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Determinants of Trade Flows among D8 Countries: Evidence from the Gravity Model

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A special grouping within the Organisation of Islamic Countries (OIC) – the so called D8 Group comprises of eight developing countries – has formed an economic development alliance. Among its objectives are to improve member countries' positions in the world economy, diversify and create new opportunities in trade relations, and enhance participation in decision-making at the international level. In this context, the present paper identifies the factors affecting export flows among the D8 countries. The results from a gravity model, which is estimated using Panel Correlated Standard Errors (PCSE), demonstrate that the trading partners' Gross Domestic Product (GDP), exchange rate, population of exporter country, border and distance are the notable factors affecting the volume of export flow among the countries in the D8 group. In line with the results, the countries would do better if they focus on exporting more to their neighbouring countries within the group and also undertake the measures which ensure low transportation costs. Additionally, the currency depreciation would increase the trade flows among the members when other adverse effects are taking into account.

1 Introduction

The Organization of Islamic Countries (OIC) is the second largest inter-governmental organization which comprises of 57 members. The member countries have undertaken several efforts to enhance trade among them. A special group within the OIC, known as the Developing 8 (D8) was formed in 1997 within the larger OIC community with the

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purpose of strengthening the economic relations and providing the forward motion for greater economic integration.

The D8 group comprises eight major countries within the OIC, namely Malaysia, Iran, Turkey, Indonesia, Egypt, Bangladesh, Pakistan, and Nigeria. The trade relation amongst the D8 countries is not showing hopeful sign for the desirable share towards the volume of world trade. The countries do not trade with or invest in each other' economy as much as they do with the industrialized or other developing countries (Jamal and Yaghoob, 2009). However, in recent years, the D8 members have came up with an attempt to broaden and strengthen their economic cooperation. Clear efforts have been made to enhance the trade within the D8 in order to develop member countries' economy and also empower the countries to participate more actively in the globalization process (Group of Developing 8 Countries, 2010). This study is an attempt to find out major factors determining the trade relations among the D8 countries by applying a gravity model to estimate an export equation among the countries by using a pooled panel of data.

This study is organized as follows. Section 1 provides the background of trade flows within the D8 members. Section 2 discusses the existing literature on determinants of trade flows. Section 3 provides a review of the gravity model, followed by section 4 which presents the methodology and data used in estimating the main factors determining the trade relations among the D8 countries. Section 5 presents the conclusion and policy implication of the study.

1 Trade Performance in D8

Table 1 depicts the trends in the D8's merchandise trade during the last two decades. As shown in the table, most economies in the region have registered steady improvement in their merchandise trade performance during the 1995-2007 period. The most open economies in the region, Malaysia and Egypt, recorded merchandise trade (as a share of gross domestic product or GDP) of more than 200 percent and 60 percent by 2007, respectively and consequently recorded a higher total trade than the rest of the world on average. On the other hand, other D8 economies, particularly Pakistan, recorded a relatively lower trade in comparison to the world trade on average.

Table 1: Merchandise trade of D8 members (percentage of GDP)

Country	1995	2000	2005	2006	2007
Bangladesh	28.2	33.21	39.63	44.21	46.48
Egypt, Arab Rep.	50.25	39.02	62.95	61.52	65.08
Pakistan	36.13	28.13	35.25	38.45	35.53
Indonesia	53.96	71.44	63.99	56.65	54.83
Iran, Islamic Rep.	34.83	40.14	57.72	56.86	53.72
Malaysia	192.11	220.41	212.1	210.98	200.74
Nigeria	59.33	49.83	46.43	-	-
Turkey	44.24	43.2	47.21	50.25	49.8
World	42.02	49.08	53.83	56.58	57.35

Source: World Bank, 2010

As indicated in Table 2, overall, intra-trade within the D-8 forms only 3.7 percent, relative to 6 percent with the Rest of Other Islamic Countries (ROIC) and 90 percent with the Rest of the World (ROW). It is clear that those Islamic countries especially the D8 members do not trade with each other as they do with the rest of the word. All other bilateral trades between the D8 countries have only been very small; mainly less than 1 percent of each country's total trade (Badri & Terrie, 2008*)***.** It clearly indicates that intra trade among the D8 countries has been dismally minute. However, trade with ROW is overwhelmingly high at about 90 percent on average.

