An Empirical Study on the Relationship between Export and import trade and Economic Growth

Li Wu [1], Yonghong Yu[2]

[1]School of Finance and Public Management, Anhui University of Finance & Economics, Bengbu 233030, China;

[2] School of Management Science and Engineering, Anhui University of Finance & Economics, Bengbu 233030, China.

Abstract

VAR model is used in this article to discuss the relationship export and import trade and economic growth in China from 2002 to 2020. The results of empirical research show that: (1) economic growth is mainly dependent on its own factors, the impact of foreign trade on economic growth is relatively weak, and economic growth has a significant impact on foreign trade; (2) the influence of the import trade on economic growth is both negative and positive. The influence of the import trade on economic growth is relatively weak. (3)the export trade has a certain demonstration effect on the economic growth. In short, economic development is fundamental, as it determines the scale and structure of foreign trade, which affects the speed of economic development.

Keywords

Export Trade; Import Trade; Economic Growth; Impulse Response.

1. Introduction

According to the theory of public goods, social goods are divided into three categories: public goods, private goods, and quasi public goods. Pure public goods have complete non-competitiveness and non-exclusivity. Quasi public goods have some non-competitiveness and non-exclusivity. It is generally believed that compulsory education is pure public goods that should be provided by government, while non-compulsory education is quasi-public goods that should be jointly provided by public sector and private sectors. Externalities can be divided into negative externalities and positive externalities. Products with positive externalities would lead to insufficient consumption and supply, while products with negative externalities would lead to excessive consumption and supply. Due to the positive externalities of education, providing educational products by government can solve the problem of insufficient consumption and supply in education.

Schultz[1], a Nobel laureate in economics in 1979, was known as the "father of human capital theory" and divides capital into two forms: material capital and human capital. Schultz proposed that capital formed through investment in human capital can be called human capital, which is a type of capital reflected in individuals. Increasing the investment of workers in the production process of goods can effectively enhance the value of labor, which is known as human capital investment. He believes that human capital investment can be divided into five categories: education and training, healthcare, employee training, and migration. Herbertsson[2] used historical data from five Nordic countries as research examples, he analyzes the impact of education investment, fixed assets, working hours, and total factor productivity on economic growth. The results show that the contribution rate of formal education investment to economic growth in Nordic countries is 12% -33%. Ning [3] studied the relationship between human capital investment and economic growth in China indicates

that there is a long-term cointegration relationship between various educational variables and the gross domestic product., the popularization of compulsory education and the increase in the proportion of labor with higher education have greatly promoted China's economic development; On the contrary, economic growth has greatly promoted the development of China's secondary and higher education. However, there are still many problems that need to be solved urgently, such as insufficient government investment in education and uneven distribution of education investment among different levels and regions, ultimately resulting in low actual effectiveness of education investment. Zhang[4] studied the relationship between public physical capital investment, public human capital investment, and R&D investment and Economic Growth suggested that the three types of public investment have varying degrees of positive economic growth effects, and their paths of promoting economic growth are also different. Public material capital investment mainly drives economic growth through capital accumulation effects, while public human capital investment and R&D investment promote economic growth by improving total factor productivity and externalities. Moreover, at different stages of development, the causal relationship and driving mechanisms between the three types of public investment and economic growth vary. Draw conclusions and policy recommendations based on empirical results, in order to provide decision-making basis for optimizing China's public investment policies. Quan[5] analyzed the relationship between government public education investment and economic growth in China The research results show that there is a cointegration relationship. Economic growth has a long-term positive response to government public education investment, and the contribution rate of government public education investment continues to increase over the long term. John Whalley[6] studied result reevaluate the contribution of human capital to China's economic growth rather than relying on years of schooling as in current literature. The results indicate that human capital plays an important role in China's economic growth, 38.1% of economic growth over 1978–2008, and even higher for 1999–2008. In addition, because human capital formation accelerated following major educational expansion increases after 1999 (college enrollment in China increased nearly fivefold between 1997 and 2007) while growth rates of Gross domestic product (GDP) are little changed over the period after 1999, total factor productivity (TFP) increases fall if human capital is used in growth accounting as we suggest. TFP, by our calculations, contributes 16.92% of growth between 1978 and 2008, but this contribution falls sharply between 1999 and 2008. TFP growth estimates along with the high contribution of physical and human capital to economic growth seem to suggest that there could have been decreases in the efficiency of input usage in China or worsened misallocation of physical and human capital in recent years. These results underscore the importance of efficient use of human capital, as well as the volume of human capital creation, in China's growth strategy.

