

# Impact analysis of trade openness on China's economic growth

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Received 21 July 2014, www.tsi.lv

## Abstract

Trade openness plays can affect China's economy significantly. In this paper, effect of trade openness on China's economic growth was discussed by using the error correction model, Granger causality test and impulse-response function. Moreover, an in-depth analysis on strategies that can facilitate China's economic development was carried out. The empirical research results demonstrated that: 1) there's a short-run equilibrium relationship rather than a long-run one between trade openness and economic growth; 2) the import trade is related with the export trade. Due to the hedging, their collaborative effect is smaller than their independent effects; 3) trade openness can facilitate economic growth within a certain time period, which presents a "U-shaped" influence mode.

*Keywords:* trade openness, economic growth, effect model

## 1 Introduction

Macroscopically, trade openness refers to proportion of the total volume of imports and exports of a region in its GDP. It reflects the contributions of imports and exports to regional GDP. China has achieved an economic boom since the reform and opening up. China's economic development accelerates with the increasing openness to the world. Currently, China's trade openness has already exceeded 60%. In the past, China's trade focused on labour-intensive products, such as textile, clothes, etc. On one hand, such trade structure is difficult to win international competitive edges. On the other hand, it is easy to lose abundant China's resources and causes various anti-dumping policies. With the economic development, China's trade pattern changes accordingly. The current China's trade pattern is focused on technology-intensive and processing industries, benefited from China's continuously increasing openness to the world. Considering its close relationship with economic growth, trade openness can affect economic development significantly.

## 2 Relative theories and researches

The neoclassical growth theory declared that the higher the trade openness is, the higher the regional trade volume will be and the better effect of the regional economies of scale will be. Romer (1986) believed that high trade openness is beneficial for regional technical progress and thereby promotes economic growth [1]. Helpman (1991) analysed from the perspective of political economy and concluded that trade openness increases transparency of economic activities, reduces rent-seeking activities and makes resources used for production activity to promote economic growth [2]. Rogoff (1996) believed that

countries with higher trade openness have higher capacity to absorb and digest new ideas and technical progress of advanced countries [3]. Based on the general equilibrium theory, Upadhyay (2002) discovered that trade openness is an important factor that determines industrial specialization level [4]. These foreign researches demonstrate the important positive effect of trade openness on regional economic development.

Chinese researchers have been arguing about the effect of trade openness on economic growth. Some scholars argue that trade openness is a kind of dependence: higher trade openness indicates higher dependence of regional economic growth on foreign trade, while smaller trade openness indicates lower dependence. Some believes that trade openness reflects regional participation in foreign trade: higher trade openness indicates the active participation of regional economy in international trade, while smaller trade openness indicates the inactive participation. On this basis, many Chinese scholars have explored effect of China's trade openness on its economy. Some scholars reported that trade openness is insignificant to economy. For example, Zhang Liguang et al. (2004) explored effect of China's trade openness on the long-run economic equilibrium, finding that the trade openness is insignificant in term of direct GDP promotion [5]. Bao Qun (2003) also believed that China's trade openness is insignificant to economic growth [6]. Some scholars reported that trade openness can affect economy to a certain extent, but such effect is indirect instead of direct. For example, Huang Xinfei (2007) deemed that increasing trade openness will accelerate technical progress of competitive industries, thus improving specialized production technology and promoting the long-term economic growth [7]. Some other scholars thought that trade openness can affect economy to a certain extent, but such effect is very complicated. For example, Zhang

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Qingjun (2008) proposed the U-shaped growth model [8]. He believes that effect of trade openness on economy is not a simple straight line, but presents a U-shaped variation law. In other words, effect of trade openness on economy often increases firstly and then weakens gradually. This paper attempts to give explore effect of China's trade openness on economic growth thoroughly from various perspectives by using the error correction model, Granger causality test and impulse-response function.

### 3 Correlation analysis between trade openness and economic growth

#### 3.1 VARIABLES AND DATA

For China, the trade openness of one year (TO) refers to the proportion of China's total volume of imports and exports in the GDP of this year. To analyse more specifically, the author divided TO into import trade openness (ITO) and export trade openness (ETO). ITO refers to the proportion of China's total imports of one year in GDP of this year, while ETO refers to the proportion of China's total exports of one year in GDP of this year. To sum up, indexes involved in this quantitative analysis includes TO, ITO, ETO and GDP.

