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Does the Gravity Model Explain Bangladesh's Direction of Trade? A Panel Data Approach

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Abstract: *The goal of this article is to investigate the determinants of bilateral trade flows of Bangladesh with her fifty two major trading partners with the use of trade gravity model approach. The gravity model has been estimated using pooled OLS, fixed effects, random effects estimation technique with the help of panel data for the period 1975-2005. Our estimation results show that trade volume of Bangladesh responds more than proportionally to per capita GDP and distance for OECD and NON –OECD trading partner countries separately. Bangladesh's direction of trade pattern is also strongly governed by geographical characteristics, such as Area implying Bangladesh has a tendency to trade with larger countries. Membership in OECD and GSP dummy has significant impact on trade. The results of gravity models have also been applied to calculate the trade potentials indicating that Bangladesh has unexploited trade potentials with countries like UK, Singapore, Netherlands, Germany, UAE, Canada, India, China, Italy, Australia, Germany, Switzerland & Pakistan. We have found that the actual trade is converging towards equilibrium level of trade using average speed of convergence measure. Therefore, identifying & utilizing unexploited trade potentials among some of Bangladesh's trading partners should stimulate growth to alleviate unemployment & poverty.*

Keywords: *Gravity Model, Panel data, Fixed effects Model, Bangladesh's trade*

I. Introduction

The possible set of factors affecting a country's direction of trade (DOT) can be quite large, incorporating many aspects of its existence. Some of the important economic factors are comparative advantage relative to the other countries, economies of scale, the aggregate income of home country as well as partner residents, government policies especially related to trade & exchange rate , membership to currency unions and / or customs unions & finally, participation in bilateral, regional & multilateral agreements.

The theory of gravity which is a very successful empirical economic theory borrowed from the Newtonian law of gravity, states that trade flows between two countries increases with the product of their gross domestic products (GDP) & decreases with the distances between them. In the literature there have been several attempts to derive this relationship between trade, GDPs & distance from theoretical considerations. It has been shown that the positive relationship with the GDPs & the negative relationship with distance can be established from a variety of assumptions regarding the structure of production & preferences. Using the model as a benchmark implicitly implies that it accounts for some of the more important natural reasons for trade. Additional factors come in to explain what remains unexplained after these natural factors have taken their course.

Another important contribution of the gravity model is the importance that it assigns to distance. From neo classical models of international trade from Smith to Heckscher-Ohlin & their extensions, transport costs were substantial & their could be no doubt that these costs played a role in determining the flow of commodities between countries. Thus the issue of distance as a determinant of trade flows is still an open issue & the gravity model is perhaps the only model that addresses the issue explicitly.

In this paper we have tried to evaluate the influence of the three variables suggested by the gravity theory in determining Bangladesh's DOT. We also attempt some simple extensions of the 'core' gravity model by adding dummies & additional variables for size in the basic structure.

II. Review of The Literature

Alam, Uddin & Taufique (2009) used panel estimation technique to study import inflows of Bangladesh covering annual data & eight major trading partners from 1985 to 2003 & found that the population (market size) of Bangladesh has significant impacts on imports. This paper also found that partner countries' GDP has significant positive impacts & partner countries' population has mixed impact on imports of Bangladesh. The geographical distance of Bangladesh with her partner countries has significant negative impacts on its import.

Rahman (2004) applied a generalized gravity model to analyze Bangladesh's trade flow with her trading partners using the panel data estimation techniques. The study estimated the gravity model of trade (sum

of imports & exports). The results showed that Bangladesh's trade is positively determined by the size (GNP) of the economies, per capita GNP differential & openness of the trade partners.

Batra (2004) estimated the trade potential for India using the gravity model approach. This study has used an augmented gravity model to first analyze bilateral trade flows between India & all her trading partners (one hundred & forty six countries). The gravity model has been estimated using the ordinary least squares (OLS) estimation technique covering cross section data for the year 2000. The estimation results showed that the gravity equation fits the data well, explaining about 70% of the variation in bilateral trade across the sample of countries. It delivers precise & plausible measurement of income & distance elasticities & estimates for other geographical, cultural & historical characteristics.

Blomquist (2004) applies gravity model to explain the trade flow of Singapore and as usual with gravity model,a very high degree of explanation is achieved especially for the GDP and distance variable.

