The Empirical Analysis and Future Prospects of Foreign Trade and Economic Growth in China's Guangdong and Jiangsu Provinces

Mingjie Zheng[a], Hangxu Zuo[b], Shujuan Lan[c*], Erwei Wang[d]

Zhuhai Campus, Beijing Institute of Technology, Zhuhai, China
[a]210081103169@bitzh.edu.cn, [b]210081103479@bitzh.edu.cn
[c*]08086@bitzh.edu.cn, [d]08119@bitzh.edu.cn

Abstract. This paper takes Guangdong Province and Jiangsu Province, the two provinces with the strongest economic strength in China, as the research objects, studies the relationship and differences between foreign trade and economic growth, and explores the reasons. Using ADF test, cointegration test, Granger causality test and VAR model, we empirically analyzed the data of GDP and total imports and exports in Guangdong and Jiangsu provinces from 2009 to 2022. The results show that there is a long-term stable relationship between foreign trade and economic growth in Guangdong and Jiangsu provinces, and foreign trade is an important factor in promoting the economic growth of Guangdong and Jiangsu provinces. However, there are certain differences in the impact degree, direction and lag period of export and import trade on economic growth. The GDP and import and export data of Guangdong and Jiangsu provinces show a stable growth trend, and the GDP growth rate of Guangdong Province is slightly higher than that of Jiangsu Province.

Keywords: Foreign trade, economic development, VAR model.

1 Introduction

Foreign trade is crucial to the economic growth of countries and regions. As the world's second-largest economy, China's foreign trade performance has far-reaching impacts on the global economy. In 2023, the GDP of Guangdong and Jiangsu Provinces ranked the first two in China, and their total accounted for more than one-fifth of China's GDP. This paper focuses on the two economically strong provinces along China's coast - Guangdong Province and Jiangsu Province. Using econometric methods such as ADF test, cointegration test, Granger causality test, combined with the VAR model, it empirically analyzes the relationship between foreign trade and economic growth in the two provinces and compares the similarities and differences in trade structure, economic growth mode, and policy environment. This paper provides policy suggestions for optimizing trade structure in coastal regions, enhancing industrial competitiveness, and promoting regional economic cooperation.

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2 Literature Review

In recent years, empirical research on the relationship between trade and economic growth has attracted widespread attention in China's academic circles.

Wang Jianpeng[1] conducts stationarity tests and regression analysis on China's service trade import and export and GDP data from 2005 to 2018, finding that service trade import and export have a certain promoting effect on economic growth. Wu Qiuhua[2] uses the VAR model to study the dynamic relationship between China's foreign trade and economic growth. The results show that China's economic growth is the Granger reason for the export amount and the import amount. Economic growth has a positive promoting effect on imports and a reverse driving force on exports. Cai Qiaoling[3] takes Jiangsu Province as an example and analyzes the data from 1990 to 2015 through the VAR model, finding that FDI and foreign trade promote economic growth in the long run. Zhang Quan et al.[4][5] use data from Jilin Province from 1978 to 2007, and apply cointegration tests and the VECM model to find that imports have a significant promoting effect on economic growth, while exports have no significant effect. This indicates that the economy of Jilin Province has the characteristics of "import-driven". Zhao Qingjun et al.[6] conduct an empirical analysis of Fujian Province's data from 1984 to 2016, showing that there is a long-term equilibrium relationship between import and export trade and economic growth. The promotion of import trade on economic growth is significant, and export trade and economic growth promote each other in the short term, suggesting that the structure of foreign trade should be optimized to enhance its contribution to the economy. Hu Yang[7] simulates the impact of RCEP on China-Australia trade through the GTAP model, finding that the RCEP agreement effectively enhances the competitiveness of China-Australia goods trade and service trade, and has a positive impact on the GDP and social welfare of member countries.

In summary, these studies have conducted a comprehensive analysis of the relationship between trade and economic growth through different regions and methods. It is generally believed that foreign trade, especially service trade and import trade, has a positive effect on China's economic growth, but the impact varies by region and time. Policy recommendations focus on optimizing trade structure, enhancing industrial competitiveness, and promoting regional economic cooperation. Future research can further refine the specific mechanisms of different types of trade on economic growth and explore more regional and temporal data to verify and expand existing conclusions.

3 Methods

Step 1: as shown in Figure 1, to determine the relationship between GDP and import and export trade, the ADF test is first conducted for stationarity, with appropriate logarithmic or differencing operations applied to reduce the non-stationarity of the data.