Table 2: Bilateral Export at World Prices (in percent value)

	D8	ROIC	ROW	Total
D8	3.7	6.0	90.2	100
ROIC	6.2	7.3	86.4	100
ROW	3.7	3.8	92.5	100
Total	3.8	4.0	92.1	100

Source: Badri & Terrie, 2008

Table 3 shows the decomposition of intra trade levels among the D8 countries. Among the grouping members, Egypt-Turkey and Indonesia-Malaysia trade have been the top trading pairs. Malaysian trade with Indonesia accounts for 59.66 percent of total trade while Indonesian

trade with Malaysia is somewhat smaller at 59.29 percent. Turkey is the main trade partner for D8 members, except for Malaysia and Indonesia, while Nigeria is a very small market for export of the D8 members. Other top trading pairs within the D8 grouping are Iran-Turkey and Egypt-Turkey, while, all other bilateral trade between the D8 countries has been very small, mainly less than 1 percent of each country's total trade.

Table 3: Decomposition of Trade among D8 (percentage) (based on year 2007)

	Partner Country									
		Bangladesh	Egypt	Indonesia	Iran	Malaysia	Nigeria	Pakistan	Turkey	Total
Reporter Country	Bangladesh	0.0000	0.0527	0.0791	0.1595	0.0528	0.0075	0.1806	0.4678	1
	Egypt	0.0067	0.0000	0.0524	0.0046	0.0199	0.0168	0.1087	0.7909	1
	Indonesia	0.0618	0.0670	0.0000	0.0451	0.5929	0.0228	0.1059	0.1044	1
	Iran	0.0291	0.0977	0.0765	0.0000	0.0447	0.0130	0.3509	0.3882	1
	Malaysia	0.0619	0.0502	0.5966	0.0646	0.0000	0.0092	0.1235	0.0939	1
	Nigeria	0.1414	0.0076	0.0621	0.0158	0.2108	0.0000	0.1254	0.4370	1
	Pakistan	0.2631	0.0715	0.0611	0.1763	0.0601	0.0334	0.0000	0.3345	1
	Turkey	0.0413	0.3187	0.0382	0.4793	0.0269	0.0373	0.0582	0.0000	1

Source: United Nations, 2010

However, intra-regional trade of D8 has been growing considerably in recent years (see Table 4). For instance, intra-regional trade in D8 expanded from US$ 7263 million in 1990 to 103056.6 US$ million in 2010. Turkey and Malaysia had the biggest share in intra-regional trade at 25% in 2010 followed by Indonesia (24%), Turkey (19 %) and Iran (14%), while Pakistan, Egypt, Bangladesh and Nigeria had relatively low shares in intra regional trade (Table 4).

Table 4: Merchandise Trade Performance among D8 (USD Million)

Year	1990	1995	2000	2005	2006	2007	2008	2009	2010	Share (%)
Malaysia	1334	3843	5367	10931	12573	15916	19577	16814	25613	25
Indonesia	1390	4889	4998	9088	10406	16920	21695	17699	24770	24
Turkey	1502	2245	2503	8034	11136	14077	17964	13363	19818	19
Iran, Islamic Republic of	1550	1741	1835	5469	7712	9013	13246	8616	14551	14
Pakistan	857	2050	1585	3120	3273	4328	5382	4980	6419	6
Egypt	345	641	1159	1636	1447	1457	4166	4645	5761	6
Bangladesh	260	389	586	1056	1298	1389	2000	2536	3562	4
Nigeria	25	282	697	1695	808	1645	2067	1993	2564	3
Total	7263	16079	18730	41028	48653	64746	86096	70646	103057	1

Source: International Monetary Fund (2011)

2 The Determinants of Trade

Trade flows between countries depend on a number of factors. Bilateral trade flows between two countries are assumed to be proportional to the level of their GDP. The GDP takes into account the fact that higher income economies tend to be more interested in product differentiation and specialization, thus they trade more (Fujimura & Edmonds, 2006).

In the traditional trade theory, such as the Heckscher-Ohlin model, patterns of trade between countries depend on natural resources, skills, and factors of production. It is assumed that trade takes place in a perfectly competitive and frictionless world without distance or geographic features (Salvatore, 1998). However, traditional explanations are thus incapable to explain the diverse patterns of exports across countries (Matthee & Naudé, 2008).

