

The impact of Economic and Geographic indicators in Trade in OIC Countries (Using Gravity Model)

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Abstract: Present paper is an attempt to estimate the impact of Economic and Geographic indicators in trade among Islamic countries according to a bilateral trade model as Gravity model, and study the relationship between Economy, Geography and Trade in this way. Fixed effect version of the panel data estimation producer with OIC member country data spanning over the 2007–2012. The result of this research is as bellow:

First; increases in Gross Domestic Product (GDP), population, the technology of importers (countries) and decreases in area of the countries and the exchange rate of importer enhance the trade among Muslim countries. Secondly, distance (as a geographical indicator) is not the only factor affecting trade but also this factor with other geographic criteria (area and population) and economic (GDP, exchange rate and technology) impact on trade. Thus economic and geographic indicators are the effective factors in improving trade among Muslim countries.

Keywords: Bilateral Trade, Gravity Model, Muslim Countries.

Introduction

Bilateral or multilateral trade between countries is influenced by multiple factors such as economic size and geographical size of countries, area of countries, distance between countries, price different in difference places (which is resulted from the advantages of every region), factors price and different productivity of factors in different regions, technology differences in regions, commercial expenses (including the costs associated with transportations) and ... which seem that all these indicators in a way are considered to be of economic – geographical indicates and indicate that geography plays an important role in economic activities and specially in trade between countries. What is so much important here is the level and type of effect these factors have on trade between countries and it is obvious that depending on the region it will be different and will show different results from it. On the basis, the present research with the use of a bilateral trade model seeks to study the relationship and correlation between three subjects of economic, geography and trade and in addition to this intends to analytically study the effect of geographical and economic indicators on the trade between countries. The model used in this research is the Gravity Model that has been first presented by Tinbergen (1962) with the use of Newton's law of gravity which shows that bilateral trade between countries has a direct relationship economic size (GDP) of the two countries and has a reverse relationship with the distance between the two countries. On this basis, with assuming the negative effect of distance, one of the factors of geographical indicators on trade, present this indicate as a trade barrier (with the use of model (Dornbusch, Fisher, Samuelson (1977))) and have studied other indicator such as population, the other factor of geographical indicator, as the factor improving trade between countries.

Although, in addition to so many studies conducted regarding the negative effect of distance (a geographical indicator) on trade (Anderson (1979); Krugman (1980); Frankel (1997); Head (2003) and ...), other studies have provided contradictory findings with regards to the effect of distance on trade after 1970 among countries. For example, Rauch (1999); Leamer & Levinsohn (1995); Engels & Rogers (1998); Leamer & Stoper (2003) and ... also have provided different finding with regards to the effect or lack of effect of different economic and geographical indicators on trade. Therefore and based on the above mentioned there is no agreement with regards to the effect of different indicators on the trade between countries. This is especially important for Muslim countries that are mostly among developing countries and seek to reach to the conditions and status of developed countries and calls politicians and scholars to conduct studies about the affecting and influential indicators on the trade between these countries. On this basis, researchers in the present paper intent to discuss and study the relationship between trade, economy and geography of Muslim countries with analyzing the effect of economic

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and geographic indicators on the trade between these countries. The rest of this paper has been organized in the following way: section 2 presents research methodology and research model. Section 3 estimates the model and presents estimations methods and finally in section 4 a summary is presented as well as the research conclusion.

Research Method

The model used in this paper is “Gravity model”. This model is as per the following:

$$(1) \text{ Trade }^{k_{ij,t}} = A^k_t \cdot (\text{Gdp }^{\alpha_i} \cdot \text{Gdp}^{\beta_j} / \text{Distance}^{\mu + \Omega_{ij}}) \text{ Where,}$$

- Trade_{ij} is the bilateral trade (export + import) between countries i and j, of course the variables of export and import are also used instead of the total trade between countries;
- A is a fixed value.

