

The Analysis of Bilateral Trade between China and the Philippines

Based on the Gravity Model

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Abstract—The Philippines, the member of the ASEAN, is one of the important trading partners of China. The Gravity Model is a commonly used tool for the analysis of international trade flows. The panel data of the import and export trade volume between China and the Philippines from 1998 to 2013 will be analyzed in this paper. The new trade gravity model, which is more suitable for the actual situation, will be built on the basis of the original trade gravity model. And then the influencing factors of the trade flows between China and the Philippines, as well as the trade potential and the effect of the trade flows are analyzed.

Keywords: Trade Flows; The Gravity Model; Trade Potential; China; The Philippines

I. INTRODUCTION

As a member of ASEAN, as well as a partner of China's "One Belt One Road" strategy, the Philippines has a close trade relation with China. From January to November in 2014, China had a 21.47 billion dollar export to the Philippines, which is increased by 19.4% on year-on-year basis. On the other hand, the import from the Philippines had a 15.5% year-on-year growth in the same period, which is 19.09 billion dollar. Nowadays, China has become the third largest trading partner of the Philippines. In this context, the Analysis of Trade Flows between China and the Philippines is practically significant.

In this paper, the panel data of the import and export trade volume between China and the Philippines from 1998 to 2013 will be analyzed based on the trade gravity model. The new trade gravity model, which is more suitable for the actual situation, will be built on the basis of the original trade gravity model. And then the influencing factors of the trade flows between China and the Philippines, as well as the trade potential and the effect of the trade flows are analyzed.

II. SUMMARY OF THE GRAVITY MODEL

A. The form of the gravity model

The gravity model is derived from the law of universal gravitation in Physics. In 1940s, James Stewart became the first person to use this model in social sciences. In 1962, Tinbergen used the gravity model to study international trade. In his opinion, the trade flows between two countries is proportional to their economics and inversely proportional to their distance. The function is:

$$X_{ij} = A Y_i Y_j / \text{Dist}_{ij} \quad (1)$$

where X_{ij} = trade volume, Y_i = country i's GDP, Y_j = country j's GDP, Dist_{ij} = the distance between the two countries, A = constant.

In 1966, Linnemann added the population variable as well as the error term into the gravity model, and converted the equation to the natural logarithm so as to form the original trade gravity model. The formula is as below:

$$\ln X_{ij} = \alpha_0 + \alpha_1 \ln(Y_i Y_j) + \alpha_2 \ln \text{Dist}_{ij} + \alpha_3 \ln(P_i P_j) + u_{ij} \quad (2)$$

where X_{ij} = trade volume, Y_i = country i's GDP, Y_j = country j's GDP, Dist_{ij} = the distance between the two countries, P_i = country i's population, P_j = country j's population, α_0 = constant, α_n ($n=1$ to 3) = the elasticity of trade flows, u_{ij} = error term.

After being used in trade research, the gravity model has been expanded and improved, that means more and more variables have been added into the function. Bergstrand (1989) added the per-capita income, the exchange rate and some dummy variables. Mdtyds (1998, 1998), Chen&Wall (1999), Breuss&Egger (1999) and Egger (2000) developed the economic metrology standard of gravity model. Berstrand (1985), Helpman (1987), Wei (1996), Soloaga&Winters (1999), Lumao&Venables (1999) and Bougheas (1999) refined original variables and added some new variables.

B. Application of Trade Gravity Model

Shi Zhaoxing and Gu Haiying (2005) classifies the new development of trade gravity model by empirical research on gravity model into adjusting explaining variable and explaining border effect stages, with introduction of the new the oretical development on the foundation of gravity model, and its application in China's foreign trade.

Zhang Yu and Tang Zhifang (2006) validates that the primary deciding factors of China's bilateral trade are the economic scale of trade partners, population, space distance, trade policy and so on.

Pan Qin and Han Jian (2006) attempts to use the gravity model to make an empirical research on the relations between them and finally gives some pertinent

policy advises about the development of China's intra-industry and regional trade integration.

