

Is the Gravity Model Still Effective?

--From the Perspective of Chinese Food Import

By AO CHEN

The gravity model is a classical model in international economics. However, there are raising voice that the model has no longer effective. In this paper, China's food import will be used to analyzed whether the model is applicable.

I. Data Description

In the recent China-US Trade Conflict, the US government has asked the Chinese to purchase more American agricultural products. From the trade deal, we can see that China is the main buyer of agricultural commodities. Compared with other industries, agriculture relies more on natural endowment like land area and climate. Therefore, it is meaningful to check whether the classical gravity model is applicable here.

A. Partners Selection

Proper trade partners are required to examine the assumption. Based on the Chinese Ministry of Commerce¹, we select some leading exporters to China like the United States, Brazil, Argentina, Canada, Australia, and New Zealand. To compare, we choose some important neighboring countries like Japan, South Korea, and ten ASEAN countries. Among the ten ASEAN members², Thailand and Indonesia are also main import sources for China's agricultural sector. However, other countries export smaller numbers of farming products compared with Canada and Australia.

¹ http://wms.mofcom.gov.cn/article/zt_ncp/table/2019_12.pdf (Chinese)

² Brunei, Myanmar, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand and Vietnam.

B. Variables Choice

a) The Dependent Variables.

The main dependent variable here is the export value of food products to China. The “food” is defined in the Standard International Trade Classification (SITC)³. According to the Ministry of Commerce in China, the main import agricultural products are cereal and soybean. The category includes soybean in SITC is Oil seeds and oleaginous fruits. Thus, the import value of these two categories will also be included as the second and third parts of the econometric model. The primary source of the data is the United Nations Conference on Trade (UNCTAD) and Development Database. The time is from 1995 to 2019.

From the trade data, Brunei and Cambodia’s export value is too small, so we drop it in the early period. On the contrary, Singapore is not known for its agricultural products but intermediary trade. Its export value will still be included in the model.

b) China’s GDP (CGDP) and Partners GDP (PGDP)

The home country’s GDP and foreign countries’ GDP are key factors in the basic Gravity Model (Head, 2003). The data source is the World Bank Open Data. With the GDP grows, we assume the trade value will increase.

c) Distance (multiple Oil Price)

The distance between the import and export countries is another essential variable. We gain the data of distance from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)⁴. Among several kinds of distance, the weighted distance is preferred in our models⁵. It is mainly based on the distance between the largest cities

³ All food items (SITC 0 + 1 + 22 + 4)

⁴ http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp

⁵ http://www.cepii.fr/distance/noticedist_en.pdf

in each nation and then the distance is weighted by the share of the city in the overall country's population.

Since a fixed effect will be included later, we use the Brent Oil Price multiple the distance to gain a flexible transport cost. With the multiple result increasing, we assume the trade value will decrease.

d) Agriculture, Value Added (% of GDP)

The Agriculture, value-added, is the agriculture sector's net output by adding up all outputs and subtracting intermediate inputs. This can be viewed as the importance of agriculture in the domestic economy. Usually, if a country is a developing country, the value will be high. If it is a developed country, the value will be low. We assume it has a negative relation with trade value. The data is from the World Bank.

e) Exchange Rate (n foreign currency unit/ per CNY unit)

The exchange rate shows the relation between different currencies. We gain the exchange rates between foreign currencies and Chinese currency through basic calculation, Renminbi (RMB). With the number n increase, 1 RMB unit can change into more units of foreign currency, which is motivating for export to China. Here we decide to drop Myanmar from the dataset because its currency was traded in the black market during the military period (Kubo, 2015).

f) Free Trade Agreement (FTA)

The Free Trade Agreement between China and foreign countries will be beneficial for agricultural trade. Generally, China is considered a country with a comparative advantage in manufacturing goods. It is natural for China to reduce the barrier for the agricultural product in exchange for the partners' lower tariffs in manufacturing goods. We set it as a dummy variable. When the FTA starts, the value will turn to "1", otherwise remain "0."

Table.1 Countries with Free Trade Agreement with China

FTA with China	Start
ASEAN	2010

Australia	2015
Chile	2006
South Korea	2015

g) Crisis

This variable mentions some economic and political events that may affect a country's macroeconomy or its relationship with China. For global or region-level, it may be 1997 Asian Financial Crisis or 2008-2009 Great Recession. For country-level, it may be China-US Trade War or Crimean Crisis. This is also a dummy variable. We assume it has negative effect on agricultural trade.