With the breakdown of model 1, model 2 is obtained.

$$(2) \text{ Trade }^{k_{ij,t}} = (\text{Gdp }^{\alpha_i} \cdot \text{Gdp}^{\beta_j} \cdot \text{Distance}^{-\mu} \sum A^k_t / \text{Distance}^{\Omega_{ij}})$$

Now, we take the logarithm of this model:

$$(3) \ln \text{Trade }_{ij,t} = k + \alpha \ln \text{Gdp }_i + \beta \ln \text{Gdp }_j - \mu \ln \text{Distance} + \ln(\sum A^k_t / \text{Distance}^{\Omega_{ij}})$$

According to model No. 3, the aggregated model of trade is presented as below which the generalized form of it will be as per the following:

$$(4) \ln \text{Trade }_{ij,t} = k + \alpha \ln \text{Gdp }_i + \beta \ln \text{Gdp }_j + \mu \ln \text{Distance} + e_{ij}$$

In gravity models in addition to the main presented indicators in model no. 4, that sometimes instead of GDP, GDP per capital, national income, per capital income and ... are used, dummy variables such as common border, common language, religion and culture, Colonial relationship and etc are used.

Introduction of the Models

The model used in the present study is gravity model which is one of the common models being used for trading flows between countries.¹ In international economy, this model has the ability of estimating the Commercial potential and estimation of commercial potential between two countries in this model is performed with the use of factors that can determine it. The model used in the present study is the generalized model of model no. 4; however, it should be mentioned that the dummy variable of common religion which is one of the main variables of common cultural communication between countries have been considered potentially in the model because all the countries being studied in this paper are Muslim countries and in the model it has been tried to emphasize mostly on economic and geographical factors:

$$\ln \text{ trade }_{ijt} = a_0 + a_1 \ln \text{ GDP}_{it} + a_2 \ln \text{ GDP}_{jt} + a_3 \ln \text{ POP}_{it} + a_4 \ln \text{ POP}_{jt} + a_5 \ln \text{ DIST}_{ij} + a_6 \ln \text{ AREA}_i + a_7 \ln \text{ AREA}_j + a_8 \ln \text{ EXR}_{it} + a_9 \ln \text{ EXR}_{jt} + a_{10} \ln \text{ Tech}_{jt} + a_{11} \text{ Tech}_{jt} + a_{12} \text{ Asia}_{kt} + a_{13} \text{ urop}_{kt} + a_{14} \text{ Afri}_{kt} + a_{15} \text{ Asia}_{kt} \text{ urop}_{kt} + a_{16} \text{ urop}_{kt} \text{ Afri}_{kt} + a_{13} \text{ Asia}_{kt} \text{ Afri}_{kt} + e_{ijt} \quad (5)$$

Trade:

Bilateral trade between countries (which are the sum of imports and exports between countries) which has been presented as dependent variable in the model.

Independent variables:

GDP: Gross domestic product that GDP_i is related to the importing country and GDP_j is related to exporting country.

Pop: population that POP_i is related to the importing country and POP_j is related to the exporting country.

DIS_{ij}: distance between the two importing country i and exporting country j, this variable has been considered as an alternative for transportation costs between countries which is the distance between the capitals of the importing country i and exporting country j.

¹ Bougheas et al(1999),WTO.UNCTAD(2003)

AREA: area that AREA_i is the area of the importing country and AREA_j is the area of the exporting country.

EXR: currency rate that EXR_i is the currency rate of the importing country and EXR_j is the currency rate of the exporting country.

Tech: Technology that Tech_i is the technology of the importing country; while Tech_j is the technology of the exporting country.

Asia: Those Muslim countries which are located in Asian region (in case a Muslim country is located in Asian region 1 and otherwise 0 will be allocated to this variable).

Urop: those Muslim countries located in European region (in case a Muslim country is located in European region 1 and otherwise 0 will be allocated to this variable).

Africa: those Muslim countries located in African region (in case a Muslim country is located in African region 1 and otherwise 0 will be allocated to this variable).

Estimation of the Model

This study with the use of panel data, reviews software and with the application of gravity bilateral trade model studies the effect of economic and geographical indicators on trade between countries. The sample being studied in this research is member states of Organization of Islamic Conference that are being analyzed for the time period of 2007 – 2012.