Ding Huixia and Feng Zongxian (2007) tests the effect of the institution variant in China on China's attraction to FDI. The result of the empirical analysis shows that the signature of bilateral trade protection agreement between China and investing countries, culture factor, policy variant and RMB devaluation have obvious positive effect on China's attraction to FDI, and the custom level of China, the degree of protection to intellectual property and the probity degree of the government don't have obvious effect on the FDI's entering China statistically.

Zhou Nianli (2010) identifies the factors which have significant effect s on the bilateral service trade in China and calculate China's service export potential and the "tariff equivalent" of the non-tariff barriers of China's major trading partners. Empirical research results indicate that the economic scale and the economic development level of the importer and exporter , the physical distance between two sides and the dummy variables whether they use a common language or not can have a significant impact on the bilateral service export in China. The general level of "tariff equivalent" of the non-tariff barriers on trade in services of China's major partners is very high. China should develop service industry quickly and carry out effective service export promotion measures.

III. BUILDING THE MODEL

A. Illustration of the model's variables

In this paper, the China - Philippines trade gravity model is built on the basis of the basic gravity model, by considering the actual trade situation between China and the Philippines. The function is:

$$\ln X_{ij} = \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln(Y_i/PoP_i) + \alpha_4 \ln(Y_j/PoP_j) + \alpha_5 CAFTA + \alpha_6 \ln IIT_{ij} + \alpha_7 DDFT_i + \alpha_8 DDFT_j + u_{ij} \quad (3)$$

where X_{ij} = trade volume between China and the Philippines, u_{ij} is the error term. The meanings and expected symbols of other variables are as below:

Y_i = China GDP, Y_j = the Philippines GDP, the expected symbols of the two variables are positive, which means the trade flows between China and the Philippines is proportional to the GDP of the two countries.

Y_i/PoP_i = China per capita GDP, Y_j/PoP_j = the per capita GDP in Philippines. Because there is no direct causal relationship between economic scale and population, in other words, large population doesn't means huge economic scale, the variable of per capita GDP is used to take the place of population.

CAFTA, which is a dummy variable, shows the effect of trade policy. After signing the "China-ASEAN Comprehensive Economic Cooperation Framework Agreement" in 2002, CAFTA = 1, else CAFTA = 0. Because of the promoting effect of trade policy, the expected symbol is positive.

IIT_{ij} = the absolute difference of the two countries' GDP. This variable can show the similarity of two countries' demand. The smaller it is, the more possible the intra industry trade between two countries is.

$DDFT_i$ = foreign-trade dependence of China, $DDFT_j$ = foreign-trade dependence of the Philippines. The foreign-

trade dependence (FTD) is the ratio of total import and export to GDP. A big FTD means a high trade dependence of a country, and the condition of international trade is advantageous. The expected symbols of the two variables are positive.

In addition, the distance variable is put out of the model because the distance between the two certain countries is constant.

B. Data source

In this paper, the panel data from 1998 to 2013 is used to do regression analysis. Data of the trade flows between China and the Philippines comes from the database of national bureau of statistics of China, other data comes from the database of the World Bank.

IV. CALCULATING RESULT AND ECONOMIC MEANING

The related data is analyzed with multiple linear regression and insignificant variables removed according to the itemized rejecting trend.

When the confidence level is 95%, the Adjusted R Square is 0.996 and the F-statistic is 699.562, which proves the rationality of the function. Most symbols of variables are in line with expectations, and all of the symbols pass the hypothesis testing, as in TABLE I below.