Data used in the empirical analysis were annual data on www.tjcn.org, including total imports, total exports, total volume of imports and exports, and GDP from 1978 ~2012. To eliminate heteroscedasticity while maintaining same quantitative analysis relationship, GDP data with high values were converted into log data (LGDP). Through a simple calculation of TO, necessary indexes for quantitative analysis can be gained:  $ITO_i = \frac{\text{Total-imports}_i}{GDP_i}$ ,

$$ETO_i = \frac{\text{Total-exports}_i}{GDP_i}$$

#### 3.2 ERROR CORRECTION MODEL

Unit root test was conducted to TO, ITO, ETO and LGDP. The unit root test in this paper used ADF test. The test results demonstrated that under no differential, all four indexes were unstable and had roots of unity. However, they became stable and their roots of unity were eliminated after the first-order difference. ADT test results are listed in Table 1. All indexes have similar variation trend, thus making co-integration analysis feasible.

TABLE 1 ADF test results of TO, ITO, ETO and LGDP

Index	t-Statistic	Prob.*	Test critical values:	
LGDP	-3.8064	0.0072	1% level	-3.6463
TO	-4.7303	0.0006	5% level	-2.9540
ETO	-5.0538	0.0002	10% level	-2.6158
ITO	-4.3953	0.0014		

Error correction term has to be determined before the establishment of error correction model. Therefore, the least square regression was implemented by taking GDP as the dependent variable while TO, ETO and ITO as independent variables. The results of three independent variables are 8.9388, 15.8890 and 19.7386, respectively. Then, the error correction term can be defined by using GENR:

$$ECM_1 = LGDP(-1) - 8.9388 \cdot TO(-1),$$

$$ECM_2 = LGDP(-1) - 15.8890 \cdot ETO(-1),$$

$$ECM_3 = LGDP(-1) - 19.7386 \cdot ITO(-1).$$

The ECM estimation results of TO, ETO, ITO and LGDP are listed in Table 2. For the error correction model established with TO and GDP, one of its tail probability valued 0.1571 (>0.1), indicating their insignificant correlation. Therefore, TO and GDP could not be used to establish the error correction model. Similarly, ETO and GDP also have insignificant correlation and could not be used to establish the error correction model. Since the error correction model reflects a long-run equilibrium relationship, the insignificant correlation means there is no long-run equilibrium relationship between two variables. However, they still may have a short-run equilibrium relationship. As a result, Granger causality test and impulse-response function are needed to confirm such short-run equilibrium relationship. With respect to the ITO-GDP relationship, both tail probabilities were smaller than 0.1, but the determination coefficient was 0.2613, over smaller under two variables. This implies that there is a weak correlation between ITO and GDP.

TO includes ITO and ETO. Although there is a weak correlation between ITO and GDP, the relationship between TO and GDP in China is even weaker. This is because there is no long-run equilibrium relationship between ETO and GDP, and exports take the dominant role in the economic growth of China, a trade surplus country. The weak correlation between ITO and GDP may be caused by the design and technological progresses through imports. This consolidates economic base for the economic boom.

The error correction model verifies the long-run equilibrium relationship between variables. The short-run equilibrium relationship can be further analysed through Granger causality test and impulse-response function.

TABLE 2 ECM estimation results of TO, ETO, ITO and LGDP as well as relative test results

No	Variable	Coefficient	Std. Error	t-Statistic	Prob.	R-squared	Adjusted R-squared
1	D(TO)	0.3092	2.13E-01	1.45E+00	0.1571	0.2060	0.1547
	ECM	-0.0418	1.60E-02	-2.62E+00	0.0135		
	C	0.4564	1.20E-01	3.808707	0.0006		
2	D(ETO)	0.4226	3.90E-01	1.08E+00	0.2864	0.1337	0.0078
	ECM	-0.0359	1.74E-02	-2.06E+00	0.0474		
	C	0.4214	1.35E-01	3.129868	0.0038		
3	D(ITO)	0.74903	4.18E-01	1.79E+00	0.0828	0.2613	0.2137
	ECM	-0.041276	1.37E-02	-3.02E+00	0.0050		
	C	4.44E-01	1.00E-01	4.433938	0.0001		

**4 Granger causality test and impulse-response analysis**

**4.1 GRANGER CAUSALITY TEST**

Granger causality test was implemented to TO, ETO, ITO and LGDP (Table 3). Under one year lagged economic growth, one tail probability of every index is smaller than 0.1. Therefore, under 5% significance level, “TO is not the cause of LGDP change”, “ITO is not the cause of LGDP change” and “ETO is not the cause of LGDP change” are denied. However, it also could not to verify that “LGDP is the cause of TO, ITO and ETO changes”.

