Advances in Economics, Business and Management Research, volume 106
Fourth International Conference on Economic and Business Management (FEBM 2019)

Empirical Analysis of Impacts on China's Transport Service Trade of International Competitiveness

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***Abstract*—This paper aims to make an empirical analysis of impacts on China's transport service trade of international competitiveness. At first it makes comparative analysis between China and some relevant countries by calculating the competitiveness index of RCA, then this paper makes an empirical analysis of main factors affecting China's transport service trade and draws a conclusion: China's goods exportation have a positive impact on the international competitiveness of transport service, with an impact of 1.1%, followed by the openness of the transport service industry, with an impact of 0.7%. Finally, it puts forward some suggestions for the future development of China's transportation service trade.**

***Keywords*—transport service trade, international competitiveness, empirical analysis**

I. INTRODUCTION

In recent years, some Chinese scholars have started to study international competitiveness of transportation service trade in different perspectives. Liu Shan (2016)[1] provided current situation and problems of China's transportation trade from the aspects of trade scale, structure and the main target. Huang Rong (2017) calculated and compared the transport service trade competitiveness indexes between China and some developed countries like United States, Japan, which combined with these competitiveness indexes and China's national conditions, this paper analyzes the causes of the competitiveness of transport service trade, and put forward several countermeasure and suggestion. Meng Fei, Li Yuting (2018) found some main factors affect China's export of transport service on the aspects of trade in goods, shipping capacity structure, linkage of transportation and related productive auxiliary industries, and the openness of the domestic transport market.

II. CURRENT SITUATION OF CHINA'S TRANSPORT SERVICE TRADE

A. Total Volume of China's Transport Service Trade

In recent years, the total volume of China's transport service trade has increased significantly compared with that of ten years ago. However, its average growth rate has decreased, and the proportion of the total trade in services showed a gradual downward trend. Compared with developed countries, China's trade in transport services account for a relatively small proportion of the world's total, and the trade deficit is a serious problem. China's total import and export of transport service increased from 88.75 billion US dollars in 2008 to 130.05 billion US dollars in 2017 (Table I), with a growth rate of 46.5% in the past decade. It was much higher than the world average. However, from 2010 to 2015, it decreased year by year. After that, there was an obvious trend of recovery. By the end of 2017, the growth rate of total import and export had rebounded to 13.55%, entering a stage of repaid growth. From the perspective of data, the growth of total export is not obvious. The export in 2017 was 3.41% lower than that in 2008, with negative growth in this decade. By contrast, the import increased from 50.33 billion US dollars in 2008 to 92.95 billion US dollars in 2017, with a growth rate of 84.67% in ten years.

B. The Structure of China's Transport Service Trade

China's trade deficit in transport service has been on rise for a decade. It is not difficult to see from Fig.1 that after 2013, the growth rate of the total deficit remained below 20%, and the negative growth of the deficit was achieved in 2015. Although the growth of the deficit has fluctuated considerably in recent years, a reduction in the deficit is achievable by adjusting the structure of import and export and improving the corresponding mechanism of transport service trade.

TABLE I. STATISTICS OF CHINA'S IMPORT AND EXPORT OF TRANSPORT SERVICE TRADE FROM 2008 TO 2017(UNIT: BILLION US DOLLARS, %)

Year	Total	Year-on-year growth	Export	Year-on-year growth	Import	Year-on-year growth
2008	88.75	—	38.42	—	50.33	—
2009	70.14	-20.96	23.57	-38.65	46.57	-7.46
2010	97.47	38.96	34.21	45.15	63.26	35.82
2011	116.02	19.03	35.57	3.97	80.45	27.17
2012	124.77	7.55	38.91	9.40	85.86	6.73
2013	131.97	5.77	37.65	-3.25	94.32	9.86
2014	134.38	1.83	38.24	1.59	96.16	1.94
2015	123.95	-7.77	38.59	0.92	85.34	-11.25
2016	114.53	-7.60	33.83	-12.35	80.58	-5.58
2017	130.05	13.55	37.10	9.69	92.95	15.34