Table.2 Specific Crisis or Events

	1997 Asian	2008-2009
Global/Regional	Financial	Great
	Crisis	Recession
	1995	2019
Argentina	Currency	Currency
	Crisis	Crisis
Brazil	2015-2016	
	Recession	
	2012-2014	
Japan	Territory	
	Dispute	
	2016-2017	
South Korea	Defense	
	Dispute	
	1994-1996	2014-2015
Ukraine	Transition	Crimean
		Crisis
	2018-2019	
USA	Trade War	

C. Data Visualization

Proper trade partners are required to examine the assumption. There is a general observation in this part. Our model include 17 countries: United States, Brazil, Chile Argentina, Canada, Australia, New Zealand, Japan, South Korea, Indonesia, Laos,

Malaysia, the Philippines, Singapore, Thailand, and Vietnam. The time starts from 1995 and ends at 2019. It is a long panel.

a) Import Data

From Figure 1, China's food import has generally been increasing from 1995 to 2019. A sharp rise is witnessed in 2002-2013 and 2017-2019. From Figure 2, we can see that in each category, the countries selected has covered more than 50% of Chinese total food import. The concentration of Oil seeds and oleaginous fruits, which include soybean, is shocking. Since 2000, it has been over 90%.

Figure1 Import Value

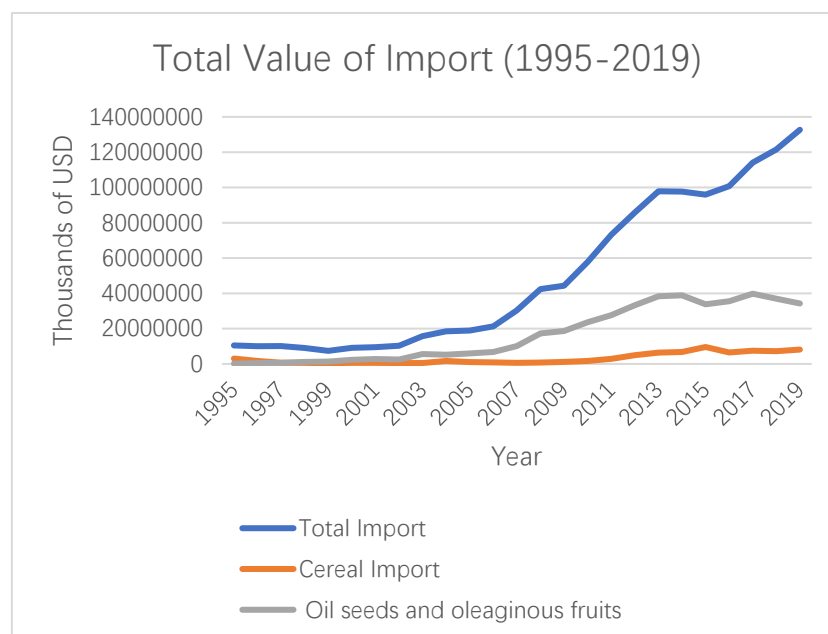
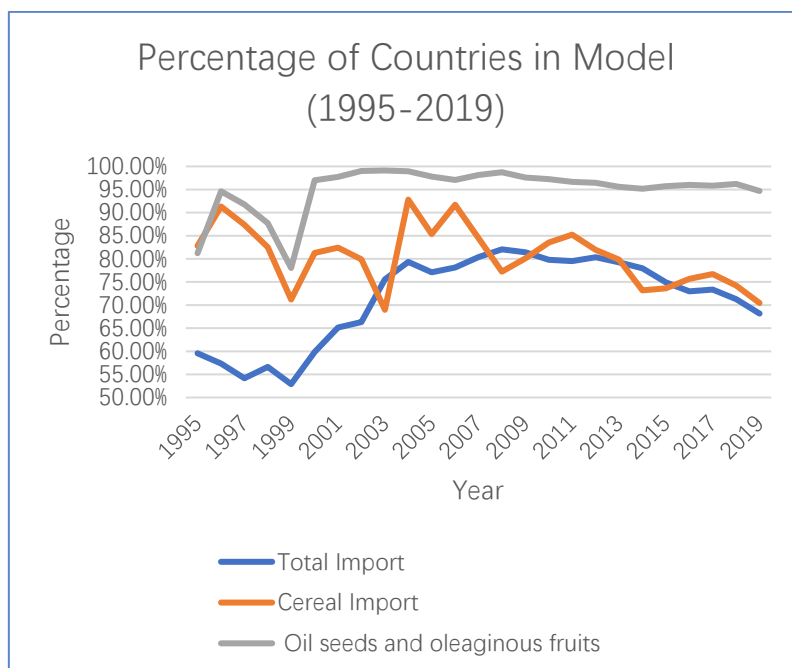


Figure2 Percentage of selected countries in the model



b) CGDP and PGDP

From Figure 3 we can see that both China's GDP and the mean value of trade partner's GDP has been growing during 1995-2019. With higher GDP, the trade value will be larger. That fits the theory of Gravity Model.



c) Distance

When it comes to the distance, things become a little different. Based on Table 3, in the

3 period, the distance of the Top 5 importers are always greater than others. The distance seems to be positively correlated with trade value. This requires further study.

Table3 Mean Distance of the Top5 Importers and Others

	1995	2008	2019
Top5	9023.247	11135.96	9824.679
Others	6790.756	5910.479	6456.842

Citation

Head, K. (2003). Gravity for beginners. *University of British Columbia*, 2053.

Kubo, K. (2015). *Transition from black to official markets for foreign exchange in Myanmar* (No. 511). Institute of Developing Economies, Japan External Trade Organization (JETRO).