan, Kuwait, Israel, UAE
Eight South Asian countries	Pakistan, Afghanistan, Sri Lanka, Maldives, Bhutan, Bangladesh, Nepal, India
Four Central Asian countries	Uzbekistan, Kyrgyzstan, Tajikistan, Kazakhstan
Seven CIS countries	Russia, Ukraine, Georgia, Armenia, Moldova, Belarus, Azerbaijan
Fifteen Central and Eastern European countries	Estonia, Latvia, Czech republic, Hungary, Slovenia, Bosnia and Herzegovina, Serbia, Romania, Bulgaria, Lithuania, Albania, Slovakia, Croatia, Montenegro, Poland

Structure of export commodity. By studying the categories of commodities exported by China to countries along the "One Belt and One Road" from 2010 to 2017, it can be seen that mechanical equipment and transportation facilities are the key commodity of China's exports to the region, with the average proportion of 40.34%. In 2017, the export volume of such products reached 205.81 billion US dollars. The second main commodity is manufactured materials, accounting for 23.79%. The third product is miscellaneous export, accounting for 21.35%. This may be related to China's overcapacity, especially in basic steel equipment, which can be transferred through exports.

3. Stochastic Frontier Gravity Model Setting and Variable Selection

3.1 Model Setting

Gravity Model. Tinbergen (1962) [11] believed that the trade scale of the two countries was proportional to their respective GDP and inversely proportional to the distance between the two countries. The trade gravity model was as follows.

$$X_{ij} = k(y_i y_j) / D_{ij} \tag{1}$$

In Formula 1, X_{ij} represents the trade scale between countries i and j, and k is a constant. y_i and y_j represents the GDP of each country, and D_{ij} represents the geographical distance between the capital of each country. The fitting value of bilateral trade estimated by trade gravity model can be used to measure trade potential, and the ratio of actual trade to trade potential can be used to measure trade efficiency. The basic assumption of the trade gravity model is frictionless trade, which leads to some errors in the estimation of trade potential and ignores unobservable trade resistance variables. Therefore, the "trade potential" obtained by the trade gravity model is only the average effect of various factors that determine the scale of trade, rather than the optimal value.

Stochastic Frontier Gravity Model. In order to solve the above problems, Stochastic Frontier Model can be combined with Trade Gravity model. Kalirajan (1999) [6] first proposed Stochastic Frontier Gravity Model to study input-output efficiency. In order to eliminate possible heteroscedasticity, natural logarithms of explained variables and some explanatory variables were taken to establish the Stochastic Frontier Trade Gravity Model and Trade Inefficiency Model as follows.

$$\begin{aligned} \ln EX_{ijt} = {} & \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln POP_{it} + \beta_4 \ln POP_{jt} \\ & + \beta_5 \ln DIS_{ij} + \beta_6 LANG_{ij} + v_{ijt} - u_{ijt} \end{aligned} \tag{2}$$

$$v_{ijt} \sim N(0, \delta_v^2), u_{ijt} \sim N^+(m_{ijt}, \delta_u^2) \qquad TE_{ijt} = exp(-u_{ijt}) \tag{3}$$

$$m_{ijt} = \theta_0 + \theta_1 \ln OFDI_{ijt} + \theta_2 CUSTOM_{jt} + \theta_3 WTO_{ij} + \theta_4 IQ_{jt} + \theta_5 TARIFF_{jt} + \varepsilon_{ijt} \tag{4}$$

$$\delta^2 = \delta_v^2 + \delta_u^2, \ \gamma = \delta_u^2 / \delta^2 \tag{5}$$

Formula 2 is the Stochastic Frontier Gravity Model, EX_{ijt} represents China's exports to a certain country along the route during the period t, GDP_{it} is China's GDP in the period t, GDP_{jt} is the certain country's GDP, POP_{it} and POP_{jt} denote the population of China and certain country, DIS_{ij} indicates the geographic distance between the capital of China and that of the certain country, and $LANG_{ij}$ shows if China and countries have a common language. Furthermore, v_{ijt} represents the influence of white noise on the model, and u_{ijt} represents the influence of technical inefficiencies on the model.