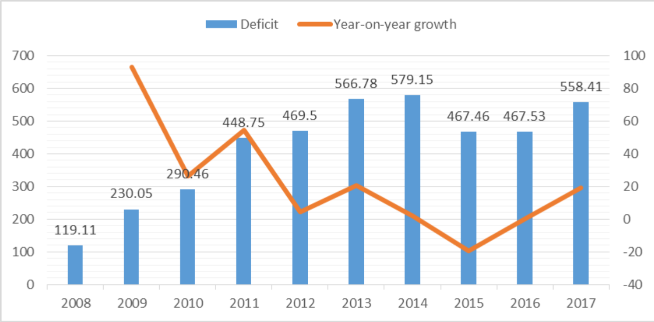

Fig. 1. China's trade deficit in transport service and its year-on-year growth rate (Unit: billion US dollars, %)

III. Analysis of International Competitiveness

A. *The Usage of RCA Index*

Index of Revealed Comparative Advantages (RCA) was first proposed in 1965 (Balasa,1965)[2] to explain the international competitiveness and then has been used widely over the international trade research area. The RCA index represents the ratio of a country's exports of a product or service to the world's exports of this product or service divided by the proportion of the country's total exports of all service in the world's total exports of all service. In this paper, if the specific product or service is transport service, the total export value of products or services is the total export of service trade. Therefore, its calculation formula is as follows:

$$RCA_{ti} = \frac{X_{ti}}{\sum_{i=1}^{n} X_{ti}} \Big/ \frac{X_{si}}{\sum_{i=1}^{n} X_{si}} \qquad (1)$$

RCA_{ti} represents the revealed comparative advantage index of transport service trade in country i. X_{ti} is the export of transport service trade of country i. $\sum_{i=1}^{n} X_{ti}$ is the total export of world transport service trade. X_{si} is the export of service trade in country i. $\sum_{i=1}^{n} X_{si}$ is the total export volume of world service trade. Whether a country has a revealed comparative advantage depends on the size of its RCA index.

B. *Measurement of RCA Index and Analysis of Revealed Competitiveness of China's Transport Service Trade*

As shown in Table II, Japan's RCA index remained at a relatively high level and its RCA average is higher than that of the other five countries. Similar to Japan, Germany's transport service trade remained above 1.0 from 2008 to 2017, which indicates that Germany has a comparative advantage in this industry. The RCA of France was always stable around 1.0, indicating that although there is no significant comparative advantage in France's transport service trade, the overall level is relatively stable. Finally, China, the United States and the United Kingdom. Except for China in 2008, the RCA value of transport service trade of these three countries has always remained below 1.0, indicating that the comparative advantages of these three countries are relatively weak. In general, the RCA of China's transport service trade is higher than that of the United States and the United Kingdom, but lower than that of other developed countries significantly.

IV. Empirical Analysis of Impacts on China's Transport Service Trade of International Competiveness

A. *Variable Selection and Data Description*

This paper chose variables based on research of Meng Fei & Li Yuting (2018) [3]and described them in Table III:

B. *Empirical Analysis*

1) Modelling: Economic model of this article was based on recent research R.HUANG(2018)[4] :

TABLE II. RCA Index of Transport Service Trade Among Six Countries

Year	China	The United States	Japan	The United Kingdom	Germany	France
2008	1.15572	0.63516	1.47398	0.54246	1.12492	0.94838
2009	0.96535	0.62938	1.32704	0.53734	1.15257	1.00249
2010	0.89808	0.61387	1.49177	0.50778	1.17908	0.99695
2011	0.85169	0.63219	1.44973	0.53900	1.16667	1.00195
2012	0.94333	0.64427	1.56006	0.56626	1.11663	0.98477
2013	0.92617	0.64734	1.50972	0.54816	1.14426	0.91793
2014	0.90573	0.64960	1.28340	0.57782	1.07495	0.91073
2015	0.95935	0.64730	1.20917	0.61241	1.13053	0.95196
2016	0.92780	0.65677	1.07111	0.61059	1.13705	1.00300
2017	0.92895	0.64400	1.07174	0.61618	1.17248	1.04646
Average	0.94622	0.63999	1.34477	0.56580	1.13991	0.97646

TABLE III. Variable Selection and Data Description

Types of variables	Indexes	Expre ssion	Expe ctatio n	Explanation
Explained variable	The export volume of transport service (TX)	Y		It is taken as the quantitative index of China's transport service trade competitiveness.
Explanatory variable	The export volume of goods (GX)	X_1	+	It is selected as the demand factor.
Explanatory variable	The number of people working in the transport service industry (TP)	X_2	+	It is regarded as the production factor.
Explanatory variable	The cargo throughput of the major ports above the scale in China's coastal areas (CT)	X_3	+	It is taken as the factor of relevant and supporting industry.
Explanatory variable	The industry openness of transport service trade (IO)	X_4	+	It is used to measure the factor of government.

