ISSN: 2688-9323

Does Trade Openness Promote the Status of Domestic Value Chain

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Abstract

Under the background of the changes at the end of the century, China proposed to build a new development pattern with domestic circulation as the main body and domestic and international double circulation promoting each other. It can be seen that foreign trade can promote the sustained and high-quality development of China's economy, and the sustained promotion of a higher level of foreign trade is still one of China's current priorities. Therefore, it is of great theoretical and practical significance to explore the impact of China's foreign trade development on the status of the domestic value chain by using the multiple linear regression model. This paper first constructs a multiple linear regression model of China's trade openness and domestic value chain, and estimates the parameters of the model. Then it carries out statistical and econometric tests on the model to determine the final model, and finally gives corresponding policy recommendations for the construction of China's trade "new development" pattern.

Keywords

Trade Openness; Domestic Value Chain; High Quality Development; Multiple Linear Regression Model.

1. Introduction

With the gradual integration of China's economy into globalization, the vertical specialization based on transnational corporations has promoted the full flow of talents, technology, capital and other production factors in China(Zhibiao Liu, 2001) [1]. The opening up of trade is one of the key factors for China's economic take-off. China has taken advantage of the comparative advantages of China's abundant labor force to participate in the division of labor in the global value chain by vigorously developing processing trade, and has obtained the dividends of the global division of labor.

Since the reform and opening up, China's trade openness, especially the continuous improvement of China's import trade openness (Xiling Tu, 2020)[2] has greatly promoted the rapid development of China's economy. According to the view of the classical school, trade openness is conducive to the exertion of comparative advantages between trading countries, and promotes the professional division of labor of each country. Through the exchange of intermediate goods and final products, each trading country promotes the improvement of its overall welfare. After China's accession to the World Trade Organization, it has gradually become an important part of the global value chain.

Relevant scholars believe that the high-quality development of China's economy should give full play to and take advantage of the strong domestic market advantages, give full play to the comparative advantages between regions, promote the construction of domestic value chain, and promote the high-quality development of China's economy (Jinran Chen et al., 2022).[3] Therefore, in the current context, studying the impact of China's trade openness on the domestic value chain is also of great significance for further understanding the impact of trade openness on China's economic development and how to build China's domestic value chain. The

ISSN: 2688-9323

research significance of this paper has the following two levels: first, enrich the understanding of the factors that affect the construction of domestic value chain; Secondly, on the basis of studying the influencing factors of China's trade openness, this paper provides policy suggestions for the higher quality development of China's foreign trade.

2. Index Selection and Model Construction

2.1. Index Selection

2.1.1. Domestic Transport Infrastructure

The construction of domestic infrastructure will undoubtedly promote the development of China's domestic trade, but there are still some problems in China's infrastructure. Liu Qian [4] (2019) found through empirical research that the impact of transportation infrastructure has a positive cumulative effect on the economic spatial effect of most provinces and cities in other regions, that is, it plays an important role in promoting the regional economy. The construction of domestic transportation infrastructure can reflect the domestic economic circulation in China to a certain extent. According to the availability of data, this paper regards the construction of domestic transport infrastructure as the construction of domestic value chain.

2.1.2. Total Imports and Exports

The total import and export volume is a measure of the overall level of openness of a country, reflecting the degree of participation of a country or region in the global division of labor. The degree of trade openness is an indicator that comprehensively reflects the degree of foreign trade development of a country. It is equal to the proportion of the amount of import and export trade of a country in the total GDP of that year. In order to eliminate the influence of multicollinearity, heteroscedasticity and other factors to a certain extent, the data are placed under the same dimension for research. Therefore, this paper studies the substitution of total imports and exports for trade openness.

2.1.3. Gross National Product

Gross national product is one of the most commonly used indicators to reflect the economic development of a country or region. Countries and regions with high GNP have high demand for the quality and types of goods. It is difficult for the local market to meet the demand. It is necessary to import goods from other regions to meet the demand. At the same time, products in excess of demand need to be exported to other regions(2020) [5]. The import and export activities are relatively frequent. According to Keynesian macroeconomics, the gross national product is composed of private sector consumption, government consumption, net exports and other components. Therefore, the gross national product is affected by domestic demand, and the gross national product also affects domestic demand from both supply and demand in the domestic market. In general, the higher the gross national product of a country, the more conducive it is to the construction of the domestic value chain.