For the purpose of estimating the present model, the Muslim countries are divided as per the following categories:

- Europe (Europe and Central Asia): Albania, Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, Uzbekistan.
- Asia: Middle East countries (Algeria, Djibouti, Egypt, Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, Yemen, Indonesia and Malaysia), East Asia and the Pacific countries (Indonesia and Malaysia), South Asia (Afghanistan, Bangladesh, Maldives, Pakistan).
- Africa (Sub-Saharan Africa): Benin, Burkina Faso, Cameroon, Chad, Phoebe, Gabon, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, Togo.

In general, there are different methods for estimating a model with the use of panel data that are:

1. Model estimation with assuming identical intercept;
2. Model estimation with assuming different intercept for cross-sections (different countries) with fixed or random effects.

For determining that which is these model have higher efficiency, Leamer-F test is used:

$$F(n - 1, nt - n - k) = \frac{(R_U^2 - R_R^2) / (n - 1)}{(1 - R_U^2) / (nt - n - 1)} \quad (6)$$

R²_U: estimation with the use of fixed effect method, Sum of squared errors of the estimated model with assuming different intercepts;

R²_R: estimation with the use of PLS¹ method, sum of squared errors of the estimated model with assuming identical intercepts;

n: the number of cross-sections;

t: the number of time-series observations;

k: the number of explanatory variables of the model.

Table (1): Results of pattern selection (F bound test)

Error percentage (prob.)	Test statistic	Title
0.00	102.34	Result

Research Results

Based on the results of table (1) it is seen that the value of calculated F is larger comparing to the F value in the table and therefore H₀ is rejected which means that intercepts are different for different cross-section and using OLS will be incompatible in this case and will not have efficiency. Therefore, in the next stage we are using Hausman test for determining that for model estimation whether fixed effects or random effects method should be

¹- Pooled + Ols

used that this test studies the following hypotheses: the test results clearly show that H_0 indicating to this that random model can be used instead of fixed model is rejected. The result is that the best estimation type is fixed effects method.

Table (2): Hausman test

Titles	(statistic)	Prob
Result	127.45	1.03

The results of estimating Model No (5) is as follows:

Table (3): the results gained from the estimation

variables	Coefficients	Std. Error	t-Statistic	Prob.
Lgdp_{it}	1.053	0.01223	3.65437	0.003
Lgdp_{jt}	1.190	0.01213	2.34120	0.0012
Lpop_{it}	0.320	0.013332	4.15609	0.0310
Lpop_{jt}	0.433	0.083737	-0.72848	0.004
Larea_{it}	-0.085	0.015420	2.43294	0.0011
Larea_{jt}	-0.021	0.04145	1.03065	0.049
Lexr_{it}	-0.394	0.01689	2.65437-	0.004
Lexr_{jt}	1.038	0.04536	1.0359	0.820
Distance_{ij}	1.04	0.1435	2.095	0.001
Ltech_{it}	0.09	0.06097	-0.6348	0.003
Ltech_{jt}	-0.0602	0.015420	-2.10344	0.984
Asia	0.041	0.04145	1.0249	0.004
Urop	0.006	0.01223	1.7098	0.031
Africa	-0.004	0.01213	-2.1207	0.040
Asia urop	0.001	0.013332	3.8030	0.007
Asia Africa	0.046	0.083737	1.407	0.024
Urop Africa	-0.09	0.015420	-2.1204	0.009
R-squared	0.7990	Mean dependent var.		0.146386
Adjusted R-squared	0.7678	S.D. dependent var.		0.036196
S.E. of regression	0.003593	Sum squared resid.		0.000787
F-statistic	35.093	Durbin-Watson stat		1.78
Prob (F-statistic)	0			