Equation 3 indicates that v_{ijt} and u_{ijt} are subject to normal distribution and truncated normal distribution respectively, and TE_{ijt} is the actual output and production frontier ratio, represents the time-varying technical efficiency. When $u_{ijt} = 0$ or $TE_{ijt} = 1$, there is no non-efficiency factor; When $u_{ijt} > 0$ or $TE_{ijt} < 1$, the sample j is not in the state of maximum output in the period t, that is to say, there is trade inefficiency.

Formula 4 is the expression of factors affecting technical non-efficiency. $\ln OFDI_{ijt}$ represents the stock of China's OFDI to the country j in the period t, $CUSTOM_{jt}$ is the customs efficiency of the country j, WTO_{ij} indicates whether China and the country j are both WTO members, $TARIFF_{jt}$ is the weighted average applicable tax rate of all products of the country j in the period t, and IQ_{jt} is the quality of port infrastructure of the country j in the period t.

In formula 5, δ_v^2 and δ_u^2 respectively represent the fluctuation of random disturbance term v_{it} and technical non-efficiency factor u_{it}, and γ represents the proportion of non-efficiency term in the total error term. The rationality of the model setting is judged by the analysis of γ. If the value γ approaches 0, it indicates that the non-efficiency term occupies a low proportion in the compound error, and the error mainly comes from the white noise term. At this time, the ordinary least square method can be directly used. On the other hand, if the value γ approaches 1, it indicates that the compound error term is dominated by non-efficiency factors, and it is suitable to use Stochastic Frontier Model to analyze non-efficiency problems.

3.2 Variables, Samples and Data

Variable selection. The explained variable of Stochastic Frontier Gravity Model is China's export in the countries along the route. Explanatory variables are China's GDP, the trading countries' GDP, China's total population, traders' population, geographic distance between China and trading nation's capital and whether China and trading countries sharing a common language and the expected signal of these variables are positive, positive, negative, positive, negative, and positive respectively.

Dependent variable of Technical Non-efficiency Model is the trading efficiency value, and the stock of China's OFDI to countries along the "One Belt And One Road" route, the level of customs efficiency of countries along the route, whether China and countries along the route are both WTO members, the port infrastructure construction of countries along the route and the average weighted tariff level of all products of countries along the route are selected as the influencing variables. Their expecting influences on trade non-efficiency are uncertain, negative, negative, negative and positive respectively.

Sample and data sources. Fifty-eight countries along "One Belt and One Road" route were studied during the period from 2010 to 2017. In the Stochastic Frontier Gravity Model, the export data of China to countries along the "One Belt and One Road" are from the United Nations trade database. GDP and population data are from the World Bank; The geographic distance of the two capitals and common language data were obtained from the CEPII database of France. In the trade inefficiency

model, WTO member information comes from WTO; OFDI data are from *China outbound investment bulletin*; Customs efficiency, tariffs and port infrastructure quality are from the World Bank database. The descriptive statistical results of all variables are shown in Table 2 below.

Table 2. Descriptive statistics of variables from 2010 to 2017

Variable	Ave.	Median	S.d	Kurtosis	Skewness	Min.	Max.
EXP_{ijt} ($100 million)	91．1	23.0	141.3	3.8	2.1	0.016	716.2
GDP_{it} ($100 million)	96022.5	100445	19335.9	-0.9	-0.5	61010	122380
GDP_{jt} ($100 million)	2115.2	598.9	3841.4	14.3	3.6	15.9	26008.2
POP_{it} (100 million)	13.6	13.6	0.2	-1.2	0.091	13.4	13.9
POP_{jt} (100 million)	0.5	0.09	1.7	44.7	6.6	0.004	13.4
DIS_{ij} (km)	5645.4	6065.7	1653.8	-1.2	-0.5	2330.8	7722.6
$OFDI_{ijt}$ ($100 million)	14.2	1.9	37.4	60.6	6.8	0.001	445.7
$CUSTOM_{jt}$	4.1	4.0	0.7	0.2	0.6	2.6	6.3
IQ_{jt}	3.9	4.0	1.1	0.093	-0.032	1.3	6.8
$TARIFF_{jt}$	4.0	2.9	3.3	4.0	1.9	0.03	20.8

4. Empirical Analysis of China's Trade in Countries along the "One Belt And One Road"

4.1 Model Results

Frontier4.1 was applied to analyze models (2) and (4), and the results were as follows. According to the output results, *the log likelihood function* has a value of -900.90, and *the LR test of the one-sided error* has a value of 62.60, both of which have passed the 1% significance test, indicating that there is indeed a technical non-efficiency factor in the mixed error. The γ value was 0.31 and passed the 1% confidence test, which also indicated that the errors in the model were caused by non-efficiency error terms. Although the value was not too large, the use of Stochastic Frontier Model was generally appropriate and the model was set correctly.