The Granger causality test reveals a short-run equilibrium relationship of ITO, ETO and TO with GDP. Such relationship is unidirectional. In other words, TO can cause GDP changes, but GDP could not influence TO. This is mainly because TO can affect import-export volume which is an important component of GDP, whole TO is controlled by the government. Government policies and decisions (e.g. tariff and export subsidy) can influence TO directly, but GDP could not affect TO significantly.

TABLE 3 Granger causality test results of TO, ETO, ITO and LGDP

Null Hypothesis	F-Statistic	Prob.
LGDP does not Granger Cause TO	0.58229	0.4512
TO does not Granger Cause LGDP	5.98753	0.0203
LGDP does not Granger Cause ITO	0.62023	0.4369
ITO does not Granger Cause LGDP	8.04044	0.0080
ETO does not Granger Cause LGDP	3.62451	0.0663
LGDP does not Granger Cause ETO	0.96198	0.3343

**4.2 IMPULSE-RESPONSE ANALYSIS**

The impulse-response function analyses the dynamic characteristics between dependent variable and independent variables based on the VAR model. Such dynamic characteristics refer the effect mechanism of every independent variable change or impact on the dependent variable. Since the VAR model is based on the Granger causality test, only unidirectional impulse-response analysis can be implemented to TO, ETO, ITO and LGDP according the Granger causality test results. The analysis results are shown in Figure 1-3.

Figure 1 shows response of LGDP to TO innovation. It remains basically same at the very beginning. However, such effect increases continuously as time goes on, reaching the peak at the 8th year. Subsequently, it becomes equilibrium and begins to weaken. Figure 2 shows

response of LGDP to ITO innovation. Similar variation law of LGDP with that in Figure 1 is observed. Figure 3 shows response of LGDP to ETO innovation, which still presents similar variation law. Viewed from the Y-axis of Figure 1, Figure 2 and Figure 3, TO is significantly smaller than ETO and ETO is significantly smaller than ITO. Therefore, effect of TO on GDP increases gradually, reaching the peak at about the 6th year. The maximum positive impact of TO is about 1, while the maximum positive impacts of both ITO and ETO are about 2. TO is smaller than ITO and ETO as well as their sum. Therefore, they can form a certain angle (>120°). This explains the smaller collaborative effect of import and export than their independent effects.