Conclusion and Results

The results obtained from estimation of gravity model with the use of fixed effect method for Muslim countries in the time period of 2007 – 2012 indicate that: A) gross domestic product, population, area, currency rate and technology variables (for importing countries) and the variable of distance between countries have a significant effect on the trade level between Muslim countries; B) positive coefficient of the variable of gross domestic product for importing and exporting Muslim countries in this model indicates that as much as gross domestic product of the Both sides of the trade between Muslim countries is increased, the trade rate between these countries is increased and this factor expresses this concept that increase of gross domestic product in Muslim countries on one hand increases demand for their import from each other and on the other hand increases export of Muslim countries to one another. C) The positive coefficient of population variable for Muslim importing and exporting countries in this model indicates that as much as the population of the Muslim importing and exporting countries is more, the trade level between these countries will be more and this factor indicates that the increase of population in Muslim countries on one hand increases demand for their imports from one another and on the other hand this increased population is the increased manpower which is one of increase factors of production and eventually results in increasing exports of Muslims countries to one another. D) Positive coefficient of technology and negative coefficient of currency rate for Muslim importing countries indicate that as much as the technology of the Muslim importing countries improves the trade of these countries increases. Technology increase in Muslim importing countries is accompanied with the import of Raw materials and manufactured or intermediate goods (related to the relevant technology) from other countries in this field) and results to the increase of imports which

is a part of a total trade. Also, the increase of currency rate indicate to the increase of the value of the money of the other Muslim countries on trade for some Muslim countries and as a result reduces imports to these countries and reduces trade for these countries. E) negative coefficient of the variable of country area (that in most of the studies is presented as an indicator of size), indicate that area increase in Muslim countries has a negative effect on the trade between these countries and the reason for this seems to be that the large area of so many of these Muslim countries such as African countries is unusable. F) positive coefficient of the variable of distance between countries indicate that increase of distance between these countries, contrary to true theories regarding to the effect of distance on trade, increases trade in Muslim countries. The reason of this can be mostly seen in the sign between the coefficients of the variables of Asia, Europe and Africa. The positive coefficient of the variables of Asia and Europe (which is mostly related to Central Asia and only one European country) which is related to importing and exporting member states of Asia or Europe indicate that in Asian Muslim countries or in Central Asia more trade occurs between them. The negative sign of the variable of Africa indicate that in African Muslim countries (in spite of less distance between these countries comparing to other Muslim countries) if the two countries are related to this region, trade between these countries decreases. Positive coefficient of the variable of Asia-Europe and Asia-Africa indicate that if the Muslim importing and exporting countries are in Africa, Asia or Europe, trade between Muslim countries increases. This means that although the distance between Asian and African countries is so much, when the importing and exporting countries are from these two regions, trades between them improves. However the negative coefficient of the variable of Europe – Africa indicates that if the trading countries are from Europe and Africa regions trade between them reduces.

Therefore, according the above mentioned, it is obvious that regarding the effect of distance on trading in Muslim countries we cannot provide a conclusive opinion, because for example trade between Asian countries is more within them; however trade between Asian or African countries also occurs more. But trade between African countries or African and European Countries occurs less. Therefore, the factor of distance in itself doesn't effect on the trade between the countries, but this factor can be one of the effective factors on trade and beside other indicators, that were mentioned above also, can be among effective indicators on trade between Muslim countries. F) The entire model is significant (F test is significant) and except for the variables of currency rate related to exporting countries and technology related to Muslim importing countries, other variables have a significant effect on trade between Muslim countries; G) high value of Durbin –Watson statistic equal to 1.78 shows the lack of auto-correlation in the model variables; H) based on the results, increase in gross domestic product related to Muslim importing countries, gross domestic product of Muslim exporting countries, population of importing countries and population of exporting countries, technology of importing countries and distance between countries helps to improve trade between Muslim countries. In other words, 1% increase in logarithm of each of the mentioned variables respectively increases trade about 1.053%, 1.19%, 0.32%, 0.43%, 0.09%, 0.04% between Muslim countries. In the same way, 1% increase in the logarithm of the area of the Muslim importing and exporting countries and the currency rate of the importing countries respectively reduces trade about 0.08%, 0.02% and 0.39%. This trend in the same way is presented for other variables in the table as well.

I) In general with presenting the results about the estimation of this model (high coefficient of determination and adjusted coefficient of determination and also studying F test) this is resulted that geographical and economic indicators are among effective indicators on trade between Muslim countries.

J) A glance on the coefficients of the mentioned variables in the sample under study indicates that the variable of gross domestic product of Muslim exporting and importing countries has the highest effect on trade between Muslim countries.

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