

Research on the Relationship of Port Logistics Development and Chinese Agricultural Trade

Pei-Zhi WANG^{1,a}, Wen-Wen LIU^{2,b,*}

^{1,2}College of International Economics and Trade, Shandong University of Finance & Economics, Jinan, Shandong, China, 250014

^awpzmail@126.com, ^bliuwenwen888999@163.com

*Corresponding author

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Abstract. In recent years, port logistics has developed rapidly, and it provides the impetus for the development of agricultural product in certain extent. This paper establishes the error correction model by using port logistics development indicators and agricultural product trade indicators. The empirical results show that port logistics' development have a positive role in promoting the development of agricultural product trade both in short term and in long term. Based on the empirical results, the authors put forward countermeasures for China's port logistics' positive development.

Introduction

China is a large agricultural country, the gross output value of agriculture, forestry and animal husbandry reached 8945.3 billion Yuan in 2012. The gross output value and breeds of China's agriculture food are both in the forefront compared with other countries in the world. Most of these agricultural products will become commodities and form a giant agricultural product logistic network. The production, distribution, exchange and consumption of agricultural products constitute the organic agricultural production chain, and any one of links' inefficiency will lead to unhealthy agricultural development.

With the development of foreign trade, port logistics industry in China has developed to a certain scale, and it enjoys a continuous development and perfection. As a tool and bridge of agriculture product foreign trade, port logistics enterprises have to break their own development restrictions, in order to minimize the logistics cost and promote the development of agriculture product foreign trade. Agriculture product foreign trade is the premise and foundation of modern logistics and the development speed and scale of agriculture product foreign trade determine port logistics' development speed and scale.

Scientifically, reasonable port logistics can guarantee the sustainable development of agriculture product trade. It is necessary to carry out a quantitative analysis on the relationship of the port logistics and agriculture product foreign trade, in order to reveal the further relationship between them.

Literature Reviews about the Relationship of Port Logistics and Foreign Trade

Chauncey B. Baker put forward the concept of "Logistics" in 1905. In the middle of 1980s, logistics had gradually become a specialized subject. Port logistics play an increasingly important role in foreign trade, therefore research on the port logistics has been deeply carried out. Michael Quayle (1999¹) carried out a comparative study of different logistics indicators' impact on economic development; Joong Kun (2001)² verified that logistics capability played a positive role in regional economic development using a mathematical model; Julia Devlin and Peter Yee (2002)³

① Michael Quayle & Bryan Jones, "Logistics: An Approach of Integration", New Castle upon Tyne: Athenaeum Press Ltd., 1999, pp:236-250.

② Joong-Kun, C, "Firm performance in the E-commerce market: the role of logistics capabilities and logistics outsourcing", Doctoral Dissertation, University of Arkansas, 2001.

③ Julia Devlin & Peter Yee, "Global Links to regional networks: trade logistics in MENA countries", the Fourth Annual Mediterranean Development Forum, Held in Amman, October 6-9, 2002.

studied the impact on foreign trade from industry logistics system and the results showed that the logistics efficiency would affect the time cost of trade, furthermore affect the trade effects. Hildegunn K. Nordas, Enrico Pinali, Massimo Geloso Grosso (2006)⁴ found that the lower the time cost of trade, the greater the trade occurrence probability, and furthermore foreign trade would promote the development of logistics. Michael P. Keane and Susan E. Feinberg (2007)⁵ took Canada and United States as study sample, and found that the trade costs' decline were conducive to the trade exchanges between enterprises. Among the decline of trade costs, logistics costs' decline played an important role. Hong-Oanh Nguyen and Jose L Tongzon (2010)⁶ analyzed the relationship between transportation, the development of logistics sector and international trade applying the VAR model, Granger causality test and other methods.

Current Situations of Chinese Agricultural Trade and Port Logistics

The status quo of Chinese agricultural trade

Economic gradient is the economic development gap between regions. The 31 provinces of China can be divided into three gradients using the industrial gradient coefficient as the standards. The following are the criteria for the classification:

China's agricultural trade possesses an important position in China's economy. As China has been increasingly integrated into the world economy and its foreign trade in agricultural products has largely developed. The trade volume has increased by 19.8 times from 10.73 billion dollars in 1985 to 223 billion dollars in 2012.