Anaman & Al-Kharusa (2003) on the other hand show that in a gravity model framework, the determinant of Brunei's trade with EU is mainly from the population of Brunei & EU countries.

Filippini (2003) used the gravity equation model to analyze trade flows between East Asian industrialization countries including China & some developed countries some EU countries, & Japan from 1970 to 2000.In this paper the signs of the GDP's are positive, showing that wealthier countries trade more. For the population variables, they obtain a negative coefficient for the developing ones. Bilateral trade flows are negatively correlated with the geographical distance. The analysis of the manufacturing exports from the developing industrialized countries to developed industrializing ones shows developing countries GDP is positively correlated with the flows of exports. But Developed countries GDP is not statistically significant. The population of the newly industrialized countries shows a negative coefficient.The population of the developed country is positively correlated with the flow of exports and is statistically significant. The coefficients of the geographical distance are negative.

Jordan & Eita (2007) analyzed the determinants of exports of wood & articles of wood using a gravity model approach for South Africa from 1997 to 2004 including sixty eight main trading partners. They found that an increase in the importer's GDP causes an increase in the exports of South Africa's wood products. The coefficient of South Africa's GDP has a negative & significant sign, & this is not consistent with the theory. South African population has a significant and positive coefficient on the exports of wood products.The importer's population has a negative & statistically significant effect on the exports of wood products. Distance has a negative & insignificant effect on wood products. The results are supported by the theory, also comparable to the estimates by Sapir (1981).

Coe & Hoffmaister (1999) estimated a gravity model to address the question of whether Africa's bilateral trade with industrial countries is 'unusual' compared to other developing country regions. They used data on bilateral trade between eighty four developing countries & twenty two industrial countries over the full 1970-95 period. The estimated coefficients on the economic mass variable (Y_iY_j) are positive, indicating that holding other things constant, trade tends to increase roughly proportionally with GDP in developing countries, the coefficient on the product of per capita GDPs' (Y_iY_j/P_iP_j) has positive sign & statistically (proxy for stage of development / economic growth) significant. The estimated coefficient on distance is negative. Finally, it was concluded that Africa's relatively low level of bilateral trade with industrial countries is mainly due to the relatively small size of the average African economy & the relatively low rates of economic growth since 1970.

Longo & Sekkat (2001) estimated the intra African trade using a gravity model taking forty one African countries into consideration, over the period 1980-97. They found that the size (GNP) of a country's economy is an important determinant of bilateral trade. The coefficients for per capita income show that the propensity to export to other African countries declines as incomes rise, which reflects the fact that richer African countries specialize in goods for which there is scarce demand by their neighbors. Distance has the expected negative impact on intra-African trade.

Martinez & Lehmann (2003) applied gravity model to annual bilateral exports between twenty countries: Mercosur and Chile & the fifteen current members of the EU, from 1988 to 1996. It should be noted that Argentina, Brazil, Paraguay & Uruguay signed the Mercosur agreement in 1991 & it went into effect in 1995 becoming a customs union. They found that exporter & importer income, have a positive influence on bilateral trade flows. Exporter population has a large & negative effect in exports showing a positive absorption effect, whereas importer population has a large & positive effect on exports, indicating that bigger countries import more than smaller countries. Bergstrand (1985) estimated the generalized gravity equation for fifteen OECD countries' trade flows for 1965, 1966, 1975, 1976. GDP variable has significant, positive effect on trade flows. Distance & contiguous area have significant negative effect on trade flows.

Egger (2002) used the gravity model to analyze the exports flows of OECD countries to other OECD members & the ten central & Eastern European countries over the period 1986-1997. He found that bilateral sum of GDP, country size, difference in relative factor endowments have significant effect on trade. He also found that distance had significant negative effect on trade.

Caetano & Galego (2006) estimated a gravity model for the period 1993-2001, considering data on EU & CEEC countries to analyze total bilateral exports (central & East European countries). The estimates support the idea that the size of the economy has a statistically positive influence on bilateral trade relations. On the other hand, countries' economic distance seems to have a negative impact on bilateral trade flows.

