

## E-commerce and International Trade: Evidence from China

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**Abstract:** The widespread use of E-commerce in the world is a new revolution in international trade. But it is regarded as a double-edged sword for the international trade. Some figure that E-commerce has a positive impetus for the development of international trade. The rest holds the view that E-commerce has worsened the trade conditions, especially, in the developing countries, like the massive tax loss. However, there are a few empirical studies on the dynamic relationship between E-commerce and international trade in the developing countries. China as a biggest developing country in the world, therefore, this paper uses the datum from 2000 to 2016 to explore the dynamic relationship between E-commerce and international trade in China via the method of combining theoretical model and empirical analysis. Performing an empirical analysis under vector error correction model, the empirical analysis results indicate that the long-run relationship between E-commerce and international trade exists in China. More specifically, E-commerce has a positive effect on international trade.

**Keywords:** E-commerce, International Trade, Vector Error Correction Model.

**INTRODUCTION**

As the economic globalization deepens, International trade in the world becomes more and more frequent, and it continues to rise in the country's economic status.

Since humans entered the new millennium, with the emergence of e-commerce and its rapid growth, E-commerce has made great changes in the traditional international economic and trade activities. E-commerce has brought new power to the global economy. Due to this, people's traditional ways of working and thinking have been influenced by the creeping influence of the process. As a matter of fact, E-commerce is to integrate network technology, information technology and computer technology as a whole. With the further strengthening of the global economic integration process and the increasingly fierce market competition, E-commerce has become the major engine of new century economic growth and the most important way of international trade in the 21st century. As human technology continues to evolve, the way of international trade has changed dramatically. We know that traditional international trade activities have experienced a fairly complex transaction process. The smooth completion of trade activities requires not only the negotiation and information exchange but also the participation of more trade tools. Moreover, the smooth progress of the bilateral trade activities will be also affected directly or indirectly by the position of the two parties and the objective conditions of their environment and culture.

With the development of modern society, all of us are in the same new economic era. The most obvious feature of this era is the emergence and application of E-commerce. The development of Internet has laid a good technical foundation for E-commerce and the successful application of E-commerce in international trade. The application of E-commerce to international trade activities not only greatly simplifies the process of trade, but also enables the occurrence of international trade activities to exceed the space time limited and can be directly transmitted by electronic data directly on the electronic network platform through direct transmission of electronic data for bilateral or multi-party trade. This kind of E-commerce has brought great excitement to the trade activity, and also increased the trade opportunities among countries. The large amount of costs of traditional face-to-face exchanges has been greatly reduced in this transaction mode. We can see that the use of E-commerce in international trade can improve the efficiency of the global trading system, and bring favorable opportunity for the development of international trade. But, on the other hand, we have to face a series of new problems that we have never seen before. How to stand in the leading position in the new round of international competition and how to master the core technology to develop E-commerce is particularly important. China is still a big country in international trade and has a very important position in the world. So, China's government should be brave and confident enough to take good use of opportunities and meet challenges from the E-commerce.

The purpose of this paper is to explore the dynamic relationship between E-commerce and international trade in China. Fully understanding the operating mechanism between them can help to preform a beneficial trade with others. To this end, the rest of this paper is organized as follows: Part II presents the previous studies on this proposition. Part III discusses the methodology used in this paper. Part IV provides the empirical analysis. And part V is the conclusion.

## LITERATURE REVIEW

Along with economic globalization, E-commerce has become a new economic mode which makes a great contribution to the international trade. Quantities of economists have spent a great deal of time and effort on this proposition by using different kinds of approaches and models. Usually, their results and conclusions always differ much.

It is reported that the twenty first century is the era of E-commerce. Bojnec and Fertó [1] use gravity model to analyze the relationship between E-commerce and food industry trade via panel and cross-sectional data. Their findings show that E-commerce has positive, significant and over time increasing effect on food industry Export. Zheng [2] performs an empirical analysis on this topic. His results show that the E-commerce plays a vital role in changing the direction of international trade such as transportation circumstance, business entity, terms of trade, business strategy and trade cost. With the rapid development of information network technology, Zhang [2] finds that the E-commerce has gradually penetrated into every aspect of society. And it has caused significant changes in the field of international trade. Weng [3] thinks that the superiority of E - commerce has becoming more and more significant in the development of international trade. However, her empirical analysis results show that the impact of E-commerce on international trade is not very significant in the short run.