Table 3. Output results of Stochastic Frontier Gravity Model and Non-efficiency Model

Variable	Symbol	Coefficient	Standard error	T value
constant	β_0	266.40	1.00	266.57(***)
$\ln GDP_{it}$	β_1	1.39	0.49	2.84(***)
$\ln GDP_{jt}$	β_2	0.53	0.17	3.21(***)
$\ln POP_{it}$	β_3	-12.68	0.65	-19.41(***)
$\ln POP_{jt}$	β_4	0.15	0.14	1.07
$\ln DIS_{ij}$	β_5	-0.62	0.40	-1.55
$LANG_{ij}$	β_6	0.95	0.61	1.56
constant	θ_0	-1.50	1.70	-0.88
$\ln OFDI_{ijt}$	θ_1	0.25	0.07	3.47(***)
$CUSTOM_{jt}$	θ_2	-1.33	0.26	-5.04(***)
WTO_{ij}	θ_3	-0.16	0.29	-0.53
IQ_{ijt}	θ_4	1.16	0.20	5.83(***)
$TARIFF_{jt}$	θ_5	-0.11	0.04	-2.51(**)
δ^2	——	2.90	0.22	12.94(***)
γ	——	0.31	0.07	4.09(***)
log likelihood function =-900.90(***)		LR test of the one-sided error =62.60(***)		

Note*: ***, ** and * means the statistic is significant at 1% ,5% and 10% confidence level respectively.*

Further calculate the export efficiency of China to 58 countries along the routes from 2010 to 2017, and the results are shown in Table 4 below.

Table 4. Export efficiency from 2010 to 2017 (%)