There is a huge number of empirical applications in the literature of international trade, which have contributed to the improvement of performance of the gravity equation. First in recent papers, Mátyás (1997), Cheng & Wall (1999) & Breuss & Egger (1999) & Egger (2000) improved the econometric specification of the gravity equation. Second, Bergstrand (1985), Helpman (1987), Wei (1996), Soloaga & addition of new variables. Winters (1999), Limao & Venables (1999) & Bougheas et al (1999) among others contributed to the refinement of the explanatory variables considered in the analysis & to the addition of new variables.

III. Sample Size and Data Issues

Our study covers a total of fifty two trading partners of Bangladesh. The countries are chosen on the basis of importance of trading partnership with Bangladesh & availability of required data. The list of the countries included in the sample is given in Table 6.1.The annual data for all variables have been collected for the period from 1975 to 2005 (31 years). The trade flow data has been collected from the "Direction of Trade" (DOT) CD-ROM data set developed by the IMF. Bilateral trade flow data on FOB exports & CIF imports in nominal American dollars are used. We have deflated trade by the American CPI data for all urban consumers (2000=100) taken from WDI CD-ROM 2007, Published by the World Bank. Since our focus is on total trade rather than exports or imports, we measure bilateral trade between a pair of countries by averaging all of the (four possible) measures potentially available (exports from i to j, imports into j from i, exports from j to i, imports into i from j). Since the four possible measures finally reduces to two measures, we estimate the volume of trade by adding exports from i to j to imports into j from i and divide it by 2.Real GDP PPP (constant 2000 international $) data & Population data have been obtained from world development indicators CD-ROM 2007 & Penn World Table (PWT) 6.3 respectively. Data on Landlocked countries, Islands, Area, distance have been collected from google earth website. Here distance is measured between the capitals of country i & country j in miles. In our data, we have land border/Contiguous area only with India, number of Landlocked countries are Austria, Hungary, Swaziland, Switzerland respectively & number of Islands are UK, SriLanka, Singapore, Philippines, Papua New Guinea, New Zealand, Japan, Ireland, Indonesia & Australia. All countries included in the sample are members of WTO except four countries (Algeria, Iran, Sudan & Syria). Bangladesh gets GSP facilities from Australia, Canada, EU, Japan, New Zealand & Switzerland.Real GDP PPP, population, exports & imports data of Bangladesh all are in millions & area is in square miles.

IV. Methodology

Recognizing the nature of trading flows between countries as relationships that develop & change over time, there is an increasing use of panel (longitudinal) data approaches to the estimation of gravity models & this method is chosen in this paper. The use of different panel data methods, such as random or fixed (within) effects estimators, allows for various assumptions regarding trade flows to be analyzed & tested.

We will control for cultural, historical & political factors using a fixed effects model that assumes that there are fixed pair-specific factors that may be correlated with levels of bilateral trade & with the right hand side variables. We assume that the gravity equation for a country pair may have a unique intercept & that it may be different for each direction of trade. However, we retain the assumption of the pooled cross section model that the slope coefficients are constant over time & across trading pairs. The country pair intercepts include the effects of all omitted variables that are cross-sectionally specific but remain constant over time, such as distance, contiguity, language, culture etc. The time dummies are included to capture the effects of any variable affecting bilateral trade that vary over time & that are constant across country pairs & have not been included in the list of explanatory variables.

The most common method for measuring distance is to simply measure it between the capital cities of the two countries to capture transportation & information costs (Head & Mayer 2001), There are problems with this, such as the implicit assumptions that overland transport costs are the same as those over sea, & that all overland/oversea distances are equally costly. Our fixed-effects approach eliminates the need to include a distance variable, as it control for all variables that do not change over time.

Another difficulty with standard measures of economic distance is the common assumption that the capital city is a useful proxy for economic center. While this may be useful for small countries with one major city, it is wide of the mark for countries like Canada & the U.S., which have major cities thousands of miles apart on different oceans, & which serve as centers for trade with completely different countries. As the U.S. has the highest GDP & the highest volume of trade, the wrong measure of economic distance can bias the estimation of the coefficients on the other variables in the gravity model. Another advantage of our approach is that it removes the problem of controlling for contiguity. Although it is potentially important, as a great deal of the

trade can occur from people crossing the border to make everyday purchases, it is accounted for only sometimes. Even when it is accounted for with a dummy variable as we have done, it still assumes that all contiguity is equivalent (does not matter so much for our sample as Bangladesh has contiguous area only with India) & time-invariant in terms of its effect on trade.