E-commerce is a new type of business operation, which has been greatly developed in recent years and has achieved considerable benefits. Ying [4] studies the application of e-commerce in international trade. He finds that E-commerce in this particular area has a positive effect on international trade. And his results reveal that all countries should open more to promote the development of E-commerce. The emergence of e-commerce has had a huge impact on traditional international trade, and has accelerated the process of "economy without borders". In recent years, China's e-commerce international trade has been developing rapidly, but compared with developed countries, there are still large gaps, which cannot meet the needs of E-commerce international trade. Zhao [5] discovers that China's E-commerce impact on international trade is positive but it is not very significant. He considers that China should increase the construction of information infrastructure, Seize the initiative of E-commerce development and fully implement E-commerce in the operation of foreign trade and economic cooperation so as to create a good internal and external environment for the development of China's foreign trade enterprises. Kuang and Zhang [6] believe that E-commerce is a new business model. Its low cost and fast speed have exerted an epoch-making influence on international trade activities and have shown great vitality. The international trade marketing of e-commerce application has the characteristics of network interactive marketing, network customization marketing and customer's initiative. The emergence of E-commerce has a positive impact on China's international trade development from product structure, the way of international trade, the enterprise operating costs, transaction efficiency, customer satisfaction, the international trade, the trade body, the international division of labor and other aspects. Terzi [7] presents study to investigate the impact of E-commerce on international trade. E-commerce offers economy-wide benefits to every country. The gains are likely to be concentrated in developed countries in the short run but, developing countries will have more to benefit in the long run. The volume of international trade will increase via E-commerce.

Liu [8] finds that E-commerce has developed rapidly in the process of economic globalization and global informationization, and its own development has greatly promoted the development of international trade. However, his empirical analysis results indicates that the E-commerce and the international trade move in the same direction. Bieron and Ahmed [9] E-commerce often leads to the cross-border transfer of digital services. Of course, these digital services must be protected against trade-abortive and home discriminatory preferences. Solaymani, Sohaili and Yazdinejad [10] find that because of uncertainty in the e-commerce, producing high-quality products and traditional exports cannot raise the tendency of sample firms to adopt e-commerce. Xu [11] finds that the rapid spread of E-commerce has brought about huge changes in the process and structure of trade and the world will benefit from the new trade mode. The application of international trade in e-commerce brings great benefits and inevitably produces corresponding risks and problems.

In recent years, e-commerce as a new business operation mode has achieved great development and considerable economic benefits, Song [12] hold the view that China's E-commerce application in international trade has also achieved good results, but compared with the developed countries in Europe and the United States, there is still a large gap, which cannot meet its rapid development needs. Hiwarkar [13] finds that E-commerce is promising as an important instrument to make sure comprehensive growth in international trade. The conventional model of business is preforming a aquatic change to decrease the fame of physical infrastructure of big cities as an essential state for the smooth performance of business. Emergence of international shipping options generates the occasion to reach online

consumers in the world. Increasing economies with rapidly rising internet diffusion offers an attractive option for the retailers to expand. Ndyali [14] figures that E-commerce has been predicted to be a new driver of economic growth for developing countries. The small and medium enterprises sector plays a vital role in its contribution to the national economy in terms of international trade. Yuan [15] thinks that the continuous expansion of the international Internet drives the rise and development of e-commerce activities around the world, and it also influences and impacts the international trade area. He conducts an empirical analysis and finds that its effect on international is always positive.

Yang [16] finds that E-commerce is establishing a new economic and trade order. The established world trading system and order are being reshuffled by the emerging trade mode of E-commerce. His results indicate that E-commerce has a mixed effect on international trade. Gomez-Herrera, Martens and Turlea [17] use data from an online consumer survey panel on online cross-border trade in goods in a linguistically fragmented EU market. Their analysis results confirm that distance-related trade costs are greatly decreased compared to offline trade in the same goods. However, language-related trade costs increase. Moreover, online trade introduces new sources of trade costs such as parcel delivery and online payments systems. On balance, there are no indications that online trade is less biased in favour of domestic market products than offline trade. Li [18] views that the rise of E-commerce has had a great impact on trade at home and abroad. Traditional trade organizations, businesses and businesses have been impacted. Conversely, the new e-commerce model is thriving. He finds that E-commerce has a disruptive effect on trade. Hu [19] reveals that since China's reform and opening up, the economic exchanges with other countries have become more and more important. As an important connector of international trade, e-commerce has been playing an increasingly important role.

