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The Determinants of Trade Flows between D-8 Group Members through Gravity Model

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ABSTRACT

Organization of Islamic Countries (OIC) is one of those organizations that is highly important politically and economically. So, creating a common market between its members can increase the cooperation in this organization. In order that and to achieve this goal, focusing on sub groups such as D-8 countries would be useful. The purpose of this study is to investigate the determinants of trade flows between D-8 group members in the period of 1995-2010 through gravity model .We modify the model, introducing a new variable, the technological distance in order to understand the relevance of the technological gap between countries in the determination of trade flows. The results show that a number of variables such as gross domestic production, real exchange rate, tariff rates, technological distance and geographical distance are important determinants of bilateral trade flows, so that the GDP of exporter and importer countries, real exchange rate and technological distance in exporter countries have a positive and significant effect on export flows and the population, tariff rates in importer countries and geographical distance have a negative and significant effect on trade flows between d-8 countries.
Jel classification: F1, F15
KEYWORDS: D-8countries, trade integration, gravity mode, technological gap.

1. INTRODUCTION

In spite of trade openness and globalization which are two main characteristics of new international trade system in recent years, the importance of blocs, organizations and economic or trade agreements has not been diminished. Some incentives such as trade increscent, economic growth, welfare enhancing, bargaining power increscent in politic, providing security and political considerations, foreign direct investment in crescent intensify establishing these kinds of international organizations (Maio, 2008). Recently another new and important dimension of these organizations has been added and it is the role of these arrangements in preparing and equipping countries to use the opportunities and overcome difficulties witch new system of global trade caused them. These arrangements can be used to ease of integration in the new system of international trade and access to world markets.

Organization of Islamic Countries (OIC) is also one of those organizations that is highly important politically and economically. Undoubtedly one of ways to increase cooperation in this organization is creating an Islamic common market. To achieve this goal and create a suitable background for the market to operate efficiently, focusing on sub groups such as the organization of D-8 [1] would be useful. So the members of OIC would be profited by creating linkage between its sub groups such as: ECO, Persian Gulf Cooperation Council and the group of D-8. So the study of factors which affect the trade between the members of D-8 group is necessary. The purpose of this study is to investigate the determinants of bilateral exports between the members of D-8 countries in the period of 1995-2010 through gravity model. And we are going to test these hypotheses:

- The economic size of members (measured by gross domestic productions) has a positive effect on bilateral exports amount.
- The real exchange rate in exporter country has a positive effect on bilateral exports amount.
- Technological distance between the members has a positive effect on bilateral exports amount.
- The importing tariff rate has a negative effect on bilateral exports amount in these countries.
- The geographical distance between the members has a negative effect on bilateral exports amount.

2. A brief picture of bilateral trade between D-8 group members

The D-8 group consists of 8 developing Islamic countries of Indonesia, Iran, Bangladesh, Pakistan, Turkey, Malaysia, Egypt and Nigeria. This group has been formed in order to establish strong economic ties

[1] . D-8 group consists of 8 developing Islamic countries of Indonesia, Iran, Bangladesh, Pakistan, Turkey, Malaysia, Egypt and Nigeria.

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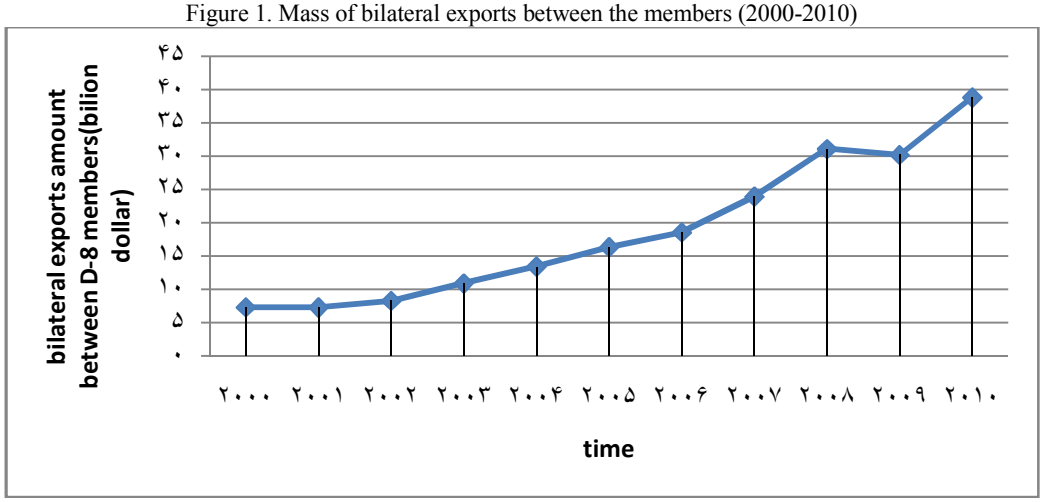
between developing countries and strengthening the role of these countries in world markets and improving the cooperation by seven industrialized countries. The main purpose of this group is economic and social development of members. Doing industrial and commercial collaborations and eliminating the trade barriers are required to improve the share of these countries in international trade.