New theories of international trade have incorporated the distance (physical geography) to explain the determinants of trade flows between countries. Theoretical and empirical studies have found significant effects of distance on international trade (Beckerman, 1956; Yeates, 1969; Harrigan 1993; Hummels and Levinsohn 1995; Harrigan 1996;

Radelet and Sachs 1998; Hummels 1999; Hoffmann 2002; Lima˜o and Venables 2001; Clark, Dollar and Micco 2004). The most beneficial of those studies was conducted by Linneman (1966) who extensively investigated the role of distance on trade flows. Additionally, Krugman (1991) considers the distance between two countries to be an important determinant of geographical patterns of trade. In Krugman' s view, trading partners located far apart from each other will have to require more cost in their bilateral trade, which erodes possible gains from trade and consequently discourages trade.

Loungani et al. (2002) and Filippini and Molini (2003) state that distance is much more than geography. In their view, distance can represent the history, culture, language, social relations and many other aspects. For example, the mere existence of a border has negative effects on trade. Furthermore, Blum and Goldfarb (2006) find that distance is a good proxy for differences in tastes and preferences. Their results provide a new explanation for the persistence effect of distance in gravity regressions. This suggests that the distance effect in gravity will persist for a number of products even if transport costs, search costs and other trade barriers associated with distance are reduced to zero, which is the case to some extent for Internet trade.

Frankel (1997) explains that countries with large populations tend to be more inwardly oriented than smaller countries because they are more competent to take advantage of scale economies in their large domestic markets. This may explain why bilateral trade flows generally have an inverse relationship to population size.

Other studies pointed toward the impact of exchange rate on trade flows. In the area of international trade, it is widely known that a change in the real exchange rate will affect exports and imports under the generalized Marshall-Lerner condition. In theory, currency devaluation can improve trade flows if the relative prices among the country and its trading partners, and other factors are unchanged. Wilson and Takacs (1979), Warner and Kreinin (1983), Bahmani –Oskoeei (1986), Asserery and Peel (1991), Ghura and Grennes (1993), Clarida (1994), Reinhart (1995), Chua and Sharma (1998), Himarios (1989), and Tegene (1989, 1991) found that trade flows responded to the exchange rate. However, some consensus has emerged among researchers as they did not find any significant effects of exchange rate on trade (Miles, 1979; Rose, 1990;

Rose, 1991). The gravity equation is a useful approach to explain the role of exchange rate as well as the other determinants of trade flows between countries.

3 The Gravity Model

The gravity model provides a simple but robust approach to identify the main factors influencing trade among the countries (Greenaway and Milner, 2002). The model is, indeed, one of the most successful models in empirical economics so far (Frankel and Rose, 2002). In the early inception of the model, Tinbergen (1962) introduces the main determinants of bilateral trade flows, among others, economic size of trading partners, and measures of "trade resistance'' between them. Trade resistance measured by the geographical distance as a representative proxy for cost of international trade, and by a dummy variable to account for common borders. Later, the gravity model was extended to include the variables to account for population of trading partners (Bergstrand, 1985), and exchange rate of the trading partners (Bergstrns, 1985; Dell'Ariccia, 1999). The basic model (Martinez-Zarsoso & Nowak-Lehman, 2003; Jakab et al., 2001) is specified as follows:

$$X_{ij} = A_0 (Y_i)^{\alpha_1} (Y_j)^{\alpha_2} (E_{ij})^{\alpha_3} (EX_j)^{\alpha_4} (EX_j)^{\alpha_5} (N_i)^{\alpha_6} (N_j)^{\alpha_7} (D_{ij})^{\alpha_8} (R_{ij})^{\alpha_9} u_{ij} \quad (1)$$

Where, X_{ij} is the export value from country ii to the country jj, Y_i (Y_j) is the value of GDP in the country i (j), E_{ij} represents the similarity of economic size, measured by an absolute differences of trading partner's GDP. EX_i (EX_j) and N_i (N_j) are the exchange rate for the country i (j) and the population in country i (j), respectively. D_{ij} is the distance between country i and country j;measured in kilometres, R_{ij} indicates dummy variable which restricts (or foster) the trade between country i and country j. u_{ij} is a random effect term. Linearising (1) gives the empirical version of the model which can be written as follows:

$$\text{Ln } X_{ij} = a_0 + \alpha_1 \text{ Ln } Y_i + \alpha_2 \text{ Ln } Y_j + \alpha_3 \text{ Ln } E_{ij} + \alpha_4 \text{ Ln } EX_i + \alpha_5 \text{ Ln } EX_j + \alpha_6 \text{ Ln } N_i + \alpha_7 \text{ Ln } N_j + \alpha_8 \text{ Ln } D_{ij} + \alpha_9 \text{Border}_{ij} + \text{Ln } u_{ij} \quad (2)$$