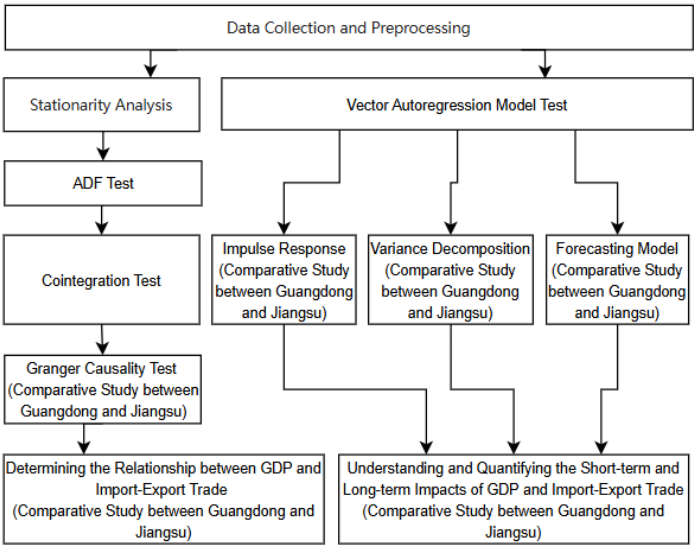


Fig. 1. Research Method Flow Chart

Step 2: the cointegration test is conducted for non-stationary series to determine the long-term stable relationship between these variables. The Engle-Granger two-step method used to test for cointegration between two non-stationary time series.

Step 3: the Granger causality test is performed to determine whether one or a group of time series can effectively predict the future values of another time series.

Step 4: to understand and quantify the short-term and long-term effects between GDP and import and export trade, a VAR model is established for impulse response and variance decomposition analysis.

4 Empirical Analysis

4.1 Data Selection and Preprocessing

This article uses Eviews 12 for data analysis. This article uses data from Guangdong and Jiangsu provinces from 2009 to 2022, a total of 14 years, for the empirical analysis of the relationship between foreign trade and economic development. The variables selected are the regional GDP of Guangdong and Jiangsu provinces, export amount (Export), and import amount (Import). Before carrying out empirical research, it is necessary to pre-process the sample data.

4.2 Comparison of Stationarity Tests

The three variables studied exhibit a roughly similar time trend, all rising over time. We initially infer that the unit root still exists after taking the logarithm of the original variables. This paper adopts the ADF test for stationarity analysis of the data. As can

be seen from the aforementioned three trend charts, the three variables studied in this paper all show a pronounced uptrend as time changes, indicating that there is a fixed trend in this process, with the time trend dominating.

The determination of the lag order of the ADF model is discussed. Here, the information criteria are used to determine the optimal order of the model (as shown in Tables 1 and 2 below). GDEX, GDIM, and GDGDP represent the export, import, and GDP values of Guangdong Province; JSIM, JSEX, and JSGDP represent the export, import, and GDP values of Jiangsu Province. In order to significantly weaken the time trend of each variable, it is necessary to differentiate the original data. In the ADF test for the differentiated variables, dGDGDP retains the constant term and time trend term, dGDEX, dGDIM, dJSEX removes the constant term and time trend term, dJSIM, and dJSGDP only retain the constant term and remove the time trend term. The ADF test is repeated for these three new variables.

Table 1. ADF Stationarity Test Result 1 for Guangdong Province

Variable name	Constan-term	Time trend term	Order of lag	Test value	5% critical value	Stationarity
GDEX	Yes	Yes	1	-2.582401	-3.875302	No
GDIM	Yes	Yes	1	-2.702821	-3.875302	No
GDGDP	Yes	Yes	1	-0.372524	-3.875302	No

Table 2. ADF Stationarity Test Result 1 for Jiangsu Province

Variable name	Constan-term	Time trend term	Order of lag	Test value	5% critical value	Stationarity
JSEX	Yes	Yes	1	-1.298969	-3.875302	No
JSIM	Yes	Yes	1	-2.109292	-3.875302	No
JSGDP	Yes	Yes	1	-0.894918	-3.875302	No

4.3 Cointegration Test Comparison

To test whether there exists a long-term equilibrium relationship among non-stationary sequence variables, this paper employs the E-G two-step method to explore the relationship between import and export trade and economic development. The first step is to estimate the regression equation and establish the cointegration model as follows:

$$GDGDP=-65851.27+3.633288GDEX+U1 \quad (1)$$

$$GDGDP=-79332.06+6.105026GDIM+U2 \quad (2)$$

$$JSGDP=-33542.60+4.707082JSEX+U3 \quad (3)$$

$$JSGDP=-56472.79+8.990439JSIM+U4 \quad (4)$$

Separately test whether the residual series of the above two regression equations (7),(8),(9),(10) are stationary. Assume H0: the residual series is stationary. Apply ADF

test to the residual series. The AEG statistic of these four cointegration models all pass the 10% significance level test, which can reject the null hypothesis, and it is believed that the regression model mentioned above is valid, and the two foreign trade-related indicators studied all have a cointegration relationship with the regional GDP.