Zhao [20] demonstrates that the emergence of e-commerce has created a good opportunity for the development of foreign trade enterprises in China, which has improved the efficiency of data transmission of domestic foreign trade enterprises and foreign customers, standardized the management of domestic foreign trade enterprises, and reduced the transaction cost of domestic foreign trade enterprises. Productivity is driven by the development of science and technology. Jiang [21] E-commerce has grown faster and faster, and the rapid growth of e-commerce has had a huge positive impact on international trade. Zhang [22] the implementation of E-commerce will promote the development of international trade and improve the economic benefits of international trade. But as a kind of consumption patterns of innovation, E-commerce still exists many shortcomings on the impact of international trade in China. Han and Lin [23] consider that E-commerce belongs to an advanced form of trade. In the process of international trade, China can reasonably use E-commerce to promote the competition and cooperation between China and other countries, and the arrival of E-commerce has created more economic benefits for our country. In order to make e-commerce more effective in international trade, they analyze the impact of E-commerce on international trade and its application status.

### Theoretical Framework

Seeking for the profit-maximization by firms is the major motivation of commodity flowing in the world. Therefore, the commodity trade is the price competition in the world. Usually, this kind of competition is located in incomplete market. In the price model, the Cournot's duopoly model reflects the changed trend under the ever-present price competition. It can reflect the state of imperfect competition in the foreign trade. Hence, this study will apply this model to analyze the impact of E-commerce on international trade.

The Cournot's duopoly model holds should satisfy three consumption. ① Product makes no difference in the world. ② Market is the imperfect competitive market. ③ Only the international market is taken into consideration. Specifically, the Cournot's duopoly model will be shown below.

Commodity price gives:

$$p = K_j - Q_j \quad (1)$$

Where,  $p$  is the commodity price;  $K_j$  is the market scale of country  $j$  (a constant);  $Q_j$  is the total amount of import of country  $j$ .

Firm's expected profit-maximization gives:

$$\text{Max } Z_{ij} = (K_j - q_j^* - q_{ij} - c - t_{ij}) \quad (2)$$

Where,  $Z_{ij}$  is the firm's profit of country  $i$  who sells its commodity in country  $j$ ;  $q_j^*$  is the amount of commodity that other firms export to country  $j$ ;  $q_j^i$  is the amount of commodity that a firm exports from country  $i$  to country  $j$ ;  $c$  is

the firm's marginal production cost (assuming as a constant);  $t_{ij}$  is the unit transportation cost from country  $i$  to country  $j$ .

Nash equilibrium (optimal equalization) gives:

$$q_{ij} = \frac{K_j - q_j^* - c - t_{ij}}{2} \quad (3)$$

Optimal solution of equation (3) gives:

$$Z_{ij} = q_{ij}^2 \quad (4)$$

Assuming that the fixed cost of entering the market is  $F_{ij}$  which is a uniform distribution at  $F_{ij} \subseteq [0, F_{ij}^*]$ .  $F_{ij}^*$  is the critical value of entering other country market. Only when the profit is greater than or equal to the market cost, then the trade is possible.

Therefore, the critical condition for entering other country's market gives:

$$Z_{ij} \geq F_{ij}^* \quad (5)$$

Total amount of export from country  $i$  to country  $j$  gives:

$$Export_{ij} = \frac{Z_{ij} q_{ij} m_i}{F_{ij}^*} = \frac{q_{ij}^3 m_i}{F_{ij}^*} \quad (6)$$

Where  $m_i$  is the number of firms in country  $i$ .

Total amount of import from country  $i$  to country  $j$  gives:

$$Im\ port_{ij} = \frac{Z_{ij} q_{ij} m_j}{F_{ij}^*} = \frac{q_{ij}^3 m_j}{F_{ij}^*} \quad (7)$$

Where,  $m_j$  is the number of firms in country  $j$ .

Along with the emergence of E-commerce and its application in international trade, its impact on the import and export trade of a country can be represented by the cost measurement as  $\alpha \subseteq (0,1)$ . In the Internet, the speed of goods and trade information has increased considerably. In the import and export market, the change in cost represents as  $\alpha F_{ij}^*$ .

Change of total trade in a country gives:

$$Total \bullet trade_{ij} = \alpha Export_{ij} + \alpha Im\ port_{ij} \quad (8)$$

Rewriting equation (8) gives:

$$Total \bullet trade_{ij} = \frac{q_{ij}^3 m_i}{\alpha F_{ij}^*} + \frac{q_{ij}^3 m_j}{\alpha F_{ij}^*} \quad (9)$$

Equation (9) indicates that due to the emergence of E-commerce, the development of e-commerce has an effect on international trade of the country  $i$ .