The mass of bilateral exports between the members of D-8 group in the period of 2000-2010 has been presented in figure 1.

Figure 1. Mass of bilateral exports between the members (2000-2010)



Source: www.uncomtrade.com

It shows that the amount of bilateral export between the members is increasing. In the year of 2000 it was about 7.3 billion dollar and it reached 38.8 billion dollar in the year of 2010. This shows that there are strong trade potentials between the members, because these countries have a common culture and religion and Islam is a common point of convergence and a major factor in intensification of trade between these countries.

3. LITERATURE REVIEW

3-1- gravity model

The gravity model originates from the Newtonian physics notion. Newton's gravity law in mechanics states that two bodies attract each other proportionally to the product of each body mass (in kilogram) divided by the square of the distance between their respective centers of gravity (in meter). This model has been applied to a wide variety of goods and factors of production moving across regional and national boundaries under different circumstances since the early 1940s. This law is specifically useful in investigating the determining factors of international trade flows. So the gravity model indicates that the trade flow between two countries is proportional to the product of each countries (economic mass) generally measured by GDP, each to the power of another quantity to be determined. This formulation can be generalized to model 1:

$$T_{ijt} = \frac{KY_{it}^{\alpha}Y_{jt}^{\beta}}{D_{ij}^{\delta}} \qquad (1)$$

Where T_{ijt} is the mass of bilateral trade between country i and country j in t- time. Y_{it}, Y_{jt}Are the gross domestic productions of country i and j at t-time. And D_{ij} is the geographical distance between the country's capitals (Shlik, 2009).

Although the gravity equation can explain the trade flows between countries by their economic size and distances, but there are another variables which affect the trade flows. So to improve the gravity equations function in explaining the mass of bilateral trade between countries, we should use the other variables. Such as GDP per capita, populations of countries, real exchange rates, tariff rates, being a member of a trade agreement, sharing a common land border, speaking the same language and so on(Zarzoso, 2003).

According to the generalized gravity model of trade, the volume of exports between pairs of countries X_{ijt} is a function of their incomes (GDPs), their populations, their geographical distance and the other effecting variables:

$$X_{ijt} = \beta_0 Y_{it}^{\beta_1} Y_{jt}^{\beta_2} N_{it}^{\beta_3} N_{jt}^{\beta_4} D_{ij}^{\beta_5} A_{ijt}^{\beta_6} U_{ijt} \qquad (2)$$

Where $Y_{it}(Y_{jt})$ indicates GDPs of the exporter(importer), $N_{it}(N_{jt})$ are populations of the exporter(importer), D_{ij} measures the distance between the two country's capitals (or economic centers), A_{ijt} represents any other factors aiding or preventing trade between pairs of countries, and U_{ij} is the error term.