Response of LGDP to Nonfactorized One Unit TO Innovation

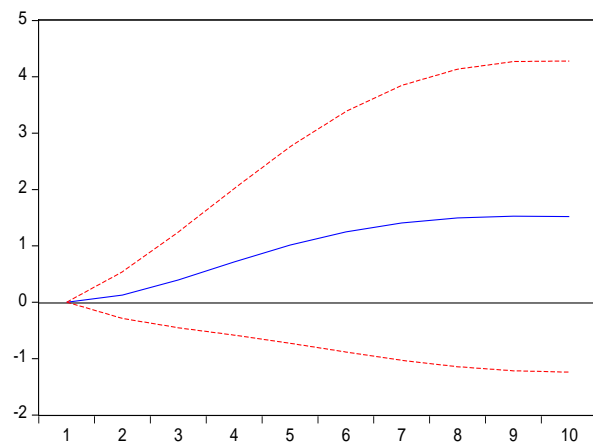


FIGURE 1 Impulse response of LGDP to TO

Response of LGDP to Nonfactorized One Unit ITO Innovation

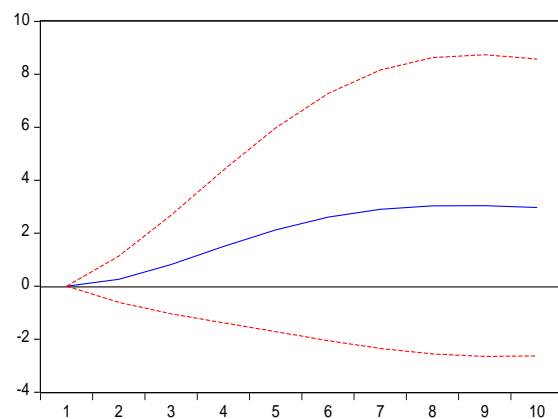


FIGURE 2 Impulse response of LGDP to ITO

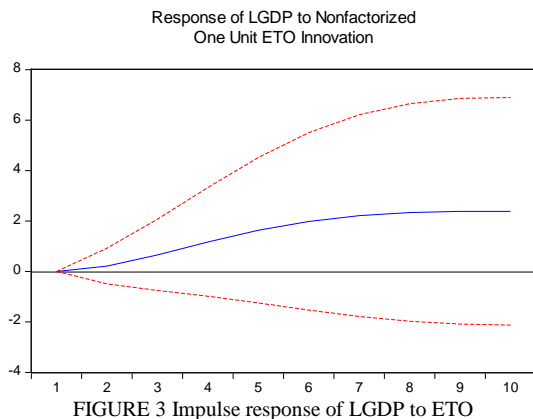


FIGURE 3 Impulse response of LGDP to ETO

**5 Result analysis**

Based on the error correction model, Granger causality test and impulse-response maps, we can conclude that:

1) Instead of the long-run equilibrium relationship, there is a short-run equilibrium relationship between TO and GDP. The error correction model confirms the weak correlation between ITO and GDP. However, as a trade surplus country, China’s export volume is higher than import volume and is significantly non-correlated with GDP. This causes the insignificant long-run equilibrium relationship between TO and GDP. According to the Granger causality test results, there is a certain causality between TO and GDP. TO can increase GDP viewed from the impulse-response maps. Such positive effect can be manifested by various aspects:

Firstly, imports can introduce in advanced technologies and equipment, stimulate improvements of local technologies and equipment, and intensify regional competitive edges. At the beginning of reform and opening up, China had backward technologies and equipment. Most technologies and equipment had to be introduced or learned from foreign countries. Technology import saves time for technical innovation and brings China advanced production level, thus facilitating the rapid economic development. On the other hand, China invents more advanced technologies based on these imported technologies, which further facilitates China’s economic development to a certain level. Nowadays, China has become an important technology exporter. For instance, China is planning to export the high-speed rail technology to other countries in the world, which can save a lot of time for foreign countries to achieve economic breakthroughs quickly.

Secondly, exports can increase domestic production. Domestic technologies and equipment also can be improved by participating in international competition. Trade openness includes import and export. Import is important to regional economic level and export also plays an important role in regional economy. China has been a trade surplus country since 1992. During this period, China’s trade structure changed. Exports shifted from labour-intensive products with low value and production level to technology-intensive products with increasing

added value. China is not a backup producer any more, but participates in international competition truly. For example, China’s Huawei technology has competed with IT technologies of various developed countries like the United States.

2) There is a hedging relationship between import and export, which causes the weaker collaborative effect of import and export than their independent effects. It can be seen from the impulse-response maps that independent ITO and ETO influence GDP more significantly than TO. This reflects that effect of import and export on economy could not be added simply. A collaborative relationship larger than 90° may exist, which weakens the collaborative effect (Figure 4). Viewed from the perspective of China, TO was less than 10% in 1978, but increased to the peak (65.17%) in 2006 and decreased to 47.00% in 2012. This may be caused by following reasons:

Firstly, the import and export structural change will adjust impact angle. As China has entered into the WTO, many imports could not pass policy constraints any more, thus diversifying import products. These imported products not only offset domestic shortage, but also compete with domestic products directly. Similarly, exports shifted from labour-intensive products to technology-intensive products. Such import and export structural change influences their direction, thus affecting the overall TO of China.

Secondly, the abovementioned TO variation is caused by China’s sound economic strategy. China adjusted its economic strategy after the financial crisis in 2008. Key attentions were shifted from exports to domestic demands. It facilitates domestic demand development vigorously, but slows down the foreign trade development. This is because internal consumption of domestic products increases with the development of domestic demand, thus slowing down export growth. Generally, TO decreases when the import and export growth is slower than China’s economic development.

