

The gravity model of trade

[Science](#), [Physics](#)



Assignment 1: The Gravity Model Of Trade

Abstract

In the field of international economics, the gravity model for trade reveals that bilateral trade is directly proportional with the extent of the economy (usually expressed in GDP) and inversely proportional with the geographical distance between the analysed entities. The present report illustrates the model for the case of Japan, elaborating the trade patterns created among it and its 9 main trade partners.

The parameters for the gravity equation are estimated and the relation between GDP and exports for the countries in question are depicted through a scattered plot, for a more in-depth view on the connections. By testing the model it can be observed that the trade relations of Japan are being influenced by the size of the economy and the distance to the trade partners. (JEL F100, F170)

THE GRAVITY MODEL OF TRADE

The law of universal gravitation was published by Isaac Newton as a general physical law.

Its application was later on spread into various fields of research, succeeding to explain a series of scientific phenomena. In international economics, the gravity model of trade is used in order to predict bilateral trade flows in respect to the economic performance (measured in GDP) and distance between the two states taken into consideration. The present report aims to illustrate the gravity model of trade for the particular case of Japan,

revealing how size and distance influence the country's exports, centering the study on the relation among Japan and its 9 top trade partner countries.

The model will be tested by estimating the parameters of the gravity equation, namely the elasticities for GDP and distance. In order to estimate the gravity equation, the R statistical software has been used. The data set contains information regarding exports, GDP and distance to destination country, retrieved from the 2011 International Trade Statistics Yearbook of the United Nations. All data has 2011 as the year of reference. The GDP value for each country has been converted into billions of USD, in order to maintain the same unit of measure.

Example: China's GDP 2011 = 47.16 trillion CN[¥]; exchange rate: 1\$ = 6.4588 CN[¥]; therefore, China's GDP for 2011 amounts to 7,298,147 millions USD. Figure 1 shows Japan's trade as percentage of the exports of the top-9 export destinations in 2011, versus the GDP as percentage of the total GDP reported by the top-9 export destinations. As it can be seen, China does a lot more trade with Japan than even with the U.S.A, the main reason being the small distance between the two states, which THE GRAVITY MODEL OF TRADE reduces transportation costs.

In addition to this, the cultural factor has also to be taken into consideration, as both Japan and China are Asian cultures sharing similar values and tastes; therefore they have a look-alike pattern of trade. The linear equation appears as it follows: $z = 12.03 + 0.05x_1 - (-0.15)x_2$ The coefficients of correlation in respect to GDP are $b = 0.05$, therefore there is a weak relationship between trade and one country's GDP. The coefficient of correlation in respect to distance is $c = -0.5$, therefore there is also a weak

relationship between trade and the distance between Japan and the trade partner country. The direct effect is that trade increases by 0.05% when the partner country's GDP increases by 1%, while it decreases by 0.15% when the distance to the partner countries increases by 1%. The mean and the standard deviation (described variables) have been computed for the variables: GDP, exports, distance. GDP: mean= 1556897.3, standard deviation= 2417090.79 Exports: mean= 58211.7, standard deviation= 52047.57 Distance: mean= 4319060., standard deviation= 3462913.81 The results obtained depict that the model it is indeed verified, but the correlations are not strong enough in order to fully explain the patterns of trade between Japan and its 9 main trade-partners. Nevertheless, we can observe that both distance between countries and the size of one country's economy are factors that influence the trade between two states.

THE GRAVITY MODEL OF TRADE

References:

1. American Economic Association, JEL Classification Codes Guide. Retrieved October 6, 2012 from: <http://www.aeaweb.org/jel/guide/jel.hp> Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) (2011).
2. Geodesic Distances. Retrieved on October 6, 2012 from: <http://www.cepii.fr/anglaisgraph/bdd/distances.htm> International Monetary Fund. (2012). International Financial Statistics Yearbook 2012.
3. Washington, DC: International Monetary Fund Krugman, Obstfeld, and Melitz (2012), International Economics Theory & Policy, (9th edition), Pearson Education United Nations. (2011).

4. 2011 International Trade Statistics Yearbook. New York: United Nations. Retrieved on October 14, 2012 from: <http://comtrade.n.org/pb/CountryPagesNew.aspx?y=2011> United Nations Statistics Division, Countries or areas, codes and abbreviations.
5. Retrieved October 15, 2012 from: <http://unstats.un.org/unsd/methods/m49/m49alpha.htm> THE GRAVITY MODEL OF TRADE
- 6 Table 1 Japan's Trade Partners Country Exports (millions USD) China USA Republic of Korea China, Hong Kong SAR Thailand Singapore Germany Malaysia Netherlands 162062. 1 127679. 0 66167. 5 42954. 4 37530. 60 27264. 60 23505. 50 18796. 00 17945. 80 GDP (millions USD) 7298147. 00 14660400. 00 1116247. 00 243666. 00 345672. 00 259849. 0 3607364. 00 287943. 00 838112. 00 2098111. 00 10855. 59 1156. 67 2891225. 00 4612997. 00 5326388. 00 9298341. 00 5329095. 00 9303377. 00 Distance (km) Source: Data retrieved from the 2011 International Trade Statistics Yearbook of the United Nations (2011 – year of reference)

THE GRAVITY MODEL OF TRADE

7 Figure 1. Which are the closest trade partners for Japan? This figure illustrates Japan's trade as percentage of the exports of the top-9 export destinations in 2011, versus the GDP as percentage of the total GDP reported by the top-9 export destinations.