2. Empirical study

Time series data used in this article are Gross Domestic Product (GDP), Total Exports (CKZE), and Total Imports (JKZE) from 2002 to 2020.In this article rgdp represents the growth rate of GDP, rckze and rjkze represent the growth rate of gross export and gross import respectively. The data of Gross domestic product (GDP) and gross import and gross export from 2002 to 2020 are derived from the websites of Zhonghong and the National Bureau of Statistics(see table 1).

Table 1. Dataset of 2002-2022

year	gdp	ckze	jkze	rgdp	rckze	rjkze
2002	121717.4	26947.9	24430.3	0	0	0
2003	137422	36287.9	34195.6	0.129025	0.346596	0.399721

2004	161840.2	49103.3	46435.8	0.177687	0.35316	0.357947
2005	187318.9	62648.1	54273.7	0.157432	0.275842	0.16879
2006	219438.5	77597.9	63376.9	0.17147	0.238631	0.167728
2007	270092.3	93627.1	73296.9	0.230834	0.206568	0.156524
2008	319244.6	100394.9	79526.5	0.181983	0.072285	0.084991
2009	348517.7	82029.7	68618.4	0.091695	-0.18293	-0.137163
2010	412119.3	107022.8	94699.5	0.182491	0.304684	0.380089
2011	487940.2	123240.6	113161.4	0.183978	0.151535	0.194952
2012	538580	129359.3	114801	0.103783	0.049648	0.014489
2013	592963.2	137131.4	121037.5	0.100975	0.060082	0.054324
2014	643563.1	143883.8	120358	0.085334	0.04924	-0.005614
2015	688858.2	141166.8	104336.1	0.070382	-0.01888	-0.133119
2016	746395.1	138419.3	104967.2	0.083525	-0.01946	0.006049
2017	832036	153309.4	124789.8	0.114739	0.107573	0.188846
2018	919281.1	164128.8	140881.3	0.104857	0.070572	0.128949
2019	986515.2	172373.6	143253.7	0.073138	0.050234	0.01684
2020	1013567	179278.8	142936.4	0.027422	0.040059	-0.002215

Fig.1 the growth rate of GDP, the growth rate of gross export and gross import

Figure 1 shows that the growth rate of GDP and gross import and gross export show an obvious fluctuation with up and down with the change of time. It can be judged basically that the time series of the growth rate of GDP, the growth rate of gross export and gross import have no stability characteristics. In order to examine the relationship between the growth rate of GDP and the growth rate of export and import, this paper uses VAR model to analyze the relationship. Therefore, taking the growth rate of GDP, growth rate export and growth rate of import as the original sequence, this paper makes an empirical analysis of the relationship between them.

Use the ADF unit root test the stationarity of the three time sequences rgdp, rckze, and rjkze, as well as their difference sequences. The ADF test results indicate that the time series rgdp, rjkze, and rckze are all non-stationary at significant levels of 1%, 5%, and 10%; But their first-order difference, d1rgdp, d1rckze, and d1rjkze are all stationary sequences at significant levels of 1%, 5%, and 10%(see table 2).

Table 2. Results of Stationarity Test

	rgdp	rckze	rjkzeeview	d1rgdp	d1rckze	d1rjkze
adf	-3.590329	-4.530238	-4.381099	-5.569785	-4.886484	-5.197747
1%	-4.616209	-4.571559	-4.571559	-4.667883	-4.667883	-4.667883

5%	-3.710482	-3.690814	-3.690814	-3.73320	-3.733200	-3.733200
10%	-3.297799	-3.286909	-3.286909	-3.310349	-3.310349	-3.310349
p	0.0615	0.0108	0.0143	0.0022	0.0069	0.0040
Check Type	c,t,3	c,t,3	c,t,3	c,t,3	c,t,3	c,t,3
	Nostationary	Nostationary	Nostationary	Stationary	Stationary	Stationary

The basic idea of co-integration test is that to prevent pseudo regression, VAR model not only requires independent and consistent distribution of random perturbations, but also requires the time series variables having stationary dependent variable and independent variable. For non-stationary time series, if their linear combination variables are stationary, it can be determined that there is co-integration relationship between these variables. When using the JJ (Johansen Juselius method) for co-integration testing of multivariate models, the maximum eigenvalue statistic and trace statistic are used to determine whether there is co-integration relationship. The specific method is to give the original hypothesis with a maximum of r co-integration relationships. If the trace statistic exceeds the critical value, the original hypothesis is rejected; otherwise, the original hypothesis is accepted. The test results are shown in the table 3.