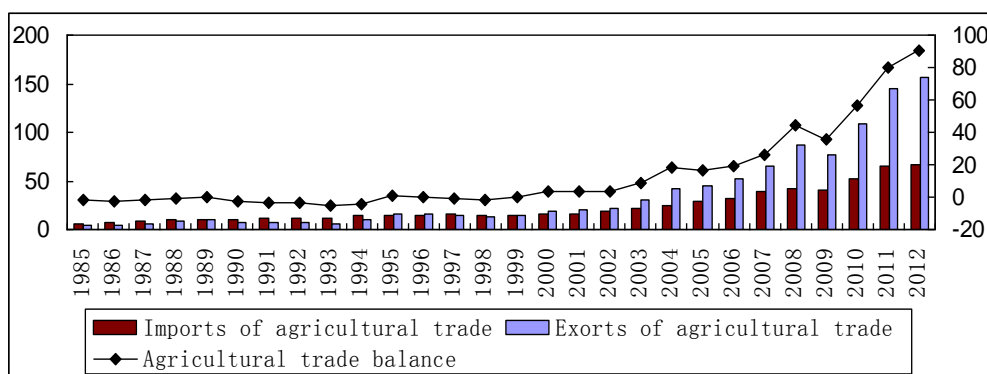


Fig 1. China's Agricultural Product Trade From 1985 to 2012
(Unit: billion dollars) Source: UNcomtrade

As can be seen from Figure 1, China's import and export trade volume of agricultural product both show a rapid growth trend. Agricultural exports exceeded agricultural products imports around 2000, turning agricultural trade deficit into a surplus. China's agricultural trade surplus reached \$ 90.647 billion dollar in 2012.

The status quo of Chinese port logistics

Since 1949, after five large-scale constructions, China's port has formed reasonable layout. There are about 125,000 kilometer of inland waterways, and 19,000 kilometer of coastline. The length of coastal port quay is about 721,200 meter, and the number of berths is 5715, of which the number of berths which are more than ten thousand tons level is 1453. The length of inland port quay is about 910,000 meter, and the number of berths is 14,700, of which the number of berths which are more than ten thousand tons level is 369.

^④ Hildegunn K. Nordas, Enrico Pinali & Massimo Geloso Grosso, "Logistics and Time as a Trade Barrier", OECD Trade Policy Working Papers, Vol.3, No.35, 2006, pp:14-25.

^⑤ Michael P. Keane & Susan E. Feinberg, "Advances in Logistics and the Growth of Intra—Firm Trade: The Case of Canadian Affiliates of U.S. Multinationals", The Journal of Industrial Economics, Vol.55, No4, 2007, pp:571-632.

^⑥ Hong Oanh Nguyen & Jose L Tongzon, "Casual Nexus between the Transport and Logistics Sector and Trade: The Case of Australia", Transport Policy, Vol.17, 2010, pp:135-146.

TABLE 1 THE SITUATION OF PORT LOGISTICS IN MAJOR COASTAL PORTS OF CHINA

| | 1994 | 1998 | 2003 | 2007 | 2012 |
|--|--------|--------|--------|--------|--------|
| Length of Quay Line(m) | 159139 | 187261 | 280756 | 564800 | 721159 |
| Number of Berths (unit) | 1519 | 1608 | 2562 | 4914 | 5715 |
| Number of Berths over 10 Thousand Tons Class(unit) | 394 | 468 | 650 | 1076 | 1453 |

Source: China Statistical Year Books

There are fourteen coastal cities ports above designated size, which are Dalian, Yingkou, Qinhuangdao, Tianjin, Yantai, Qingdao, Rizhao, Shanghai, Lianyungang, Ningbo-Zhoushan, Shantou, Guangzhou, Zhanjiang, Haikou and Basuo. China has signed a maritime agreement with more than 50 countries, and part of China's port can developed into international hub ports.