4.4 Granger Causality Test

To explore the economic predictability among variables, we need to conduct Granger causality tests on GDGDP, GDEX, GDIM in Guangdong Province and JSGDP, JSEX, JSIM in Jiangsu Province to further examine whether import and export trade serves as a driving force for the economic growth of Guangdong and Jiangsu Provinces. The conclusion drawn from this is that both the economic growth of Guangdong Province and Jiangsu Province are Granger caused by imports and exports. However, there is a slight difference between the two. The export trade of Guangdong Province is also a Granger cause for economic growth.

4.5 Comparison of VAR Model Testing

Model Identification and Establishment.

Based on the LR statistic, final prediction error (FPE), and information criteria such as AIC, SC, and HQ, the optimal lag order is determined. The optimal lag order is 1, so a VAR(1) model is established, as shown in figure 2.

$$GDGDP_t = 1.055422GDGDP_{t-1} - 0.517875GDIM_{t-1} + 0.156409GDEX_{t-1} + 9626.857$$
$$GDEX_t = 0.136085GDGDP_{t-1} + 0.200867GDIM_{t-1} + 0.265102GDEX_{t-1} + 15367.09$$
$$GDIM_t = 0.098829GDGDP_{t-1} + 0.568588GDIM_{t-1} - 0.360750GDEX_{t-1} + 18624.59$$
$$JSGDP_t = 1.419564JSGDP_{t-1} - 3.218792JSIM_{t-1} - 3.655534JSEX_{t-1} + 11804.84$$
$$JSEX_t = 0.265807JSGDP_{t-1} + 1.774243JSIM_{t-1} - 1.2157722JSEX_{t-1} + 6453.425$$
$$JSIM_t = 0.143789JSGDP_{t-1} + 1.256781JSIM_{t-1} - 0.918548JSEX_{t-1} + 7189.944$$

Fig. 2. VAR(1) Regression Equations for Guangdong and Jiangsu

The F statistic for the regression equation is much larger than the critical value, indicating a good overall significance of the fitted equation. The adjusted coefficients of determination for the regression equations are 0.895805, 0.982997, 0.517339, 0.903137, 0.989246, and 0.715510, which indicates a good fit to the original series.

Comparison of Impulse Responses.

According to the Granger causality test, it is concluded that economic growth (GDP) is the Granger cause of both export trade (EX) and import trade (IM). Therefore, the impulse response analysis of economic growth (GDP) on export trade (EX) and import trade (IM) is mainly conducted.

The export data in Guangdong Province shows a gradual increase, while the export data in Jiangsu Province has a negative value from the second period, indicating a decrease in exports. The GDP data in both Guangdong and Jiangsu show a growth trend, but the growth in Guangdong is gradually slowing down, while in Jiangsu, after some fluctuations in the second period, the growth rate remains relatively stable. The import

in Guangdong starts from zero and gradually decreases, while in Jiangsu, the import increases in the second period and then stabilizes.

Several possible reasons for these differences are identified. Economic scale and structure: Guangdong Province's economy is dominated by manufacturing and foreign trade, and has a strong advantage in digital economy, high-tech industries, etc. Jiangsu Province's economy is dominated by the service industry and has a strong advantage in high-end manufacturing, modern service industry, etc. This structural difference may affect their export, import, and GDP growth. Local policies and strategies: Guangdong Province insists on manufacturing as the mainstay, strengthens its openness, and is in the forefront of the country in promoting digital economy and building an international science and technology innovation center. Jiangsu Province is guided by the service industry, strengthens its innovative drive for development, and has obvious advantages in promoting the modern service industry and building a modern economic system.

Comparison of Variance Decompositions.

To compare the contribution of export and import trade to economic growth in Guangdong and Jiangsu provinces, a variance decomposition is performed on the variables that have an impact on real GDP: real GDP, export trade, and import trade.

In Guangdong Province, from the second period, the contribution of real GDP begins to significantly decrease, while the contributions of export and import trade gradually increase. From the third to sixth period, the contribution of export trade increases rapidly and stabilizes at around 30% in the sixth period. As the contribution of export trade stabilizes in the sixth period, the contribution of real GDP also stabilizes at around 60%. The contribution of import trade increases rapidly in the first to third period and then stabilizes at around 10%.