**Empirical Analysis**

**Data Description**

The data in this paper are basically time series data for China covering the period from 2000 to 2016. The two variables include in this paper are the E-commerce transactions (E-commerce) and the total amount of import & export (international trade). Datum are sourced from the National Bureau of Statistics of the People’s Republic of China and China’s E-commerce research center. In order to remove the impact of heteroscedasticity, all variables are performed as the logarithm form. And the two variables will be shown in (Table 1) in details.

**Table-1: Variables**

Variable	Logarithmic form	Definition	Source
E-commerce transactions	$\log E - CT$	E-commerce stands for the E-commerce transactions in China	China e-commerce research center
Total amount of import & export	$\log TAIE$	International trade stands for the total amount of import & export in China	National Bureau of Statistics of the People’s Republic of China

**Unit Root Test**

In the classical regression model, the sequence of explanatory variable and explained variable should satisfy the stationarity. Namely, their expected value is zero and their variance is a constant. If the sequence is not stationary, it is east to lead to spurious regression.

The Augmented Dickey-Fuller test is applied in this paper. There are three basic models.

Model 1 gives:

$$Y_t = \gamma Y_{t-1} + \sum_i^{\gamma} \beta_i \Delta Y_{t-i} + \varepsilon_t \tag{10}$$

Model 2 gives:

$$Y_t = \alpha + \gamma Y_{t-1} + \sum_i^{\gamma} \beta_i \Delta Y_{t-i} + \varepsilon_t \tag{11}$$

Model 3 gives:

$$Y_t = \alpha + \gamma Y_{t-1} + \sigma t + \sum_i^{\gamma} \beta_i \Delta Y_{t-i} + \varepsilon_t \tag{12}$$

Where,  $Y_t$  is the time series;  $\alpha$  is constant;  $t$  is the time trend;  $Y_{t-i}$  is the term in lag  $i^{th}$ .  $\gamma$  is the lagged number.

The hypotheses of Augmented Dickey-Fuller test give:

Null hypothesis:  $H_0 : \gamma = 0$  means that unit root exists. Alternative hypothesis:  $H_1 : \gamma < 0$  means that unit root does not exist. More specifically, if ADF statistic is less than its corresponding critical value, the null hypothesis will be rejected. It indicates that there is no unit root (time series is stationery). Conversely, if ADF statistic is greater than its corresponding critical value, the null hypothesis will be accepted. It indicates that there is an unit root (time series is non-stationery). The results of unit root test will be shown in (Table-2).

**Table 2: Results of unit test**

Variable	T-Statistic	Test critical value	Prob.*	Result
$\log E - CT$	-0.919	-1.968	0.301	Non-stationary
$\log TAIE$	-2.634	-3.066	0.107	Non-stationary
$D \log E - CT$	-2.010	-1.968	0.046	Stationary
$D \log TAIE$	-4.078	-3.760	0.030	Stationary

**Note:**  $D$  represents the first difference of all variables

\*MacKinnon (1996) one-sided p-values [24].

Table-2 indicates that all variables are non-stationary in their real levels. However, after first difference, all variables become stationary under 5% significant level. It illustrates that they are integrated of order 1, which provides the precondition of co-integration test.

**Co-integration Test**

There are two methods to process a co-integration test. They are the Engle-Granger and Johansen co-integration tests. This paper uses the Engle-Granger test to analyze the relationship between E-commerce transactions and international trade in China. For  $\log E - CT$  and  $\log TAIE$ , the regression equation is obtained by using least square regression. The results of least square regression are shown in (Table-3).

**Table-3: results of least square regression**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\log E - CT$	0.359	0.022	16.495	0.000
$C$	2.967	0.073	40.823	0.000
$R - squared = 0.948$		$Adjusted - R - squared = 0.944$		$D.W = 2.197$

Table-3 indicates that  $\log E - CT$  gets through the significant test under 5% level.  $Adjusted - R - squared = 0.944$  Shows that the explanatory variable has a good ability to interpret the explained variable. Meanwhile,  $D.W = 2.197$  also demonstrates that all sequences have no auto correlation. In order to confirm the long-run relationship between them, the residual of them should be tested.

**Table-4: Null Hypothesis: Residual has a unit root**

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.296	0.034
Test critical values	1% level	-3.959
	5% level	-3.081
	10% level	-2.681

**Note:** \*MacKinnon (1996) one-sided p-values [24].

Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15.