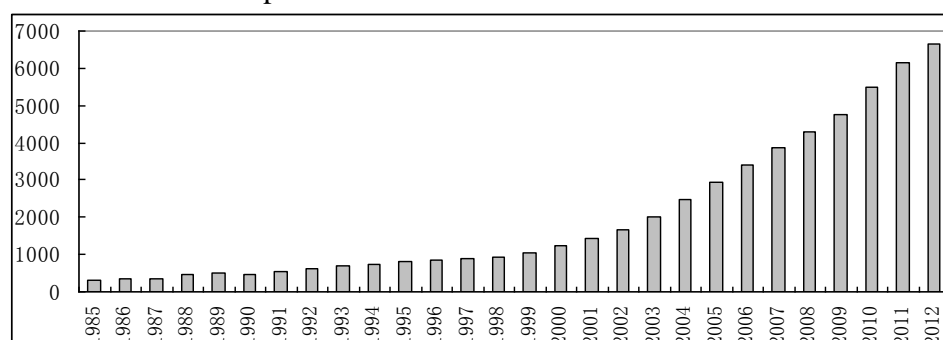


Fig.2 China's Port Cargo Throughput Status from 1985 to 2012
(Unit: 10 thousand tons) Source: China Statistical Year Books

As it can be seen from figure 2, China's port cargo throughput increased year by year. The port cargo throughput is 312 million tons in 1985, and the port cargo throughput in 2012 was 6.652 billion tons, which increased by 20 times.

In recent years, although China's port logistics already experienced considerable progress, but the situation of both the development concept and port logistics hardware facilities in some ports are still in backwardness state. China's port logistics level hang behind developed countries in many aspects. Weaknesses of China's port logistics development are mainly reflected in the following aspects.

(1) Weak Infrastructure

The port logistics' infrastructure condition is still relatively low compared with developed countries. The standardization degree of port logistics facilities and equipment is low, and there is no uniform standard for transport equipment. Ports lack large specialized deep-water berths generally. China's deep-water berths indicators take up 16.4 percent of the deep-water berths indicators in America. The shortage of large-scale, specialized deep-water berths, the insufficient mileage of deep-water channel and the lack of automation equipment and logistics facilities all restrict the development of port logistics.

(2) Disordered Management System

Government and corporate responsibility is not clear in China's port logistics management system, which leads to a phenomenon that port enterprises cannot operate independently in accordance with the modern market rules. The irrational port function structure carries out the result that the corresponding port logistics industry cannot develop rapidly.

(3) Low Level of Information Technology

The port logistics enterprises' information service awareness is not clear, and many of them do not realize the importance of information technology in port logistics. A large part of the ports logistics enterprises remain extensive logistics operations. The application of information technology in port logistics is generally low except for POS technology and bar code technology.

Many port logistics enterprises' logistics informational management and technical level are lagging behind.

4) Lack of Professionals

China's port logistics professionals are in short supply. In addition to the shortage of total amount, there exists the situation of professional education's lack and logistics industry experience's shortage, which makes the port logistics enterprises unable to adapt to the requirements of modern port logistics' development. These factors result in the efficiency of port logistics.

Empirical Study of China's Agricultural Trade and Port Logistics

Port cargo throughput not only reflects the size of the port logistics, but also reflects ports' productive forces and regional economic development conditions, therefore, port cargo throughput index (PCT) is chosen as a quantitative indicator of port logistics development. Agricultural trade indicator (AGT) includes agricultural trade import and agricultural products export. The scope of agriculture products includes all products in category 1~4 (chapter 1~24) according to HS code⁷.

We select the periods from 1985 to 2012 as the research periods and the data come from China's Statistical Year Book and UNcomtrade. By studying the quantitative relationship between port cargo throughput and agricultural trade, we propose applicable policies for long-term development of port logistics and to promote China's import and export trade of agricultural products in the end.

Unit Root Test of Variables

Carry out stationary test for variables before co-integration analysis. Table 1 is the variables' unit root test result under level condition and the 1st difference condition.