$$\ln Y = \beta_0+\beta_1\ln X_1+\beta_2\ln X_2+\beta_3\ln X_3+\beta_4\ln X_4+\mu. \qquad (2)$$

2) Model modification and regression analysis: The results of preliminary regression are shown in Table IV:

3) Multicollinearity test: By the Table IV, the F-statistic is significant, both R-squared and Adjusted R-squared indicated a good fitting degree. But the Prob. Values were not significant except lnX_1. Therefore, it can be considered that there is a serious multicollinearity among the explanatory variables. In order to eliminate the multicollinearity among explanatory variables, the correlation coefficient between each variable should be calculated first, as shown in Table V.

According to the data from the Table V, there is a high correlation between $\ln X_1$ and $\ln X_2$, $\ln X_1$ and $\ln X_3$, $\ln X_2$ and $\ln X_3$, so stepwise regression is used to eliminate multicollinearity. The regression equation of lnY with respect to $\ln X_1$, $\ln X_2$, $\ln X_3$ and $\ln X_4$ are established respectively. Through separate regression, it can be seen that the export value of China's transport service trade is the most affected by the export value of goods trade, so the stepwise regression is carried out accordingly. The results of the first stepwise regression are shown in Table VI.

On the basis of retaining the explanatory variable lnX_1, only one other explanatory variable is introduced to the model at a time to observe and compare the fitting results, so as to select the optimal linear combination. It is verified that lnX_2 and lnX_3, which are correlated with lnX_1, are used to replace lnX_1. Its regression effect with lnX_4 is not as good as the combination of lnX_1 and lnX_4. Therefore, Y = f (lnX_1, lnX_4) is the optimal linear combination, and the fitting results are shown in Table VII.

As shown in Table VII, the regression results after eliminating multicollinearity are:

$$\mathbf{\ln Y = -1.8628+1.086513\ln X_1+0.693255\ln X_4}$$

TABLE IV. THE RESULTS OF PRELIMINARY REGRESSION

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.705569	3.297528	0.213969	0.8349
LNX1	1.510724	0.575334	2.625822	0.0253
LNX2	-0.108766	0.215061	-0.505744	0.6240
LNX3	-0.532579	0.810621	-0.657002	0.5260
LNX4	0.435887	0.394332	1.105381	0.2949
R-squared	0.977206	Mean dependent var	5.597118	
Adjusted R-squared	0.968088	S.D. dependent var	0.498192	
S.E. of regression	0.088996	Akaike info criterion	-1.739241	
Sum squared resid	0.079204	Schwarz criterion	-1.503224	
Log likelihood	18.04431	Hannan-Quinn criter.	-1.741755	
F-statistic	107.1775	Durbin-Watson stat	0.822859	
Prob(F-statistic)	0.000000			

TABLE V. CORRELATION COEFFICIENT

variable	lnX_1	lnX_2	lnX_3	lnX_4
lnX_1	1.000000	0.848609	0.981944	-0.643185
lnX_2	0.848609	1.000000	0.857199	-0.600879
lnX_3	0.981944	0.857199	1.000000	-0.767229
lnX_4	-0.643185	-0.600879	-0.767229	1.000000

TABLE VI. THE RESULT OF STEPWISE REGRESSION

Model	lnX_1	lnX_2	lnX_3	lnX_4	Prob.	R^2	D.W.
Y=f(X_1)	0.892				< 0.05	0.914	0.782
T-Statistic	11.719						
Y=f(X_1,X_2)	0.996	-0.294			> 0.05	0.918	0.879
T-Statistic	6.845	-0.842					
Y=f(X_1,X_3)	2.087		-1.390		< 0.05	0.974	0.810
T-Statistic	9.138		-5.327				
Y=f(X_1,X_4)	1.087			0.693	< 0.05	0.975	0.911
T-Statistic	19.493			0.693			