Table-4 indicates that the residual gets through the significant test under 5% level. It proves that there is a long-run relationship between them.

Specific equation gives:

$$\log TAIE_t = 0.359 \log E - CT_t + 2.967 + \varepsilon_t \quad (13)$$

Table 3 & 4 indicate that the co-integration exists between E-commerce and international trade. It means that there is a long-run relationship between them. More specifically, equation (13) demonstrates that seen from the long run, 1% increase in the E-commerce transactions will result in 0.359% in the total amount of import & export. In summary, the E-commerce transactions have a positive and steady effect on total amount of import & export. The elastic coefficient of total amount of import & export to the E-commerce transactions is 0.359.

**Vector Error Correction Model**

The co-integration test verifies that the co-integration exists between E-commerce and international trade in China. Therefore, its auto-regression distributed lag (1, 1) can be written:

$$\log TAIE_t = \alpha_1 \log E - CT_t + \alpha_2 \log E - CT_{t-1} + \beta \log TAIE_{t-1} + \varepsilon_t \quad (14)$$

Rewriting equation (23) gives:

$$D \log TAIE_t = \alpha_1 D \log E - CT_t - \lambda (\log TAIE_{t-1} - \sigma \log E - CT_{t-1}) + \varepsilon_t \quad (15)$$



Where,  $\lambda = 1 - \beta$  ;  $\sigma = \frac{\alpha_1 + \alpha_2}{\lambda}$ .

Rewriting equation (15) gives:

$$D \log TAIE_t = \alpha_1 D \log E - CT_t - \lambda(ecm_{t-1}) + \varepsilon_t \tag{16}$$

Where  $ecm_{t-1}$  is the error correction term

The estimated coefficients are presented in (Table-5).

**Table-5: Estimated Coefficients**

$\alpha_1$	$\alpha_2$	$\sigma$	$\beta$	$\lambda$
1.639 (0.653) [0.026]	-1.544 (0.589) [0.021]	0.792	0.880 (0.075) [0.000]	0.120

**Note:** represents the Std. Error; represents the prob.

Therefore, the vector error correction model gives:

$$D \log TAIE_t = 1.639 D \log E - CT_t + 0.120 ecm_{t-1} + \varepsilon_t \tag{17}$$

Equation (13) and equation (17) indicate that the long-run elastic coefficient of total amount of import & export to the E-commerce transactions (0.359) is less than the short-run elastic coefficient of total amount of import & export to the E-commerce transactions (1.639). Namely, the total amount of import & export has a quick response on E-commerce transactions in the short run. It also verifies that the total amount of import & export in China keeps an open attitude to the world. Equation (17) reflects the short-run adjusting process between E-commerce transactions and total amount of import & export. There into, the coefficient of  $ecm_{t-1}$  represents the short-run derivation from the long-run equilibrium relationship between E-commerce transactions and total amount of import & export. The estimated result shows that the change of total amount of import & export is not only determined by the E-commerce transactions but also it is determined by deviation of equilibrium level of total amount of import & export in the last period in China. The coefficient of  $ecm_{t-1}$  is 0.120. It means that the balanced error of total amount of import & export and E-commerce transactions in the last period can be corrected at the current period by 12%. This coefficient is relative small. In other word, it demonstrates that the mutual effect between E-commerce transactions and total amount of import & export fluctuates relatively small in the short run.

**CONCLUSION**

The target of this paper to make the dynamic relationship between E-commerce and international trade clear in China. The Cournot's duopoly model is treated as a theoretical basis to build a connection between them. The vector error correction model is treated as an empirical approach to dig the relation between them in details. The co-integration test results show that there is a long-run relationship between them. More specifically, 1% increase in the E-commerce transactions will result in 0.359% in the total amount of import & export. Conversely, the vector error correction model indicates that in the short run, 1% increase in the E-commerce transactions will result in 1.639% in the total amount of import & export. The long-run elastic coefficient of total amount of import & export to the E-commerce transactions is less than the short-run elastic coefficient of total amount of import & export to the E-commerce transactions. In other word, the total amount of import & export has a quick response on E-commerce transactions in the short run. More importantly, the error correction term also indicates that the mutual effect between E-commerce transactions and total amount of import & export fluctuates relatively small in the short run. Also, this paper provides a view for China's government to deal with the relation between E-commerce and international trade in China. This paper suggests that China's government should open its E-commerce market more so as to conduct a beneficial international trade.

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