Table 3. Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.79308684538569615	0.3845408293309335	35.19275463060789	0.0005937850647702278
At most 1 *	0.69470921467921892	5.177242962521452	0.26183964046247	0.009655089579446474
At most 2	0.3209680670075703	6.19339396936574	9.164545912218351	0.176297048772894

Trace test indicates 2 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

It can be see from the table 3 that the trace statistic 50.38454 is greater than the critical value 35.19275, the original assumption is rejected that there is no co-integration relationship among the three variables. The trace statistic 25.17724 is greater than the critical value 20.26184, the original assumption is rejected that there is a co-integration relationship among the three variables. The trace statistic 6.193394 is less than the critical value 9.164546, the original assumption can be accepted that there are two co-integration relationships among the three variables at the 5% significance level.

Based on the existence of co-integration relationships, construct a VAR model with a time series lag period of 3. Excessive lag period can lead to a decrease in the degree of freedom of the VAR model, while too few lag period can affect the effectiveness of the VAR model. In order to verify whether the constructed VAR model is stable and effective, it is necessary to use AR eigenvalues root test. When the lag period is set to be 3, the inverse root of AR characteristic is less than 1 and uniformly distributed. The result of parameter estimation is expressed in matrix form as follows:

$$\begin{pmatrix} d1rgdp \\ d1rckze \\ d1rjkze \end{pmatrix} = \begin{pmatrix} -0.008277 \\ -0.019932 \\ -0.026762 \end{pmatrix} + \begin{pmatrix} 0.190623 & -0.121695 & -0.001328 \\ -0.379598 & -0.744067 & 0.126307 \\ 0.427409 & -1.039151 & 0.059850 \end{pmatrix} \begin{pmatrix} d1rgdp(-1) \\ d1rckze(-1 \\ d1rjkze(-1) \end{pmatrix}$$

$$+ \begin{pmatrix} -0.360165 & -0.041416 & -0.023758 \\ -2.316619 & -0.529547 & 0.719196 \\ -2.026982 & -0.756346 & 0.564430 \end{pmatrix} \begin{pmatrix} d1rgdp(-2) \\ d1rckze(-2) \\ d1rjkze(-2) \end{pmatrix}$$
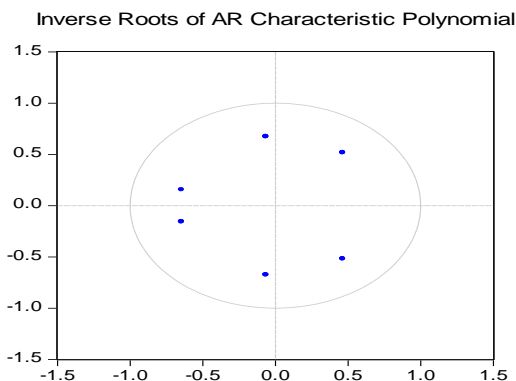

Fig. 2 Inverse Roots of AR Characteristic Polynomial

The test results of the VAR model show that the eigenvalues are all in the unit circle (see Fig. 2), and the residual sequence obeys normal distribution, and there is no hetero-scedasticity and autocorrelation, that is, there is no deviation in VAR model.