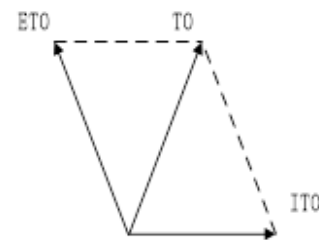


FIGURE 4 Collaborative effect of import and export

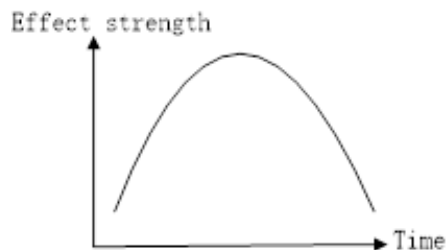


FIGURE 5 Effect strength of TO on economy



Thirdly, TO has a positive effect on GDP within a certain time period. According to the impulse-response analysis, effect of TO on GDP intensifies gradually, reaching the peak at the 8th year and then decreased. It presents an inverse “U-shaped” effect mode (Figure 5). This confirms the correctness of China’s domestic demand-oriented economic strategy:

Firstly, China’s TO has reached 60%, which is very high although it is smaller than some wide-open countries. China is a big country and could not open fully like common small countries. This is caused by the more complicated economy of big countries, which is difficult to be controlled and solved upon financial crisis. This is why wide-economic-open countries or regions in the world are small countries and regions. Economy can be influenced by both political competition and economic competition. Moreover, considering the frequent financial crises of developed countries, higher TO will bring more serious negative impacts. As a result, it is correct for China to adopt domestic demand-oriented economic strategy for the sake of its sound economic development and national political security.

Secondly, the domestic demand-oriented economic strategy is driven by the unbalanced regional economic development in China. An evident urban-rural economic development disharmony exists in China. The over lower rural consumption not only influences the living standard of rural residents, but also affects the rural economic or even the whole economic development. As a result, the domestic demand-oriented economic development strategy is necessary considering of the economic security and harmonious economic development in China.

## 6 Conclusions and suggestions

Based on abovementioned analysis, trade openness plays an important positive role in China’s economic growth. It improves China’s production level significantly and accelerates China’s economic development. Effect of ITO and ETO on economy differs from that of TO. ITO and ETO form a certain angle, making their collaborative effect smaller than the sum of their independent effects. Furthermore, trade openness affects economic growth with a certain time period. Meanwhile, effect of world economy on China’s economy increases as trade openness expands continuously. Good world economy can promote economic growth of China, while world economic crisis will bring China’s economy negative effects. Such negative effect is proportional to the trade openness. Considering the sound development and security of China’s economy, the author gives some suggestions:

Firstly, trade openness shall be enhanced in the period when it can promote economic growth. The empirical research demonstrates an inverse “U-shaped” effect mode of trade openness on economic growth. This may be because trade openness will facilitate domestic technology improvement and production, but after a certain period,

such facilitation effect will be weakened as the technical gap between regions narrows. At the beginning of reform and opening up, China mainly imported technologies and equipment. With the technical progress, China not only imports but also exports technologies and equipment. It imports less and less technologies and equipment, but exports more and more.

Secondly, import and export may form a certain collaborative effect. The angle of such collaborative effect may be determined by import-export content and level. To enhance positive effect of import and export trades on China’s economic growth, the import-export trade structure and content shall be perfected and trade quality shall be improved. Although China’s trade structure has been improved to a certain extent in recent years, export is still dominated by products with lower added value, which is against resource protection, collaborative effect of import and export, and the achievement of China’s foreign trade strategic goal – increase productivity and facilitate sound economic development of China.

Thirdly, China’s trade openness increases steadily and gradually. Although such steady development strategy contributes to economic growth, the maximum trade openness shall be limited. Higher trade openness enables world economy to occupy higher proportion in regional economy and exert larger effect on China’s economy, especially during the world economic crisis. Therefore, both advantages and disadvantages of trade openness shall be considered during enhancing foreign trade. To keep economic stability, China has been using conservative economic policies, which are beneficial for the sound economic development. Since the reform and opening up, China has achieved rapid economic development with backward systems, thus causing many economic and social problems [8]. On this basis, China shall adopt sound economic development strategy to prevent uncontrollable economic instability caused by over high trade openness.

Fourthly, equal attentions shall be paid to enhancing foreign trade and promoting domestic demand. As China has entered into the WTO, its economy will surely be influenced by the world economy. Hence, China shall take measures to avoid adverse effect but enhance positive effect. Although China is expanding the domestic demand continuously and slowing down the foreign trade development in recent years, this will not affect the importance of trade. Therefore, China shall view domestic demand promotion and foreign trade development equally [9]. Currently, China is strongly recommended to adjusting its import and export structures simultaneously with economic and industrial restructuring.

## Acknowledgement

Social science fund project of Liaoning Province (The coordinated development of Liaoning coastal economic belt port logistics research L12BJL013).

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