In Jiangsu Province, before the sixth period, the contribution of real GDP increases rapidly. The contribution of export trade gradually decreases and reaches its lowest point in the second period before slowly increasing. After the sixth period, the contribution of export trade stabilizes at around 10%. The contribution of import trade gradually increases and reaches its peak in the second period before slowly decreasing. After the sixth period, the contribution of import trade stabilizes at around 10%. The contribution of real GDP stabilizes at around 80% after the sixth period.

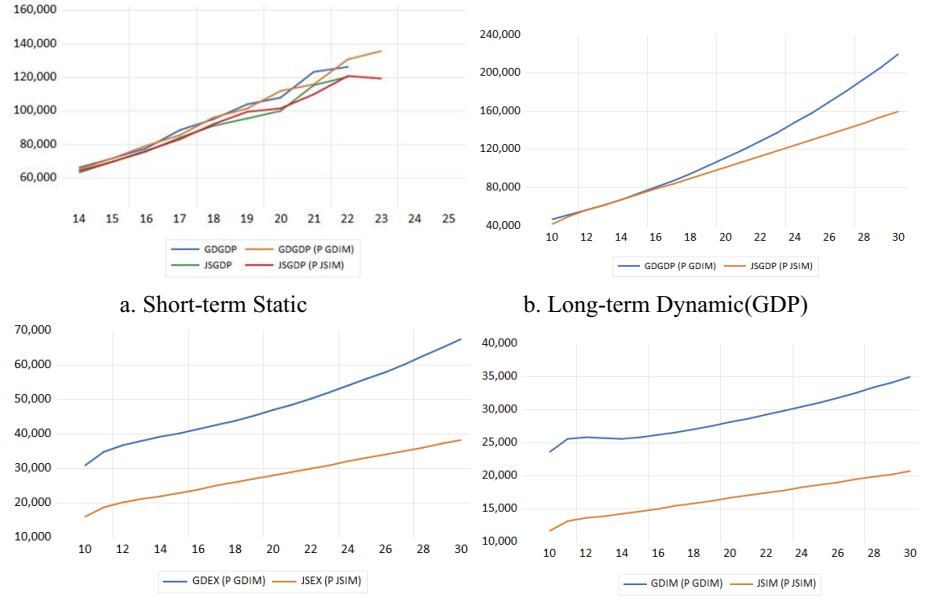
In the long term, the contribution of export trade to economic growth in Guangdong Province is much higher than that of import trade. On the other hand, the contribution of import and export trade to economic growth in Jiangsu Province shows a smaller variation, indicating that the impact of import and export trade on economic growth in Jiangsu Province is not as significant as in Guangdong Province.

5 Comparison of Predictive Models

To compare and test the predictive performance of the VAR model with the published values of Guangdong and Jiangsu provinces, a VAR(1) model is established using the original data. The inverse of the AR characteristic polynomial roots for both models is

less than 1 within the unit circle, indicating that the models have passed the stationarity test.

As shown in figure 3(a), the VAR(1) model established has a good fit for the historical data of economic growth, with relatively small deviations from the observed values.



a. Short-term Static

b. Long-term Dynamic(GDP)

c. Long-term Dynamic(EX)

d. Long-term Dynamic(IM)

Fig. 3. Prediction for Two Provinces

As shown in figures 3(b), (c), and (d), from 2010 to 2030, both Guangdong and Jiangsu provinces show a stable growth trend in GDP and import/export data, which is consistent with the overall trend of China's continuous economic growth. However, a comparison shows that the GDP growth rate in Guangdong Province seems to be slightly higher than that of Jiangsu Province.

6 Conclusion

There exists a Granger causality relationship between economic growth and import-export trade in Guangdong Province and Jiangsu Province, with slight differences. In Guangdong Province, economic growth is a Granger cause of import-export trade, and export trade is a Granger cause of economic growth. In Jiangsu Province, economic growth is a Granger cause of import-export trade, but the reverse is not true. Through impulse response analysis, Guangdong Province's economic growth exhibits a positive reaction to shocks in export trade and a negative reaction to shocks in import trade. Conversely, the impulse response in Jiangsu Province is opposite to that in Guangdong Province. The contribution of export trade to Guangdong Province's economic growth

is relatively significant, while the contribution of import-export trade to Jiangsu Province's economic growth is relatively minor. Both Guangdong Province and Jiangsu Province show a stable growth trend in GDP and import-export data. However, a comparison reveals that Guangdong Province's GDP growth rate is slightly higher than that of Jiangsu Province.

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