The second specification is usually chosen when the gravity model is applied to estimate bilateral exports for specific products (bergstrand, 1989), whereas the specification given by equation (2) is often used to estimate

aggregated exports (Endoh, 2000). For estimation purposes, model (2) in log linear form for a single year, is expressed as:

$$lX_{ij} = \beta_0 + \beta_1 lY_i + \beta_2 lY_j + \beta_3 lN_i + \beta_4 lN_j + \beta_5 lD_{ij} + \sum_h \delta_h P_{ijh} + U_{ij} \quad (3)$$

Where l denotes variables in natural logs, $\sum_h \delta_h P_{ijh}$ is a sum of the other affecting variables. A high level of incomes in the exporting country indicates a high level of production; witch increases the availabilities of goods for exports. Therefore we expect $\beta_1$to be positive. The coefficient of Y_j, β_2 , is also expected to be positive since a high level of income in the importing country suggests higher imports. The coefficient estimate for population of the exporter β_3, may be negative or positive signed, depending on whether the country exports less when it is big (absorption effect) or whether a big country exports more than a small country(economies of scale). The coefficient of the importer population β_4 has also an ambiguous sign, for similar reason (zarzoso, Lehman, 2003). The distance coefficient is expected to be negative since it is a proxy of all possible trade cost sources (Minniti, Parello, 2011).

Our model includes real exchange rates, tariff rates and technological distances additionally. We expect that the real exchange rate in exporter country has a positive effect on export flows (Gust et-al, 2010). But the tariff rate has a negative effect on bilateral exports (Chisik, 2011).

So, what about the technological distance? In analyzing the theoretical foundations of gravity equations, Evenet and Keller (1998) mention three types of trade models. One of them is the technology differences across countries in the Ricardian model. Ricardian theory indicates that trade occurs because of differences across countries in technologies. So it can be an intensive to export flows. Therefore in Ricardian theory we expect that the technological distance has a positive effect on bilateral exports between countries. (Rahman, 2003). But Helpman (1987) indicates that the technological gap can be a check on trade and similar countries have more intense commercial relations. So we should expect a negative correlation between this variable and the flow of exports. Actually, the technological distance is generally considered a barrier to trade, but it might become an intensive. For example the technological gap might have been an incentive to import higher tech products in order to copy the technology, to reproduce it at a lower cost and to shift outward the production possibility frontier in a catching up pattern (Filippini, Molini, 2003).

3.2. Empirical evidence

Bahmani et al (2010) studied the trade integration between Canada and Mexico and showed that both countries trade flows are influenced by real exchange rates and free trade agreement. And Mexico's largest export industries respond currency depreciations more than Canada's largest export industries do. Melitz (2008) studied the trade integration between 112 countries in the period of 1970-1997 and found that the level of educations and sharing a common language has a positive and significant effect on the amount of bilateral trade between those countries. Bhattacharya (2007) analyzed the pattern of trade between Japan and members of BIMSTEC[2] countries in 2003 through gravity model. He showed that the cooperation between Japan and these countries can increase the amount of bilateral trade in this region. Also, decreasing the level of tariff rates can intensify bilateral trade between these countries.

Lee and Shin (2006) examined how existing or proposed East Asian trading blocs affect intra-bloc and extra-bloc trade and thereby global trade in 175 countries in the period of 1948-1999 .they showed that the East Asian RTAs are likely to create more trade among members without diverting trade from non-members. Kisu(2006) examined Malawi's trade with her major trading partners using an econometric gravity model. The results showed that Malawi's bilateral trade is positively determined by the size of economies (GDP) and similar membership to regional integration agreements. Also the geographical distance, exchange rate volatility has a negative effect on trade flows. Pass and Tafenau (2005) studied the trade integration in east European countries in the period of 1993-2002 through gravity model. The results showed that the economic size of countries measured by GDPs and the level of economic development and geographical distance has a significant effect on bilateral trade between these countries. Zarzoso and Lehmann (2003) applied the gravity model to assess Mercosur-European Union trade, and trade potentials between both trade blocs. They found that a number of variables, namely, infrastructure, income differences and exchange rates are important determinants of bilateral trade flows.

Philipini, Molini (2003) used the gravity equation model to analyze trade flows between East Asian industrializing countries and some developed countries. The results show that GDPs, population, geographical distance and technological distance are the most important determinants of trade flows. Also they showed that technological distance has a negative effect on trade between these countries. Rahman (2003) showed that the exchange rates, partner countries total import demand and openness of the Bangladesh economy are the major determinants of Bangladesh exports. And all of them have a positive and significant effect on exports. Bavier and Bergstrand(2001) investigated the effects of transportation costs, tariff rates and income convergence on trade integration in OECD countries in the period of 1950-1980 and they showed that GDPs has a positive effect on trade integration but the tariff rates and transportation costs(measured by geographical distance) have

[2] BIMSTEC: seven nation Bay of Bengal Initiative for Multi spectral Technical and Economic Cooperation

negative effect on bilateral trade. Also they showed that income convergences are not an effective factor on trade integration between these countries.