2.1.4. Residents' Disposable Income

The disposable income of residents is one of the important indicators reflecting the actual and potential consumption level of residents in a country or region. In international trade theory, the similar demand structure of two countries is also an important factor to promote international trade. Linde, the proponent of the overlapping demand theory, believes that international trade is an extension of domestic trade, and the export structure, flow direction and trade volume of products depend on the domestic demand preference, while the demand preference of a country depends on the average income level of that country. Therefore, the increase of residents' disposable income has a positive role in promoting China's total trade import and export and the construction of domestic value chain. Since the disposable income data of residents cannot be directly found, this paper first uses EPS and the National Bureau of

ISSN: 2688-9323

Statistics database to collect the per capita disposable income and total population indicators, and then directly multiplies the two to obtain the total disposable income of Chinese residents.

2.1.5. Scientific and Technological Research and Development Level

The level of scientific research has always been regarded as the core competitiveness of a country or region. With the increasingly obvious spillover effect brought by the level of science and technology, more and more countries pay more attention to scientific and technological research and development. In addition, the level of scientific and technological research and development also has a relatively obvious role in promoting the development of China's domestic value chain. Li Nan[6] (2020) believes that the development of science and technology can promote the status of eastern China in the domestic value chain and promote the overall level of China's value chain. Therefore, we can get that the improvement of scientific and technological research and development level is conducive to the construction of China's domestic value chain. In this paper, scientific and technological research and development expenditure is used to represent scientific and technological research and development expenditure.

2.1.6. Posts and Telecommunications Business Volume

In a broad sense, transportation infrastructure and post and telecommunications network belong to the general category of infrastructure. The former is more inclined to tangible infrastructure, while the latter is inclined to intangible infrastructure. In modern international trade transactions, the commonly used methods of payment and settlement include bill of exchange, collection, letter of credit, and the delivery and receipt of some important bills, most of which require telegraphic transfer. Therefore, the number of postal and telecommunications services can reflect the overall level and scale of foreign trade of a country. The improvement of foreign trade level is not conducive to the construction of domestic value chain to some extent.

2.2. Model Building

According to the analysis of the above indicators and the research needs of this paper, the double logarithmic model is selected to fit the relationship between independent variables and dependent variables. The selection of double logarithmic model is not only more in line with the research needs, but also can reduce the impact of adverse factors such as heteroscedasticity and multicollinearity to a certain extent. Based on this, this paper constructs the following multiple linear model:

$$logy_i = log\alpha_i + \beta_1 logx_{1i} + \beta_2 logx_{2i} + \beta_3 logx_{3i} + \beta_4 logx_{4i} + \beta_5 logx_{5i} + \varepsilon_i \quad (1)$$

Among them, irepresents the year, y represents the degree of construction of the domestic value chain, x_1 represents the degree of trade openness, x_2 represents the disposable income of residents, x_3 represents the scientific and technological research and development expenditure, x_4 represents posts and telecommunications business volume, x_5 represents the level of economic development, and ε is a random disturbance item.

2.3. Data Sources

The original data collected in this paper are from the National Bureau of Statistics and the EPS database.

3. Model Estimation

3.1. Parameter Estimation

Import the collected data of gross national product, disposable income of residents, investment in scientific and technological research and development, construction of transportation infrastructure, and post and telecommunications business volume from 2010 to 2019 into

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Eviews, and use the least squares method to estimate the estimated value of parameters. The estimated results are shown in Figure 1 :

Dependent Variable: Y11
Method: Least Squares
Date: 01/29/23 Time: 09:18
Sample: 2010 2019
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.16511	0.429846	30.62751	0.0000
X11	-0.074797	0.057773	-1.294675	0.2651
X22	0.093868	0.311032	0.301794	0.7778
X33	0.081998	0.111074	0.738228	0.5013
X44	0.003858	0.005466	0.705787	0.5193
X55	0.092996	0.264454	0.351654	0.7428

R-squared	0.998770	Mean dependent var	15.31888
Adjusted R-squared	0.997233	S.D. dependent var	0.073958
S.E. of regression	0.003891	Akaike info criterion	-7.976796
Sum squared resid	6.05E-05	Schwarz criterion	-7.795245
Log likelihood	45.88398	Hannan-Quinn criter.	-8.175957
F-statistic	649.6346	Durbin-Watson stat	2.918231
Prob(F-statistic)	0.000007		

Figure 1. Schematic diagram of the results of the least squares method

Therefore, the model can be preliminarily estimated:

$$\log y_i = 13 - 0.07\log x_{1i} + 0.09\log x_{2i} + 0.08\log x_{3i} + 0.01\log x_{4i} + 0.09\log x_{5i} + \varepsilon_i \quad (2)$$

Among them, R^2=0.9988, the adjusted R^2=0.9972, which means that 99.88% of the change in the total import and export volume of the dependent variable can be caused by the change in the explanatory variable, with a high goodness of fit, F=649.6346, DW=2.9182. Since the influence of multicollinearity, heteroscedasticity and autocorrelation is not taken into account when using the least squares method, the model has some errors. Next, this paper will test and revise the model.