	Country	2010	2011	2012	2013	2014	2015	2016	2017	Ave.
ASEAN	Singapore	3.4	2.5	2.3	2.2	2.0	2.0	2.0	2.2	2.3
	Malaysia	4.3	5.3	6.4	6.4	4.6	5.0	5.2	5.4	5.3
	Indonesia	10.1	9.9	9.7	6.1	5.0	5.2	5.2	5.6	7.1
	Myanmar	21.6	17.1	21.5	13.4	11.7	8.6	9.1	9.9	14.1
	Brunei	16.8	11.8	13.4	13.4	15.5	13.9	11.1	9.4	13.2
	Thailand	3.7	3.7	3.5	4.5	3.3	2.5	2.3	4.1	3.5
	Laos	90.9	85.1	70.7	60.5	41.7	93.9	37.6	24.1	63.1
	Cambodia	8.9	9.3	9.2	5.3	3.7	3.6	5.2	3.5	6.1
	Philippines	13.8	8.0	7.0	5.9	7.7	10.1	12.4	7.3	9.0
	Vietnam	8.7	10.6	10.8	6.6	5.7	6.1	5.5	10.1	8.0
West Asia	Iran	16.1	14.0	12.9	9.5	7.9	9.2	9.1	12.0	11.3
	Turkey	6.2	5.2	3.5	4.9	4.1	3.3	3.4	4.0	4.3
	Jordan	51.8	50.7	45.1	45.3	38.0	40.4	41.5	31.0	43.0
	Lebanon	9.1	12.1	12.3	9.5	8.1	10.0	9.1	22.6	11.6
	Israel	16.3	42.1	34.3	35.1	27.9	17.0	8.6	5.9	23.4
	Saudi Arabia	7.9	7.2	5.4	4.1	3.4	5.2	5.2	10.8	6.1
	Yemen	8.1	11.0	12.9	14.7	14.9	12.8	19.0	10.1	12.9
	Oman	21.4	14.3	12.1	9.4	8.7	6.7	8.0	12.8	11.7
	United Arab Emirates	8.7	5.7	5.5	6.1	5.3	4.5	4.2	7.2	5.9
	Qatar	12.0	9.0	14.2	20.5	14.0	10.6	8.5	6.2	11.9
	Kuwait	13.1	14.7	10.3	10.0	6.4	5.1	4.9	7.2	9.0
	Bahrain	42.4	33.6	16.3	18.9	11.8	22.9	12.4	36.1	24.3
	Greek	30.4	23.7	15.1	5.8	7.2	7.6	9.1	7.2	13.3
	Cyprus	41.8	12.1	10.2	12.7	15.3	17.7	18.4	10.3	17.3
South Asia	India	17.1	12.5	8.7	5.8	8.1	10.4	10.5	8.4	10.2
	Pakistan	9.0	6.7	5.4	5.0	4.7	4.6	4.8	7.7	6.0
	Bangladesh	28.8	28.0	30.7	27.2	24.2	18.1	14.7	20.9	24.1
	Afghanistan	3.1	3.4	4.6	4.5	5.7	7.4	7.4	9.9	5.7
	Sri Lanka	13.1	13.0	10.4	15.8	13.2	9.4	11.5	8.2	11.8
	Maldives	96.3	96.0	36.0	59.2	50.8	79.6	44.0	22.0	60.5
	Nepal	88.4	92.3	91.5	87.3	80.4	96.0	95.9	96.6	91.1
	Bhutan	96.6	96.5	96.8	96.7	97.6	97.5	97.8	97.6	97.1
Central Asia	Kazakhstan	8.4	4.6	8.5	21.2	17.7	27.1	20.6	8.9	14.6
	Uzbekistan	10.3	7.1	5.1	4.8	5.0	7.1	7.4	10.3	7.1
	Tajikistan	85.1	88.1	88.5	76.6	55.6	83.4	73.2	84.8	79.4
	Kyrgyzstan	54.6	33.7	41.7	63.4	76.9	77.6	73.0	83.5	63.1
CIS	Russia	2.9	2.7	2.7	3.1	4.1	2.7	3.1	3.6	3.1
	Ukraine	8.8	4.9	3.5	6.1	12.7	15.0	14.7	6.7	9.0
	Belarus	20.3	16.3	13.2	14.8	10.6	5.7	5.7	4.9	11.4
	Georgia	26.0	30.0	34.7	37.9	48.8	50.7	54.6	42.7	40.7
	Azerbaijan	10.0	8.5	8.9	4.2	4.4	4.4	5.2	15.9	7.7
	Armenia	25.7	46.5	45.6	33.2	68.0	91.4	91.0	77.7	59.9
	Moldova	66.4	83.1	58.5	85.5	94.6	96.2	95.4	95.6	84.4
Central and Eastern Europe	Poland	40.6	35.8	27.4	18.3	14.6	15.3	16.9	16.2	23.1
	Lithuania	35.3	19.1	11.6	12.9	17.0	15.7	14.4	17.5	17.9
	Estonia	22.2	18.3	21.8	25.0	26.3	26.8	29.8	33.7	25.5
	Latvia	26.0	23.2	20.5	19.0	23.1	22.7	23.3	16.9	21.8
	Czech	17.2	10.3	8.7	12.5	19.9	38.3	37.1	65.2	26.2
	Slovakia	41.1	29.9	19.6	28.1	43.4	61.9	68.6	80.2	46.6
	Hungary	13.9	16.9	21.4	27.2	31.7	43.7	51.3	84.0	36.3
	Slovenia	31.4	25.4	22.0	21.7	29.2	30.4	19.5	21.8	25.2
	Montenegro	95.0	94.0	91.0	73.7	51.6	47.3	22.0	18.8	61.7
	Croatia	28.7	26.9	20.1	21.5	24.7	25.0	28.1	11.2	23.3
	Bosnia and Herzegovina	96.3	94.1	97.1	99.9	96.0	74.5	74.1	83.6	89.5
	Serbia	54.6	66.8	47.9	36.5	44.6	34.0	27.3	26.9	42.3
	Albania	67.4	38.2	24.6	16.3	14.8	10.5	9.4	22.0	25.4
	Romania	37.6	19.1	15.0	14.6	15.3	19.9	19.3	23.3	20.5
	Bulgaria	12.2	8.4	9.3	10.7	10.1	8.7	9.7	7.8	9.6

4.2 Analysis of Export Influencing Factors

China's *GDP*. β_1 is significantly positive, which means that every 1% increase in China's GDP will increase the export of countries along the Belt and Road by 1.39%, and China's economic size can promote China's export in countries along the Belt and Road.