TABLE VII. THE REGRESSION RESULTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNX1	1.086513	0.055739	19.49278	0.0000
LNX4	0.693225	0.127916	5.419386	0.0002
C	-1.862800	0.451476	-4.126018	0.0014
R-squared	0.974916	Mean dependent var	5.597118	
Adjusted R-squared	0.970735	S.D. dependent var	0.498192	
S.E. of regression	0.085226	Akaike info criterion	-1.910163	
Sum squared resid	0.087162	Schwarz criterion	-1.768552	
Log likelihood	17.32622	Hannan-Quinn criter.	-1.911671	
F-statistic	233.1922	Durbin-Watson stat	0.910742	
Prob(F-statistic)	0.000000			

4) Self-correlation test: According to the fitting results after eliminating multicollinearity, D.W.=0.910742. By looking up the table, we find that $d_l <$ D.W. $< d_u$, so we cannot determine whether there is self-correlation or not. Therefore, LM test is used to determine whether there is first order self-correlation and higher-order self-correlation. The test results of first order self-correlation are shown in Table VIII.

Through the first order self-correlation test, it is found that the resid(-1) is not significant (Prob.$>$0.05), indicating that there is no first order self-correlation. Therefore, there is no self-correlation in this model.

5) Heteroscedasticity test: After passing the self-correlation test, the regression model shall be tested by the heteroscedasticity test. The results are shown in Table IX. In the test results, $nR^2 = 15 \times 0.283429 = 4.251435$. Since there are 5 variables in this test regression model, n=5. According to the table, when n=5, the critical value of χ^2distribution at the significance level of 0.05 is 11.07. Since $4.251435 < 11.07$, there is no heteroscedasticity in the regression results.

In conclusion, through the empirical model research, the export function of China's transport service trade is finally obtained as follows:

$$\ln \hat{Y} = -1.8628 + 1.086513 \ln X_1 + 0.693255 \ln X_4$$

TABLE VIII. THE RESULTS OF FIRST ORDER SELF-CORRELATION TEST

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNX1	0.017487	0.049156	0.355752	0.7288
LNX4	0.042100	0.112957	0.372713	0.7164
C	0.009967	0.392946	0.025366	0.9802
RESID(-1)	0.562721	0.255697	2.200734	0.0600
R-squared	0.305697	Mean dependent var	7.96E-16	
Adjusted R-squared	0.116342	S.D. dependent var	0.078904	
S.E. of regression	0.074172	Akaike info criterion	-2.141676	
Sum squared resid	0.060517	Schwarz criterion	-1.952863	
Log likelihood	20.06257	Hannan-Quinn criter.	-2.143688	
F-statistic	1.614411	Durbin-Watson stat	1.484752	
Prob(F-statistic)	0.242306			

TABLE IX. THE RESULTS OF WHITE TEST

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.625712	1.583304	-0.395194	0.7019
LNX1^2	0.005059	0.012570	0.402442	0.6967
LNX1*LNX4	0.040722	0.049147	0.828571	0.4288
LNX1	0.082503	0.238016	0.346628	0.7368
LNX4^2	0.031495	0.065560	0.480394	0.6424
LNX4	-0.109542	0.366311	-0.299042	0.7717
R-squared	0.283429	Mean dependent var	0.005811	
Adjusted R-squared	-0.114666	S.D. dependent var	0.007086	
S.E. of regression	0.007481	Akaike info criterion	-6.663594	
Sum squared resid	0.000504	Schwarz criterion	-6.380374	
Log likelihood	55.97696	Hannan-Quinn criter.	-6.666611	
F-statistic	0.711964	Durbin-Watson stat	2.104596	
Prob(F-statistic)	0.629806			

6) Empirical results and analysis: The empirical analysis results show that: when other conditions are fixed, the export value of goods increases by 1%, and the export value of China's transport service trade increases by 1.086513%. When the opening degree of China's transport service industry increased by 1%, the export value of transport service trade increased by 0.693255%. Therefore, China's export of goods has the largest positive impact on the international competitiveness of transport service trade, followed by the opening degree of China's transport service industry.

V. CONCLUSION

This paper comes to the following conclusions: China's international competitiveness in transport service trade is relatively weak and has not reached the world average ($RCA_{China} < 1$). The two decisive factors affecting the international competitiveness of transport service trade are the export value of goods and the opening degree of China's transport service industry whose influence coefficients are 1.1% and 0.7% respectively according to the empirical analysis. Therefore, the Chinese government may afford subsidy for domestic transport service enterprises appropriately so as to encourage them to go global market. In addition, China's transport service enterprises and related supporting industries should also enhance their power and complete the process of transforming from labor-intensive industry to technology-intensive and capital-intensive industry as soon as possible.

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