4. Model Inspection and Correction

4.1. Test and Correction of Multicollinearity

If there is a strong linear relationship between the explained variables of the model, the model is considered to be multicollinearity. If there is multicollinearity in the model, it will be difficult to analyze the independent influence of each explanatory variable, increase the variance of the least squares method, reduce the reliability of the t-test, etc. Therefore, it is of great significance to test and correct the multicollinearity. Next, this paper will use the simple correlation coefficient method and the variance expansion factor method to test the multicollinearity.

4.1.1. Simple Correlation Coefficient Method

First, import all independent variables into Eviews, set all explanatory variables into an array, click View/Variance Analysis in the array window, and then select Correlation in the pop-up dialog box to get the correlation coefficient matrix, as shown in Figure 2.

	X1	X2	X3	X4	X5
X1	1.000000	0.894410	0.895311	0.775526	0.913714
X2	0.894410	1.000000	0.996348	0.769923	0.998306
X3	0.895311	0.996348	1.000000	0.795991	0.993716
X4	0.775526	0.769923	0.795991	1.000000	0.786796
X5	0.913714	0.998306	0.993716	0.786796	1.000000

Figure 2. Schematic diagram of independent variable correlation coefficient matrix

ISSN: 2688-9323

According to the correlation coefficient matrix, the correlation coefficient between multiple independent variables is greater than 0.8, so it can be roughly considered that the model has multicollinearity.

Variance Inflation Factors
Date: 01/29/23 Time: 09:56
Sample: 2010 2019
Included observations: 10

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.184767	122065.2	NA
X11	0.003338	342254.6	33.48977
X22	0.096741	10074061	5524.940
X33	0.012337	468594.7	701.9052
X44	2.99E-05	2107.527	8.890403
X55	0.069936	8302151.	3272.831

Figure 3. Test results of variance expansion factor method

4.1.2. Variance Expansion Factor Method

First, import the independent and dependent variables into EVIEWS, and then use the least squares method to get the regression results. Then click View/Coefficient Diagnostics/Variance Impact Factors in the regression results, where the Centered VIF in the result column is the variance inflation factor, as shown in Figure 3.

The result shows that the variance expansion factor of the other independent variables is more than 10 except x_{44}, so the model has serious multicollinearity.

4.1.3. Correction of Multicollinearity

Common correction methods of multicollinearity include eliminating secondary variables, using prior information, transforming model form, stepwise regression and principal component regression. In view of the practical operability, this paper adopts the stepwise regression method to modify the model and the regression results. The modified results are shown in Figure 4.

Dependent Variable: Y11
Method: Stepwise Regression
Date: 01/29/23 Time: 10:30
Sample: 2010 2019
Included observations: 10
Number of always included regressors: 1
Number of search regressors: 5
Selection method: Stepwise forwards
Stopping criterion: p-value forwards/backwards = 0.1/0.1
Stopping criterion: Number of search regressors = 5

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	12.84517	0.164346	78.15943	0.0000
X22	0.248709	0.008631	28.81617	0.0000
X11	-0.057363	0.019520	-2.938586	0.0260
X44	0.006466	0.002396	2.699010	0.0356

R-squared	0.998515	Mean dependent var	15.31888
Adjusted R-squared	0.997773	S.D. dependent var	0.073958
S.E. of regression	0.003490	Akaike info criterion	-8.188449
Sum squared resid	7.31E-05	Schwarz criterion	-8.067415
Log likelihood	44.94225	Hannan-Quinn criter.	-8.321223
F-statistic	1344.932	Durbin-Watson stat	2.659913
Prob(F-statistic)	0.000000		

Selection Summary

Added X22
Added X11
Added X44

*Note: p-values and subsequent tests do not account for stepwise selection.