In this specification, an adjacency dummy variable R_{ij} is included. Border takes the value of unity when the country i has a geographical border with the country j and zero otherwise. Each of the exogenous variables in equation 2 has a predictable effect on the trade follows between trading partners. It is expected that the income variables have positive effect on the trade flows (Oguledo and Macphee, 1994; Karemera et al., 1999). In the view of demand side of the economy, an increase in income will result in a rise in import while, on the supply side, the raise in income may lead to the greater domestic production available for export. Therefore, positive signs are expected for both α_1 and α_2. Additionally, it seems that the more similar the countries in terms of economic wealth, the larger are the volume of this bilateral trade. Thus, the value of α_3 is expected to be negative.

Currency depreciation (increase in exchange rate) of a country is expected to increase the amount of its export as export would be cheaper. Besides this, the currency appreciation of a trading partner may result in a contraction of exporter's country as the import for the trading partner would be more expensive. In view of this argument, it is expected that α_4 and α_5 may take positive and negative values respectively. With regard to the size of the domestic market (population), higher population is expected to enhance the domestic demand, while inhibiting the export. According to this argument, α_6 and α_7 are expected to be positive and negative, respectively.

Transport cost between countries is proxied by the distance between any given pair of countries. Therefore, distance between a pair of countries naturally determines the volume of trade between two countries; larger transportation cost is expected to have a negative impact on trade flows. Thus, α_8 is expected to be negative The distances are not only a proxy for transport cost but the larger distances might indicate the larger psychological distances (Papazoglou et al., 2006). The common border means lower cost and easier market access and thereby, α_8 is expected to have positive signs.

4 Methodology and Data

This paper attempts to analyse the determinants of bilateral trade flows among the D8 community based on gravity model and a panel of data

for years 1990 to 2007. As time series data and cross section analysis do not control for individual heterogeneity and might give a bias estimation, a panel framework is designed to cover trade variations among the D8 members. Panel data offers more variability, more degree of freedom, and reduces the collinearity among the explanatory variables thus improving the efficiency of econometric estimates. Panel analysis also can measure the effects that are not detectable in cross section and time series data (Baltagi, 2005).

Following Papazogulou (2006) and Marques (2008), we utilize the Prais-Winsten regression with Panel Corrected Standard Errors (PCSE) which assumes that the disturbances are heteroskedastic (each country has its own variance) and contemporaneously correlated across countries (each pair of countries has their own covariance). The present study uses the related information on all the D8 members for the period from 1990 to 2007. The trade data, which is in the US dollar (USD) is gathered from the United Nations (UN) Comtrade Database (United Nation, 2010), covering trade flows among the countries. Estimates of the distance between capitals and border sharing are obtained from the John Haveman's website for gravity model (Haveman, 2010). The information on common borders for Malaysia and Indonesia is corrected for the database, and we consider the common border between these two countries. The common land border is in Borneo, between Kalimantan (Indonesia) and Sabah and Sarawak (Malaysia) and there are a significant number of transports crossing between the two countries in Borneo. Data for the remaining variables are collected from the International Financial statistics' database and its browser on CD-ROM (International Monetary Fund, 2008). The exchange rates for the countries are based on their national currency per USD for the average of each period. The endowment variable is calculated based on absolute GDP differences between the trading partners.

The entire variables are entered as natural logarithm, except for the dummy variable. The method has the double advantages of not assuming that data for all pairs of countries bear the same degree of autocorrelation and also of correcting for contemporaneous error correlation across country pairs. Table 5 shows the estimated results[2].