TABLE I. Result of Regression

Confidence level: 95%			
Variables	Coefficients	Standard Error	t Stat
Intercept	-29.70	385.09	-0.08
$\ln Y_i$	-0.02	26.84	0.00
$\ln Y_j$	2.47	10.30	0.24
Y_i/PoP_i	0.70	26.67	0.03
Y_j/PoP_j	-2.32	10.27	-0.23
DDFT _i	0.04	0.00	12.60
CAFTA	0.19	0.09	2.05
Adjusted R Square: 0.9964		F-statistic: 699.5617	

According to the result of regression, the function of trade gravity model of China and the Philippines is:

$$\ln X_{ij} = -29.70 - 0.02 \ln Y_i + 2.47 \ln Y_j + 0.7 \ln(Y_i/PoP_i) - 2.32 \ln(Y_j/PoP_j) + 0.04 DDFT_i + 0.19 CAFTA + u_{ij} \quad (4)$$

Function(4) shows that the main influencing factors of trade volume between China and the Philippines are the GDP and per capita GDP in the two countries, the foreign-trade dependence of China and the trade policy.

First of all, the Philippines' GDP plays an important role in promoting bilateral trade between China and the Philippines, every 1% increase of Philippines GDP will make the trade volume increase by 2.74%. But on the contrary, every 1% increase of China GDP will reduce the trade volume by 0.02%. This result may be caused by the change in China's economic structure. In recent years China has been trying to expand domestic demand in order

to replace the role of foreign trade in GDP growth. This situation may cause the decline in foreign trade while GDP is growing.

Secondly, per capita GDP in China, every 1% increase of which will increase the trade volume by 0.7%, can promote the growth of China-Philippines trade. In comparison, per capita GDP in Philippines has a negative effect on the trade. The possible reason is the population effect. On the one hand, increasing population will create new demand to increase international trade. On the other hand, it can also reduce the demand of international trade by strengthening the domestic division of labor. When the latter is more significant than the former, the trade volume will decline with the increase of per capita GDP.

Thirdly, it can be inferred from the coefficient of the DDF_{ij}, which is 0.04, that the Philippines is not the main trading partner of China, as every 1% increase of FTD of

China only makes the trade volume increase by 0.04%. And this can also be verified by the coefficient of CAFTA, which is 0.19.

V. THE POTENTIAL OF CHINA-PHILIPPINES TRADE

A. The potential of China-Philippines trade in recent years

X_{ij} in function(4) is the theoretical trade volume calculated by GDP, per capita GDP, FTD and so on, and it is the trade potential.

As Fig. 1 shows, the theoretical trade volume was increasing year by year from 1998 to 2007, same as the actual trade volume. Affected by the financial crisis, both the theoretical and actual trade volume decreased in 2008 and 2009, then have rebounded since 2010.

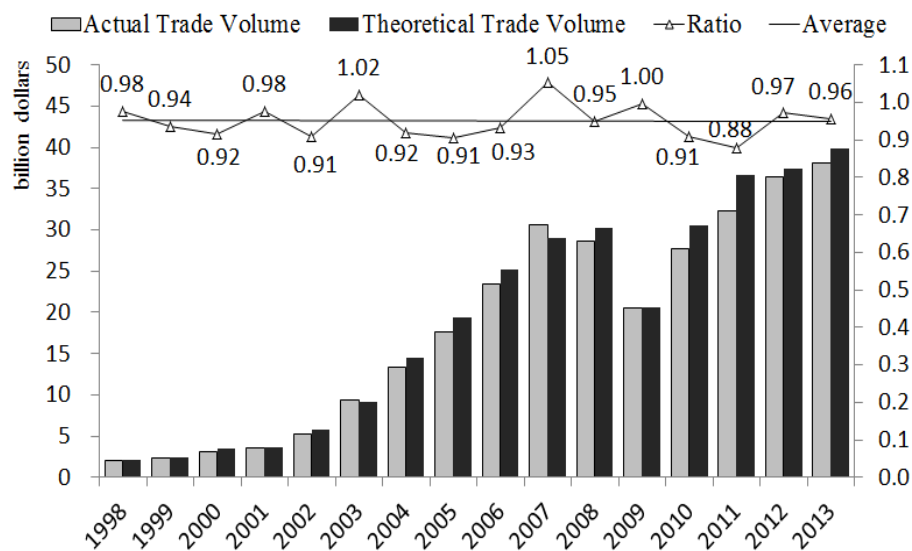


Figure 1. Trade Volume between China and Philippines

Meanwhile the ratios of actual trade volume to theoretical trade volume show over-trading of China and the Philippines in 2003 and 2007, as the ratios are greater than 1. In 2009 the actual trade volume is almost equal to the theoretical trade volume, which means the trade is mostly saturated. Although the ratios of the rest years are smaller than 1, they are close to 1. Generally speaking, the average value of the ratios is 0.95, it shows that the bilateral trade between China and Philippines has developed very well and there is very little potential unless the sort of a breakthrough has been found.