4. Model and Data

The model is estimated taking into account 8 countries of D-8 group over a period of 16 years (1995-2010). We get 721 bilateral exports flow between these countries. The gravity equation is expressed in the additive form using the logarithmic transformation as follows:

$$LOG(Exp_{ijt}) = \alpha_0 + \alpha_1 LOG(GDP_{it}) + \alpha_2 LOG(GDP_{jt}) + \alpha_3 LOG(POP_{it}) + \alpha_4 LOG(POP_{jt}) + \alpha_5 LOG(REX_{it}) + \alpha_6 LOG(tariff_{jt}) + \alpha_7 LOG(D_{ij}) + \alpha_8 LOG(Tech\ dis_{ijt}) + U_{ijt} \quad (4)$$

All the economic variables are expressed in real terms:

$LOG(Exp_{ijt})$ is the value of exports from country i to j in year t

$LOG(GDP_{it})$ is the value of gross domestic production of exporting country in year t

$LOG(GDP_{jt})$ is the value of gross domestic production of importing country in year t

$LOG(POP_{it})$ is the population of exporting country in year t

$LOG(POP_{jt})$ is the population of importing country in year t

$LOG(REX_{it})$ is the real exchange rate of exporting country in year t

$LOG(tariff_{jt})$ is the import tariff rate in importing country in year t

$LOG(D_{ij})$ is the distance between country i and j

$LOG(Tech\ dis_{ijt})$ is the technological distance between i and j in year t

Export flows data has been derived from www.uncomtrade.com database, the values of GDP, population, real exchange rates and tariff rates have been derived from World Development Indicator 2010 CD-ROM (WDI, 2010). The geographical distance has been downloaded from http://www.indo.com, and expressed in km.

We define the technological distance as the absolute difference between the technological indicators (TI) of the two trade partners:

$$\text{Techdist}=|TI_{it} - TI_{jt}| \quad (5)$$

The TI indicator is calculated as a simple average of three different dimensions, assuming that these components play a comparable role in determining the technological capabilities of an economy: the creation of technology (HMTRCA), the diffusion of technology and the development of human skills.

The creation of technology is proxied by the Balassa Relative Comparative Advantage Index (Balassa, 1965) in medium and high tech sectors, as we assumed that the capacity of producing technology is sufficiently proxide by this indicator, defined HMTRCA:

$$HMTRCA_{it} = \frac{EXPmht_{it}/EXPtot_{it}}{EXPmht_{wt}/EXPtot_{wt}} \quad (6)$$

Where $EXPmht_{it}$ are the medium/high- tech exports of country i at t- time, $EXPtot_{it}$ are the total exports of country i at t-time. $EXPmht_{wt}$Are the world medium/high- tech exports at t- time, $EXPtot_{wt}$ are the world total exports at t-time.

The diffusion of technology is measured as a simple average of electricity consumption, telephone penetration and internet users.

The development of human resources is measured as a simple average of secondary and tertiary enrolment ratios plus the literacy rate.

The second and third indexes are expressed as a value between 0 and 1 by applying the following general formula (7). The maximum and minimum values are respectively the USAs and the nil ones:

$$Index_{it} = \frac{actual\ value_{it} - minimum\ value_t}{actual\ value_t - minimum\ value_t} \quad (7)$$

The technological distance has been computed by the authors using the same data used for export flows as far as the creation of technology of component is concerned, and the WDI 2010 for the other two components.

5. Empirical Results and Interpretations

To determine whether we should use pooled method or panel method we can perform a significance test with an F test.

$$F = \frac{(SSR_{pool} - SSR_{panel})/q}{SSR_{panel}/(N-K)} \quad (8)$$

In aforesaid equation F is test statistic, SSR_{pool} is sum of residuals square in pool model, SSR_{panel} is sum of residuals square in panel model, q is the number of limitation, N the number of data, K is degree of freedom.