GDP of countries *along the route.* The significant positive value β_2 can be interpreted as that every 1% increase in GDP of the country or region will increase China's exports to countries along the route by 0.53%. It indicates that the higher the level of economic development of the countries

along the routes is, the higher the level of people's diversified demand for products will be, and the better the promotion of China's export trade will be.

The population *of China.* β_3 is significantly negative at 1% confidential level. It could be interpreted as a 1% increase in China's population reducing exports by 12.68%. This result is in line with expectations, because China has a large population base, products will give priority to meet the consumer demand of its own people, and foreign trade may be relatively reduced.

Population *of countries along the route.* β_4 is positive. Although it fails the significance test of 10%, it still indicates that the more population there is in countries along the Belt and Road, the greater the demand for goods and the larger the scale of foreign markets will be, which can stimulate Chinese manufacturers to export goods to countries along the Belt and Road. This is in line with the expectation, but has little impact on China's export.

Distance between *two countries.* The value β_5 is negative and almost passes the significance test of 10%, indicating that the greater the distance between the two countries is, the higher the time and cost of transportation will have, which is not conducive to foreign trade. This is in line with expectations, but it has little impact on China's export.

Common language. The value β_6 is positive and almost passes the significance test of 10%, indicating that if China and the countries along the routes share the same language and then the language barrier is small, the trade exchanges between the two countries will be more smooth, which will promote China's export trade. This is consistent with the expected symbol.

4.3 Analysis of Influencing Factors of Export Efficiency

In the Equation of technical inefficiencies, θ_1 is significantly positive at the significance level of 1%, indicating that China's OFDI has a positive effect on trade inefficiencies. In other words, every 1% increase of China's OFDI will reduce China's export efficiency in countries along the routes by 0.25, indicating that the increase of China's OFDI has a substitution effect on China's export efficiency. θ_2 is negative and has passed the significance test with a confidence level of 1%. It can be understood that every 1% increase in the customs efficiency of countries along the routes will promote the export efficiency of China by 1.33, indicating that the higher the customs efficiency of countries along the routes is, the faster the circulation speed of goods will be, and the more inclined China will be to export to that country. The coefficient θ_3 is negative, but it does not pass the significance test with a confidence level of 10%, which can be interpreted as: both trade parties are members of the WTO and then will improve the trade efficiency of the two countries, but this effect is not obvious. This may be due to the prevalence of various non-tariff barriers, so the advantages of tariff preference among WTO members are not obvious. θ_4 and θ_5 are significantly positive and significantly negative respectively, which is not in line with the expected impact direction of port infrastructure quality and weighted average tariff of all products on export trade efficiency.

4.4 Export Efficiency Analysis

From 2010 to 2017, 32 out of the 58 sample countries were trade deficient, accounting for 55.2%, 16 countries were trade moderate, and 10 countries were trade excessive. Overall, the trade efficiency between China and countries along the "One Belt And One Road" is low, only 26.2%.The average trade efficiency between China and 10 ASEAN countries, 14 West Asian countries, 8 South Asian countries, 4 Central Asian countries, 7 CIS countries and 15 Central and Eastern European countries were 13.2%, 14.6%, 38.3%, 41.1%, 30.9% and 33.0%, respectively. It can be seen that the overall trade efficiency between China and 4 Central Asian countries is relatively high, the trade efficiency between China and 8 South Asian countries, 7 CIS countries and 15 Central and Eastern European countries is relatively low, and the overall trade efficiency between China and 10 ASEAN countries and 14 West Asian countries is the lowest. Among the ASEAN countries, Laos is the most efficient country in the region with a trade efficiency of 63.1%, which exceed 60%. Singapore is the least efficient country in this region, with an average trade efficiency of just 2.3%. Of the 14 countries of Western Asia, Jordan had the highest trade efficiency in this region, at 43%, while

Turkey had the lowest trade efficiency, which is at 4.3%. Among the 8 south Asian countries, Bhutan and Nepal both achieved trade efficiencies of more than 90%. Among the 4 Central Asian countries, Kyrgyzstan and Tajikistan had the highest trade efficiency of 63.1% and 79.4% respectively. Among the 7 CIS countries, Moldova had the highest trade efficiency, with an average trade efficiency of 84.4%. Of the 15 Central and Eastern European countries, the top four are Bosnia and Herzegovina (89.5%), Montenegro (61.7%), Slovakia (46.6%) and Serbia (42.3%). The above analysis shows that the trade potential between China and most of the countries along the "One Belt and One Road" has not been fully realized.