TABLE 2 THE RESULT OF UNIT ROOT TEST OF VARIABLES

| Variables | Test Type (C,T,K) | Augmented Dickey-Fuller test statistic | Test critical values | | | Result |
|----------------|-------------------|--|----------------------|-----------|-----------|------------|
| | | | 1% level | 5% level | 10% level | |
| LNAGT | (C,T,6) | -1.183218 | -4.33933 | -3.587527 | -3.22923 | Non-stable |
| LNPCT | (C,T,6) | -1.651867 | -4.356068 | -3.595026 | -3.233456 | Non-stable |
| Δ LNAGT | (C,0,2) | -4.767099 | -4.374307 | -3.603202 | -3.238054 | stable |
| Δ LNPCT | (C,0,2) | -3.431523 | -4.356068 | -3.595026 | -3.233456 | stable |

Note: Δ represents 1st difference condition. C, T, K indicate the intercept, trend and intercept and lag length, 0 means none.

As can be seen from table 2, the two variables are non-smooth in the original sequence, while the first-order differential variables are smooth, so two variables' co-integration can be carried out.

Co-integration Test of Variables

The regression equation of LNAGT and LNPCT is as follows:

$$LNAGT = 0.9036LNPCT + 13.7738$$

$$(42.6752) \quad (33.0384)$$

$$R^2 = 0.9767 \quad DW = 0.6953$$

①The first category is live animals and animal products (chapters 1-5: live animals; meat and edible meat offal; fish, crustaceans, molluscs, aquatic invertebrates nes; dairy products, eggs, honey, edible animal product nes; products of animal origin, nes); The second category is plant products (chapters 6-14: live trees, plants, bulbs, roots, cut flowers etc; edible vegetables and certain roots and tubers; edible fruit, nuts, peel of citrus fruit, melons; coffee, tea, mate and spices; cereals; milling products, malt, starches, inulin, wheat gluten; oil seed, oleagious fruits, grain, seed, fruit, etc, nes; lac, gums, resins, vegetable saps and extracts nes; vegetable plaiting materials, vegetable products nes); The third category is animal, vegetable fats and oils, cleavage products, etc. (chapter 15); The fourth category is food, beverage, wine and vinegar, tobacco and manufactured tobacco substitutes (chapters 16-24: meat, fish and seafood food preparations nes; sugars and sugar confectionery; cocoa and cocoa preparations; cereal, flour, starch, milk preparations and products; vegetable, fruit, nut, etc food preparations; miscellaneous edible preparations; beverages, spirits and vinegar; residues, wastes of food industry, animal fodder; tobacco and manufactured tobacco substitutes).

The goodness of fit of the regression equation is 0.9767, all the indicators pass test. The regression coefficient of LNPCT is 0.9036 which indicates that there is a positive relation-ship between port cargo throughput and China's agricultural trade. Along with 1 per unit's increase in China's port cargo throughput, China's agricultural trade will grow 0.9036 units.

Then carry out stationary test for residual term. E represents the residual term. If residual term is smooth sequence, the co-integration of LNAGT and LNPCT exists.

TABLE 3 STATIONARY TEST RESULTS OF THE RESIDUAL

| Variables | Test Type (C,T,K) | Augmented Dickey-Fuller test statistic | Test critical values | | | Result |
|-----------|-----------------------|--|----------------------|-----------|-----------|--------|
| | | | 1% level | 5% level | 10% level | |
| ΔLNE | (C,0,6) | -5.015137 | -4.374307 | -3.603202 | -3.238054 | Stable |

The stationary test results for residual term are shown in table 3. The results show that the residual term is stable, and the further error correction model analysis of the two variables can be carried out.

Granger Causality Tests of the Variables

The co-integration analysis can only reflect the existence of long-run equilibrium relationship between the two variables, but they cannot necessarily explain the causal relation-ship between the two variables. Therefore causal relationship analysis is needed to determine the relationship of the two variables.

TABLE 4 GRANGER CAUSALITY TEST RESULTS

| Lags | Null Hypothesis | Obs | F-Statistic | Prob | Result |
|--------|------------------------------------|-----|-------------|--------|--------|
| Lags:1 | LNAGT does not Granger Cause LNPCT | 27 | 10.7293 | 0.0032 | Deny |
| | LNPCT does not Granger Cause LNAGT | 27 | 9.23500 | 0.0057 | Deny |
| Lags:2 | LNPCT does not Granger Cause LNAGT | 26 | 5.99071 | 0.0087 | Deny |
| | LNAGT does not Granger Cause LNPCT | 26 | 5.23096 | 0.0143 | Deny |

As can be seen from table 4, there exist causal relationship between LNAGT and LNPCT, which means the agricultural trade and port logistics exist a mutually reinforcing relationship.