Figure 4. Revised results by stepwise regression method

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According to the stepwise regression results, the modified model is:

$$\log y_i = 12.8451 - 0.0574\log x_{1i} + 0.2487\log x_{2i} + 0.065log_{4i} + \varepsilon_i \quad (3)$$

4.2. Test and Correction of Heteroscedasticity

In the econometric model, if the variance dispersion of the random disturbance is different or the variance is not equal to a constant, the model is considered to have heteroscedasticity. Heteroscedasticity will also lead to the inefficiency of the OLS estimator, which will reduce the reliability of the parameter significance test. Therefore, it is of great significance to test and revise the heteroscedasticity of the model. In this paper, the modified model will be tested by White test.

4.2.1. White Test

White's test can not only test whether the model has heteroscedasticity, but also test the regression coefficient of the auxiliary regression model in the case of multiple variables to determine which or which explanatory variables are related to heteroscedasticity. The results of White method are shown in Figure5.

Heteroskedasticity Test: White

F-statistic	6.098816	Prob. F(7,2)	0.1481
Obs*R-squared	9.552490	Prob. Chi-Square(7)	0.2154
Scaled explained SS	4.215246	Prob. Chi-Square(7)	0.7547

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/29/23 Time: 10:40
Sample: 2010 2019
Included observations: 10
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.045670	0.014399	3.171680	0.0867
X11^2	-0.000673	0.000238	-2.829421	0.1055
X11*X22	0.000535	0.000296	1.804491	0.2129
X11*X44	0.000983	0.000327	3.011828	0.0948
X22^2	-0.000209	0.000150	-1.393626	0.2981
X22*X44	-0.000146	9.51E-05	-1.535131	0.2645
X44^2	-7.58E-05	2.66E-05	-2.852381	0.1041
X44	-0.008858	0.002790	-3.174824	0.0865

R-squared	0.955249	Mean dependent var	7.31E-06
Adjusted R-squared	0.798620	S.D. dependent var	1.21E-05
S.E. of regression	5.41E-06	Akaike info criterion	-21.42471
Sum squared resid	5.86E-11	Schwarz criterion	-21.18264
Log likelihood	115.1236	Hannan-Quinn criter.	-21.69026
F-statistic	6.098816	Durbin-Watson stat	3.427925
Prob(F-statistic)	0.148062		

Figure 5. White test results

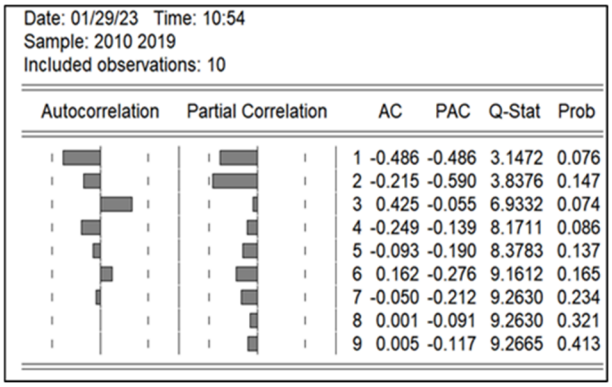
4.3. Test and Correction of Autocorrelation

According to the definition, if there is a certain correlation between the random perturbation items corresponding to different sample points, it is considered that the model has a certain autocorrelation. If the model has autocorrelation, the effectiveness of parameter estimation and the accuracy of model prediction will be reduced. Therefore, the autocorrelation test and correction of the model is also a key step. In this paper, the partial correlation coefficient method is used to test and modify the model.

4.3.1. Bias Relation Number Method Test

The results obtained by using the biased relation number method are shown in Figure 6. According to the test of the number of bias relations, the modified model does not have 1-9 order autocorrelation, so it can be considered that the modified model does not have autocorrelation and does not need to be modified.

ISSN: 2688-9323

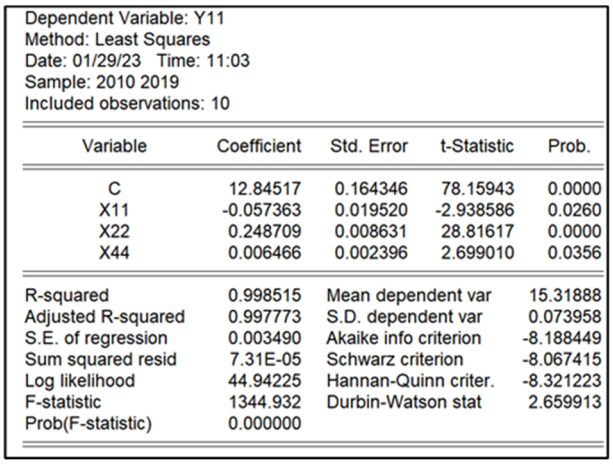

Date: 01/29/23 Time: 10:54
Sample: 2010 2019
Included observations: 10

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.486	-0.486	3.1472	0.076
		2	-0.215	-0.590	3.8376	0.147
		3	0.425	-0.055	6.9332	0.074
		4	-0.249	-0.139	8.1711	0.086
		5	-0.093	-0.190	8.3783	0.137
		6	0.162	-0.276	9.1612	0.165
		7	-0.050	-0.212	9.2630	0.234
		8	0.001	-0.091	9.2630	0.321
		9	0.005	-0.117	9.2665	0.413

Figure 6. Test results of bias relation number

4.4. Statistical Test

The revised model estimation results are shown in Figure 7.