According to the practice of Liu Qingfeng and Jiang Shuzhu (2002) [12], and based on the results of trade efficiency, the trade efficiency between China and 58 countries along the routes is divided into the following 3 categories, as shown in Table 5.

Table 5. Trade efficiency classification (%)

Area	Trade deficit (<20%)	Moderate trade (20%～50%)	Excessive trade (>50%)
ASEAN	Singapore (2.3), Brunei (13.2), Malaysia (5.3), Philippines (9.0) Indonesia (7.1), Myanmar (14.1), Thailand (3.5), Cambodia (6.1), Vietnam (8.0)		Laos (63.1)
West Asia	Saudi Arabia (6.1), Cyprus (17.3), Turkey (4.3), Iran (11.3), Lebanon (11.3), United Arab Emirates (5.9), Qatar (11.9), Yemen (12.9), Oman (11.7), Kuwait (9.0), Greece (13.3)	Jordan (43.0), Israel (23.4), Bahrain (24.3)	
South Asia	Pakistan (6.0), India (10.2), Sri Lanka (11.8), Afghanistan (5.7)	Bangladesh (24.1)	Maldives (60.5), Nepal (91.1), Bhutan (97.1)
Central Asia	Kazakhstan (14.6), Uzbekistan (7.1)		Tajikistan (79.4), Kyrgyzstan (63.0)
CIS	Ukraine (9.0), Russia (3.1), Belarus (11.4), Azerbaijan (7.7)	Georgia (40.7)	Armenia (59.9), Moldova (84.4)
Central and Eastern Europe	Lithuania (17.9), Bulgaria (9.6)	Estonia (25.5), Latvia (21.8), Slovakia (46.6), Hungary (36.3), Poland (23.1), Romania (20.5), Slovenia (25.2), Serbia (42.3), Albania (25.4), Croatia (23.3), Czech (26.2)	Bosnia-Herzegovina (89.5) Montenegro (61.7)

As can be seen from Table 7, although ASEAN countries account for a large proportion of China's exports and are an important export market for China, except Laos, the other 9 countries are trade deficit, indicating that ASEAN export market has great room for growth and great trade potential. West Asia is rich in energy, and China's exports to West Asia are on a steady rise. Among the countries in west Asia, only Jordan, Israel and Bahrain have moderate trade, while the other 11 countries have insufficient trade. China should fully exploit the market of West Asia and give full play to its trade potential. Among the South Asian countries, Maldives, Nepal and Bhutan are over-trading, especially the latter two countries have very high trade efficiency, which indicates that China needs to explore new trade areas and optimize China's export industrial structure. The trade potential of Pakistan, India and other countries is insufficient. China should strengthen the construction of the china-Pakistan economic corridor to make it an important channel for China to connect south and south-east Asia and promote China's trade development. Among the four central Asian countries, Kazakhstan and Uzbekistan are deficient in trade, which indicates that there is a huge space for cooperation between China and these countries. As the core hub of “One Belt and One Road”, Central Asia should be given more attention to play its role as a "transit station" and strengthen the convenient circulation of trade. Among the CIS countries, Armenia and Moldova belong to excessive trade, Georgia belongs to moderate trade, and other countries are insufficient trade. Affected by the global economic crisis, the CIS countries have experienced economic recession, and China's exports to the CIS countries account for a relatively small proportion.

However, the CIS countries have a superior geographical position and connect China with the European continent. China should take advantage of the China-Europe railway to actively trade with CIS countries. Among Central and Eastern European countries, only Lithuania and Bulgaria are trade insufficient, which indicates that China's trade with Central and Eastern European countries is in good condition and China should change its export structure to seek new export growth points.