Error Correction Model of the Variables

Even the long-run equilibrium relationship exists between two variables, the relationship of the variables may occur imbalance due to external factors interfere in the short term. Then the error correction model can be used to correct this type of short-term imbalances. The regression equation of error correction model is as follows:

$$D(AGT) = a + b \cdot D(PCT) + \lambda \cdot ECM(-1) + \varepsilon$$

The practical equation is as follows:

$$D(LNAGT) = 0.0017 + 0.9818d(LNPCT) - 0.3051ECM(-1) + \mu$$

$$(-0.029025) \quad (2.043125) \quad (-1.491568)$$

$$R^2 = 0.376891 \quad DW = 1.687462$$

$$ECM(-1) = LNAGT - 0.9036LNPCT - 13.7738$$

The fluctuations of agricultural products trade variable can be divided into short-term fluctuations and long-term equilibrium. The short-term fluctuation is reflected by variables' differential term, and the long-term equilibrium is reflected by the error term. In the short term, port cargo throughput and agricultural product trade share the same variation direction. If the port cargo

throughput increases by 1 percent, it will cause 0.9818 percent's increase of agricultural product trade. Non-equilibrium of last period corrects long-term equilibrium value deviation of agricultural product trade with the intensity of 0.3051.

Development Strategy of China's Port Logistics Industry

China's port logistics and agricultural product trade have long-term mutual interaction. Port logistics has a positive role in promoting the development of China's agricultural product trade. Therefore the development of agricultural product trade cannot be isolated from the support of port logistics. Relevant departments should improve the optimal allocation of port logistics resources, in order to promote the development of agricultural product trade.

Firstly, it is necessary to strengthen port infrastructure construction by integrating port resources and upgrading ports' facilities and to promote the business processes and improve equipment utilization. By shortening the ships' residence time we can increase goods' distribution function. Besides, we should take advantage of deep water resources and to provide large modern warehouse for port logistics service enterprises in order to improve the efficiency of port logistics.

Secondly, it is critical to accelerate the construction of port logistics information network. We need to provide freight market situation, sailing notice, warehousing storage, cargo transfer documents, berth usage and other information for relevant enterprises using electronic ordering system, effective customer feedback resource management system and MIS database technology. To connect port, shippers, customs and carriers by building network platform covering production, circulation, warehousing and transportation. All the links form an open organic system, which could provide a favorable environment for the development of port logistics.

Thirdly, it is essential to strengthen education and training of talented person. Relevant departments should increase investment on logistics institutions. To carry out logistics professional education in vocational colleges according to working characteristics of port logistics enterprises' related positions. Enterprises should train employees regularly so employees' knowledge, logistics awareness can keep up with the development trend. Realize logistics efficiency's increase and service level's improvement from all respects.

Conclusion

We have analyzed the relationship between China's agricultural product trade and port logistics by establishing the error correction model of the two variables from 1985 to 2012.

Co-integration test results indicate that long-term stable equilibrium relationship exists between the development of port logistics and agricultural product trade. Granger causality test results further prove that mutual promotion relation exists between port logistics' development and agricultural product trade growth. As it has seen from error correction model, port logistics development and China's agricultural product trade share the same variation direction. One unit of growth in port logistics would stir up 0.9818 unit of China's agricultural product trade in long term. When short-term fluctuations occur, the error correction term will fix the deviation state to equilibrium state with the intensity of 0.3051.

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Author Introduction

Peizhi Wang: Dean of School of International Economics & Trade and Dr. and Prof. of Shandong University of Finance and Economics, majored at International Economics and Business Administration, the tutor of doctors in International Trade.

Wenwen Liu: PhD. candidate of Shandong University of Finance and Economics, majoring in International Economics.