B. The trade volume between China and Philippines in 2014

Data from the World Bank show that in 2014 GDP in China is 10360.1 billion dollars, and 284.6 billion dollars in the Philippines. The per capita GDP is 7593.9 dollars in China and 2,843.1 dollars in the Philippines. The FTD of China can be calculated by GDP and the summary of exports and imports, that is 41.54%.

As a result of calculation by function(4), the theoretical trade volume is 40.49 billion dollars. It is about 0.94% of the total trade volume of China, which is 4303.04 billion dollars. In other words, the potential of bilateral trade between China and Philippines is very small in proportion

to China's exports and imports. It proves again that the Philippines is not the main trading partner of China, and trade with Philippines has little contribution to China's trade growth.

VI. CONCLUSIONS

According to gravity model, the GDP and per capita GDP in the Philippines have a great effect on the trade volume between China and the Philippines. And the development of the trade between the two countries is well enough so that the trade potential is small.

The Philippines is one of the "One Belt One Road" Strategic partnership of China. But it can be inferred from the result of gravity model that China may not pay too much attention to the trade with the Philippines, as the Philippines is not the main trading partner of China. However, for Philippines, things have changed. Actually, as mentioned before, China is the third largest trading partner of the Philippines. If the trade between the two countries becomes worse, the economy of Philippines will be greatly affected.

REFERENCES

- [1] SHI Zhao-xing, GU Hai-ying, "New Development of the Gravity Model and Its Application in China's Foreign Trade", Finance and Trade Research, vol.3 Mar.2005
- [2] ZHANG Yu, TANG Zhi-fang, "Trade Gravity Mode: Demonstration from China and Inspiration", Economic Survey, vol.4, Apr.2006
- [3] PAN Qin, HAN Jian, "A Study of the Relations between Intra-industry Trade and Regional Economic Integration Based on Gravity Model", Journal of International Trade, vol.9, Sept.2006
- [4] DING Huixia, FENG Zongxian, "The effects of Institution as Location Advantage on China's Attraction to FDI---An Empirical Analysis on the Basis of Gravity Model", Economic Survey, vol.2, Feb.2007
- [5] Zhou Nianli, "The Empirical Research on the Bilateral Service Trade Flow and Export Potential in China based on the Gravity Model", The Journal of Quantitative & Technical Economics, vol.12, Dec.2010
- [6] HUANG Yeqing, ZHANG Yu, "An Empirical Analysis of New Trends of China's Foreign Trade Based on Trade Gravity Model", International Economics and Trade Research, vol.2, Feb.2008
- [7] Zhao Yu-lin, Lin Guanghua, "A Study on the Flow and Potentiality of Bilateral Agricultural Products Trade between China and ASEAN-Based on Trade Gravity Model", Journal of International Trade, vol.12, Dec.2008
- [8] Xie Mengjun, "Study on Influencing Factors of China's Export Location Choice from Institutional Quality Perspective: An Empirical Test of Panel Data with Augmented Gravity Model", Journal of International Trade, vol.6, Jun.2013
- [9] Xie MengJun, Wang LiYong, "Empirical Research on the Impact of the Quality of Economic System of China's Export: Improved Gravity Model Based on 36 Countries(or Regions) Panel Data Analysis", Finance and Trade Research, vol.3, Mar.2013
- [10] Guo Kewei, "The Study of the Influence Factors of China - ASEAN Future Economic and Trade Relations", Asia-Pacific Economic Review, vol.4, Apr.2015