5. Conclusion

First, based on the trade data of China and 58 countries along the "One Belt and One Road" route from 2010 to 2017, the current export situation of China in this region was analyzed. The results showed that China's total export and export proportion of countries along the "One Belt and One Road" route rose steadily and the total export accounted for about 27% of China's total export to the world. Among the six regions, China's exports to ASEAN and Central and Eastern Europe account for a large proportion, with steady growth. Exports to South Asia, West Asia and Central Asia accounted for a smaller share, but exports to four Central Asian countries grew the fastest. The proportion of exports to CIS countries is the smallest. In terms of export commodity structure, China's exports to countries along the routes are mainly concentrated in machinery and transportation equipment, manufactured materials and miscellaneous products.

Secondly, based on the Stochastic Frontier Gravity Model, this paper analyzes the impact of economic size, population, geographical distance and common language on China's export trade in countries along the routes. The results show that the economy scale of China and the countries are important positive influence factors, China's population size is significantly negative influence factors, and the population of the along countries has a weak positive influence. Geographic distance and the common language influence are low, but meet the economic expectations.

Third, based on the Technical Non-efficiency Model, this paper analyzes the influence of China's OFDI, customs efficiency of countries along the routes, WTO member, port facility quality s and weighted average tariff of countries along the routes on trade inefficiency. Results show that the increase of China's OFDI will hinder China's export efficiency to some extent, and customs efficiency of countries along the route can promote the improvement of trade efficiency. It is not obvious whether the two countries are both WTO members to improve the efficiency of trade. The impact of port infrastructure quality and weighted average tariffs on China's export trade efficiency is not in line with the expected direction.

Finally, trade efficiency is classified according to the value of trade efficiency of countries along the routes. The results show that from 2010 to 2017, there were 32 countries with insufficient trade, accounting for 55.2%, 16 countries are with moderate trade, and 10 countries are with excessive trade. The overall trade efficiency between China and countries along the "One Belt And One Road" was only 26.2%. China has relatively high trade efficiency with four Central Asian countries, relatively low trade efficiency with eight South Asian countries, seven CIS countries and 15 Central and Eastern European countries, and the lowest overall trade efficiency with 10 ASEAN countries and 14 west Asian countries.

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References

[1] Sun Jinyan, Liu Haiyun. 2016.An Empirical Study on China's Trade Potential under the Background of "One Belt and One Road" Strategy [J]. *Contemporary Finance and Economics*, Vol.06.

[2] Tang Chunling, Shao jinglan, Li Ruoxin, Wang Shuai. 2018. Potential of China's Goods Export Trade to Countries along the "One Belt and One Road" [J]. *Economic Geography*, Vol.38(09).

[3] Xu Juan. 2016. Study on trade effects of China-ASEAN Free Trade Area Based on Gravity Model [D]. *Nanjing University*.

[4] Liu Hongman, Wang Mengxing.2017. Influence of Institutional Environment on the Trade Efficiency of Agricultural Products between China and Countries along the "One Belt and One Road" [J]. *Economic Issues*, Vol.07.

[5] Armstrong, S. 2007.Measuring Trade and Trade Potential: A Survey[R]. *Asia Pacific Economic Paper*, No.368.

[6] Kalirajan, K. 1999.Stochastic Varying Coefficients Gravity Model: An Application Analysis in Trade [J]. *Journal of Applied Statistics*, Vol.26.

[7] Li ping. 2018.Trade Potential and Efficiency between China and Countries along the "One Belt and One Road" and Determinants---An Empirical Study Based on Stochastic Frontier Gravity Model [J]. *International Business Research*, Vol.39(05).

[8] zhang Huiqing. 2017.Study on Trade Potential between China and Regions along the "One Belt and One Road" [J]. *International trade Issues*, Vol.07.

[9] Fu Shaojun. 2016. "One Belt and One Road" Construction and China's Export Efficiency Improvement --- An Empirical Study Based on Panel Data Stochastic Frontier Gravity Model [J]. *Industrial Technology and Economics*, Vol.5(10).

[10] Fang Ying, Ma Rui. 2018. Potential and Influencing Factors of Cultural Trade between China and Countries along the "One Belt and One Road": An Empirical Study Based on Stochastic Frontier Gravity Model [J]. *World Economic Research*, Vol.1.

[11] Tinbergen, J. 1962.Shaping the world Economy: suggestion for an International Economy Policy [M]. *New York: The Twentieth Century Fund*.

[12] Liu Qingfeng, Jiang Shuzhu. 2002. Bilateral Trade Arrangements in China from the Perspective of Trade Gravity Model [J]. *Zhejiang Social Sciences*, Vol.6