Dependent Variable: Y11
Method: Least Squares
Date: 01/29/23 Time: 11:03
Sample: 2010 2019
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.84517	0.164346	78.15943	0.0000
X11	-0.057363	0.019520	-2.938586	0.0260
X22	0.248709	0.008631	28.81617	0.0000
X44	0.006466	0.002396	2.699010	0.0356

R-squared	0.998515	Mean dependent var	15.31888
Adjusted R-squared	0.997773	S.D. dependent var	0.073958
S.E. of regression	0.003490	Akaike info criterion	-8.188449
Sum squared resid	7.31E-05	Schwarz criterion	-8.067415
Log likelihood	44.94225	Hannan-Quinn criter.	-8.321223
F-statistic	1344.932	Durbin-Watson stat	2.659913
Prob(F-statistic)	0.000000		

Figure 7. Revised model estimation results

It can be seen from Figure 7 that the modified determinability coefficient of the model is 0.9978, that is, 99.78% of the variation of the variable can be changed by the variation of the explanatory variable, and the modified determinability coefficient is greater than 0.6, so the modified model can be considered to have a high goodness of fit. In the model $F = 1344.392 > F_{0.05}(3,6) = 4.76$,which rejects the original assumption $H_0: \beta_1 = \beta_4 = 0$.And in the model, $|t_1| => t_{0.05}(8) = 2.3060$, $t_2 = 328.8162 > t_{0.05}(8) = 2.3060$, $t_4 = 2.6990 > t_{0.05}(8) = 2.3060$.Therefore, it can be considered that the significance of variables is high.

Therefore, the final model estimation result of this paper is:

$$logy_i = 12.8452 - 0.0574logx_{1i} + 0.2487logx_{2i} + 0.0065logx_{4i} + \varepsilon_i \quad (4)$$

The model indicates that when other factors remain unchanged, the degree of domestic value chain construction will decrease by 0.0574% for each 1% increase in trade openness; With other factors unchanged, when the disposable income of residents increases by 1%, the construction of China's domestic value chain will increase by 0.2487%; With other factors unchanged, the construction degree of domestic value chain will increase by 0.0065% for every 1% increase in post and telecommunications business volume. It can be concluded that the increase of disposable income of residents and the volume of post and telecommunications business has a positive role in promoting the construction of China's domestic value chain, while the improvement of trade openness is not conducive to the development of China's import and export trade to a certain extent. Therefore, it is of great significance to properly handle the relationship between domestic and international trade for building a new

development pattern with the domestic big cycle as the main body and the domestic and international double cycles promoting each other.

5. Policy Suggestion

Based on the above research conclusions, this paper puts forward the following suggestions: First, we should deal with the relationship between trade openness and domestic value chain. Trade openness has strong effects such as technology spillover and resource allocation. The construction of domestic value chain is conducive to improving the resilience of China's economic development and further consolidating the security of China's economic development. Therefore, while adhering to the continuous expansion of opening up, we should strive to promote the construction and improvement of domestic value chain, promote the mutual connection and parallel development of the two, and help the realization of the new development pattern. Secondly, we should promote the research, development and breakthrough of advanced and sophisticated technologies and overcome the "neck technology". Encourage all kinds of small and medium-sized enterprises to promote innovation in production technology, business mode and management mode, cultivate innovative talents, strengthen key talents and technical support, promote the construction of domestic value chain, and realize that the construction of domestic value chain drives China to climb up the global value chain. Finally, local governments should further optimize the market business environment, streamline administration and delegate power, break down barriers to market segmentation, give play to the leading role of the market, better play the role of the government, promote the interconnection of regional transportation and other infrastructure, realize the differentiated development of regional industries, and provide environmental support for the professional division of labor between domestic regions.

Acknowledgments

This work is supported by Anhui University of Finance and Economics Undergraduate Research innovation fund project fund, Project number: XSKY22117.

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