[2] The export equation is estimated using the statistic package, STATA Version 11

Table 5: Gravity Model Results

$Ln\ X_{ij}$	Coefficient	Het-corrected Std .Err
$Ln\ Y_i$	1.299*	0.128
$Ln\ Y_j$	0.408*	0.093
$Ln\ E_{ij}$	0.1102	0.077
$Ln\ D_{ij}$	-0.530*	0.136
$Border_{\ ij}$	1.301*	0.242
$Ln\ EX_i$	0.127*	0.230
$Ln\ EX_j$	-0.054**	0.027
$Ln\ N_i$	-0.927*	0.114
$Ln\ N_j$	0.163*	0.139
Constant	16.47*	1.47
Number of observation.	733	
Number of Country Pairs	56	
R-Squared	0.373	
F	512	

Notes:
Dependent variable: Exports in logarithm term $Ln\ X_{ij}$.
Regression model: Paris Wintsen with panel Corrected Standard errors.
Significance levels:*Significant at 1 percent; **significant at 5 percent.

The coefficient of GDP for the exporter countries takes the value of higher than 1 and it is about 1.3; suggesting that if the GDP goes up by 1 percent, the amount of exports will go up by 1.3 percent. The GDP for importer country takes the significant positive elasticity value about 0.41, indicating that export will increase by 0.41 percent when the partners' country‘s economic size increase by 1 percent. Nonetheless, the D8 exports could rise significantly if the trading partners maintain strong economic growth. The export elasticity of own GDP is higher than the export elasticity of partner GDP. This indicates the existences of stronger home market effects. The estimated coefficient of the log of absolute differences of two countries GDP is not significant. This indicates that similar economic wealth does not guarantee the export to increase”, perhaps this is due to high variability in GDP among D8 members. The result confirmed that the distance effects are still not died out to influence the trade relations. The variable has taken a significant negative value of -0.53, indicating that when the distance between two countries increases by 1 percent, the exports flow between them decrease by -3.91 percent. The coefficient value of a common border

dummy variable is strongly significant. The value of this coefficient is 1.3, *ceteris paribus*, meaning that two countries sharing a common border trade 1.3 percent more than two otherwise similar countries.

The exchange rate coefficients capture the influence of currency appreciation and depreciation in a country. The value of their coefficients is in line with theory where the effect of changes in exporter's exchange rate is higher than the similar effect on the importer's exchange rate, *ceteris paribus*. The higher effect of exporter's exchange rate confirms the stronger effect of home currency appreciation or devaluation. Population coefficients for the exporter's country have the expected sign values. However, the importer's population does not have a statistically significant value.

5 Conclusion and Policy Remarks

The objective of this study is to estimate the effects of factors influencing the export flows among the D8 members. In order to meet this objective, the gravity model was applied, and consequently the model coefficients were estimated based on the panel data analysis for the period from 1990 to 2007. The results show that the export flows among the D8 members are positively determined by the trading partners' GDP, exporter population and its currency depreciation, and the common border effect. However, the export flows among the D8 members are negatively determined by transportation costs and importers currency appreciation. Moreover, the difference in the countries' economic size which is measured by absolute differences in GDP was found to be insignificant. This shows that similar economic wealth does not warrant an increase in the export , perhaps this is due to high variability in GDP among the D8 members.

Since there is a strong effect of economic growth on the exports in the D8 region, the policies which promote the economic growth in the region should be undertaken. Additionally, the stronger effect of exporter compared to importer currency depreciation on export in the region somewhat suggests that the devaluation of the currency would promote the trade flows in the D8 group. Nevertheless, other adverse effects, such as domestic inflation brought about by devaluation would be taken into account.

As the transportation cost was found to be an important factor affecting the trade relations in the region, policy measures need to be undertaken to ensure low transportation costs, thereby further promoting trade in the region. The policy measures might include improving both the physical infrastructure and the efficiency of transportation systems, and ensuring the low level fuel prices which significantly reduce trade costs and enhance trade flows. In addition, the export flows of the countries were found to be influenced to a great extent by the border variable, indicating that these countries would increase their trade flows if they trade with their neighbour countries within the group.

It is worthwhile to mention that since the export flows are not independent of country specific effects, all the partner countries' propensities to export must be taken into account sufficiently and adequately before trade policy comes into the practice. Apart from this, there are trade-offs when the alternative policy recommendations are directed at the system's endogenous variables such as real exchange rates, domestic and foreign real income. For example, a policy measure to increase trade flows in the region may adversely affects the economic growth of trading partners. The avenue for future research may include consideration of such trade-offs.

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