While active estimator is the "Pool Model" under null hypothesis, if it was rejected then we use a panel model .

This test has been done and the results of F statistic have been presented in table (1).

Table (1). The Results of F Test

F statistic	(Prob)
110.43	**(0.000)**

The result of F statistic shows that, H0 hypothesis is rejected and therefore the panel model is suitable. Then we used the Hausman test to examine whether we should select fixed or random effect model. The result of Housman test has been presented in table (2).

Table (2). The Result of Housman Test

$\chi 2$ statistic	(prob)
179.41	**(0.0000)**

The results show that we should use fixed effect model. After testing for heteroscedasticity, the outcome of estimation using fixed effect (FGLS) has been showed in Table (3).

Table (3) The results of fixed effect estimation

variables	Coefficient	Z statistic	prob
C	1.69	1.33	0.18
$Lgdp_{it}$	1.73^{*}	22.38	0.000
$Lgdp_{jt}$	0.31^{*}	5.04	0.000
$Lpop_{it}$	-1.53^{*}	-19.39	0.000
$Lpop_{jt}$	-0.21^{*}	-3.85	0.000
$Lrex_{it}$	0.28^{*}	16.63	0.000
$Ltar_{jt}$	-0.08^{**}	-1.85	0.064
$Ldis_{ij}$	-0.96^{*}	-17.76	0.000
$L\ tech\ dis_{ijt}$	0.06^{*}	2.46	0.014
Number of observations, (groups)	721, (8)		
wald chi2	1644.36		
Prob>chi2	0.000		

*،**, shows significant level at 99and 95 percent respectively.

The empirical results indicate that the effect of GDP is positive and significant. This result shows that the wealthier countries trade more. So we accept the first hypothesis. For the population variables, on the contrary we obtain a negative coefficient for the countries. So we can note the existence of an import-substitution effect: the increasing size of the market is an incentive for the domestic production. Also the existence of absorption effect is noted. It means that although the populations increased and it cause production increscent, but the produced goods has been consumed by populations instead of exporting them to foreign countries.

Real exchange rate variable is found to be highly significant. The positive coefficient of real exchange rate implies that D-8 member's exports depend on their currency devaluation. It shows that the devaluation of currency is required to promote the country's exports taking other adverse effects, such as domestic inflation, of devaluation into account. So we can't reject the second hypothesis. Bilateral export flows are also negatively correlated with the geographic distance, as we expected. At this stage of analysis this type of distance can be considered barrier to international trade. So, the grater is the geographical distance, the smaller the export flows. So it indicates that the members tend to trade more with their immediate neighboring countries. The third hypothesis can't be rejected. Tariff rate has a negative and significant effect on export flows. It shows that tariff rates are trade barriers for these countries. Actually the forth hypothesis can't be rejected.

As the results show, the technological distance is positively correlated with exports flow. We can therefore support the catch-up effect hypothesis. Technological gap has been an incentive to import specifically capital goods from country i to country j imitating or doing reverse engineering. So the technological gap isn't trade barrier in these countries. and the fifth hypothesis can't be rejected.

6. Conclusions

The objective of this paper was to analyze the determinants of D-8 members trade flows and the trade potentials between these countries. With this aim we apply a gravity model to annual bilateral exports between these countries in the period of 1995-2010. Our results showed that exporter and importer incomes, as expected, have a positive influence on bilateral export flows. So these countries would be better by trading more with wealthier countries. Exporter and importer populations have a negative and significant effect on export flows, showing a positive absorption effect.

We investigated the role of technological distance between countries on export flows and results showed that technological gap between countries is not a trade barrier but it can intensify the export between countries. So developing of technology can improve the trade integration between these countries. Trying to reach a high level of technology would be a good strategy for policy makers. Also geographical distance has a negative effect on bilateral exports in these countries, showing that D-8 members would be better by trading more with its neighboring countries. Devaluation of exporter country currency has a positive effect on the amount of exports. So exchange rates would be a good instrument for policy makers to encourage exporters to increase the exports. There is a negative correlation between tariff rates and the amount of bilateral exports between countries. So tariff rates are trade barriers between the members and the countries should try to decrease tariff rates to achieve a high level of exports.

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