3. Impulse Response Analysis

Since the OLS parameters estimators of VAR model has only consistency, it is difficult to interpret the single parameter estimators economically, so it is necessary to analysis the impulse response of the system. Impulse response function (PRF) is the response of an endogenous variable to an random error shock. It describes the impact of a standard deviation shock on the current and future values of the endogenous variable, Figure 3 shows the results of impulse response:
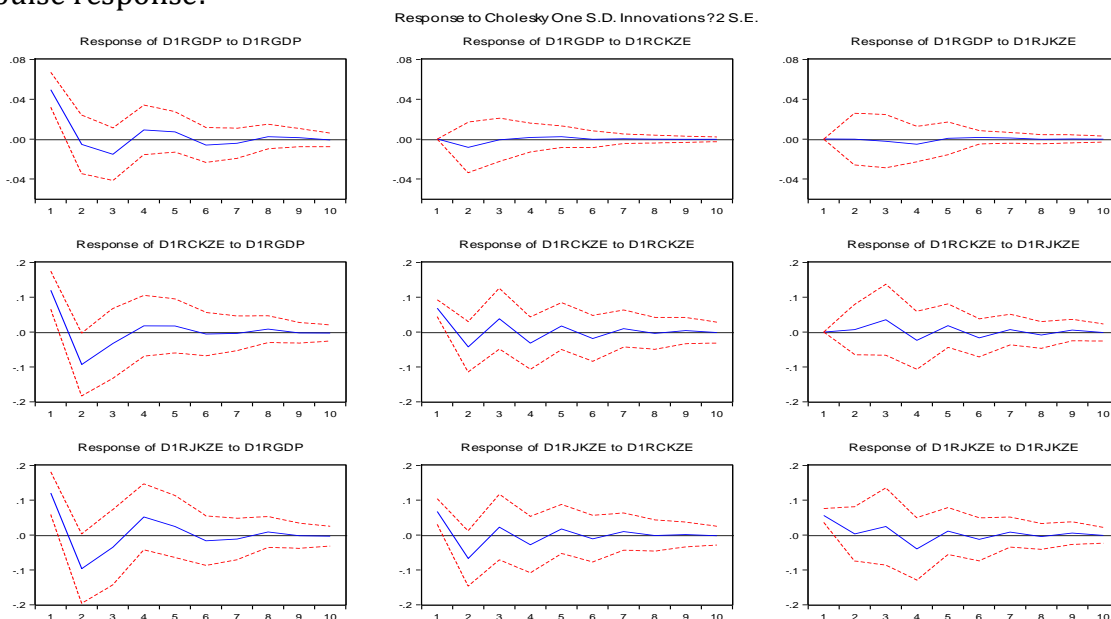

Fig. 3 impulse response

According to the pulse response function of GDP, a positive impact of standard deviation is given to GDP, and the impact on GDP growth reaches its highest point in the third year. This impact gradually decreases and continues until the eighth year. This indicates that economic development plays a decisive role in GDP growth, and the better the foundation of economic development, the faster the GDP growth.

According to the pulse response function of total export volume, a standard deviation positive impact is given to the total export volume. In the first and second years, exports have almost no impact on GDP. Starting from the third year, exports steadily promote GDP growth, indicating that exports will bring a positive impact on GDP and have a long-term promoting effect on economic growth.

According to the pulse response function of total imports, a standard deviation positive shock is given to the total imports. In the first and second years, imports have almost no impact on GDP. Starting from the third year, imports have a weak negative impact on GDP, and this negative shock gradually transforms into a positive shock in the fifth year. This indicates that the impact of total imports on GDP is not significant in the initial stage. After the lag period ends, in the third and fourth years, imports will hinder GDP growth, but in the long run, imports will promote GDP growth.

4. Conclusion and Suggestions

The most important influencing factor of economic growth is the influence of the economy itself, but its impact on GDP shows a gradually decreasing trend, indicating that economic growth has the ability to promote itself. The impact of changes in exports on GDP was almost non-existent in the early stage, but began to have a positive impact in the third period and showed a long-term effect. The impact of changes in imports on GDP was almost non-existent in the early stage, with a negative impact in the third period, but a positive impact starting from the fifth period and showing a long-term effect. In the long run, the growth of import and export trade will promote economic growth, but the impact of imports on GDP is significantly smaller than the impact of exports on GDP. These analysis results are consistent with the analysis results of the pulse response function.

In the forty years of China's reform and opening up, foreign trade has been an important factor in China's economic growth. However, with the development of the economy, the prices of domestic production factors have increased, traditional comparative advantages have weakened, and capital accumulation is slowly evolving into an important source of comparative advantage. China is still in the process of industrialization, but the proportion of service industry has exceeded that of manufacturing industry, indicating that China's foreign trade development has entered a turning point and will inevitably have a significant impact on the medium to long-term development of China's foreign trade. In short, economic development is fundamental, as it determines the scale and structure of foreign trade, which affects the speed of economic development.

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