When unobservable country pair effects & unobservable time effects are assumed to be fixed parameters to be estimated & the explanatory variables are considered to be independent of error term, then we have fixed effects error component model. When the unobservable country pair effects & the unobservable time effects are treated as random variables, we have random effects model. In the random effects model, the explanatory variables are assumed to be independent of errors, unobservable country-pair effects & unobservable time effects. Here unobservable country-pair effects & errors are assumed to follow a common distribution with zero mean & constant variance & unobservable country-pair effects are assumed to be independent of errors. As the cross-section effects follow a common distribution with zero mean & constant variance, individual effects/ cross-section effects are not estimated separately. This prevents the loss of degrees of freedom which happens with the fixed effects estimation.

The inclusion of country pair fixed effects doesn't allow the estimation of the coefficients of the variables which are time-invariant like geographic distance, the existence of frontier, number of Islands, number of Landlocked countries, Area & so on. Therefore we use a two step procedure proposed by Arellano & Bover (1990) in order to obtain these coefficients. This procedure consists on a regression of the country-pair effects obtained in the within estimation on the time invariant explanatory variables.

4.1 Model Specification

In order to study the bilateral trade relations between Bangladesh & her fifty two trading partners, we have estimated a gravity model for the period 1975-2005. In this paper, following previous studies (Rose 2003) bilateral trade flows are modeled as a function of distance between i (Bangladesh) & j (trading partners), log of GDP of country i & j, log of per capita GDP of country i & j, log of area of country i & j. We have also included the existence of a common border, number of Landlocked countries, number of Islands, GSP facilities, civil liberty & membership in WTO & OECD.

Therefore, the exact specification of the gravity model used in the paper is as follows:

$$\ln (X_{ijt})=\beta_0+\beta_1 \ln D_{ij}+ \beta_2 \ln (Y_iY_j)_t + \beta_3 \ln (Y_iY_j/Pop_iPop_j)_t + \beta_4 Cont_{ij}+ \beta_5 Landl_{ij}+ \beta_6 IsLand_{ij} + \beta_7 \ln (Area_iArea_j)+ \beta_8 GSP_{ijt} +\Sigma_t\delta_tT_t+\varphi_1 WTO2_{ijt}+ \phi_2 OECD1_{ijt}+ \beta_9 \ln(cl_i+cl_j)_t+\xi_{ijt} \ldots\ldots(1)$$

Where i & j denote trading partners, t denotes time, β and δ are vectors of coefficients, X_{ijt} denotes the average value of real bilateral trade between countries i & j at time t, Y is real GDP PPP (constant 2000 international $), Pop is population, D is the distance between i & j, Cont is a binary variable which is unity if i & j share a land border, Landl is the number of Landlocked countries in the country pair (0, 1 or 2),Island is the number of Island nations in the pair (0, 1 or 2),Area is the Area of the country, GSP is a binary variable which is unity if j extended a GSP concession to i at t, $WTO2_{ijt}$ is a binary variable which is unity if both i & j are GATT/WTO members at t, $OECD1_{ijt}$ is a binary variable which is unity if either i or j is an OECD member at t.Here cl_i and cl_j are civil liberty of i and civil liberty of j respectively. Civil liberties are measured on a one to seven scale, freedom index scores are categorized as follows, Free-countries with a score of 1& 2;Partly Free-countries with a score of 3 & 4; Not free-countries with a score of 5,6 &7 and ξ_{ijt} represents the omitted other influences on bilateral trade, assumed to be well behaved.

The above mentioned model is estimated taking fifty two main trading partners of Bangladesh into consideration, from 1975 to 2005. This model is estimated again taking only OECD trading partners of Bangladesh (twenty four countries) into account. The model is as follows:

$$\ln(X_{ijt})=\beta_0+\beta_1 \ln D_{ij}+ \beta_2 \ln(Y_iY_j)_t + \beta_3 \ln (Y_iY_j/Pop_iPop_j)_t + \beta_4 Landl_{ij}+ \beta_5 IsLand_{ij} + \beta_6 \ln(Area_iArea_j)+ \beta_8 GSP_{ijt} + \beta_9 \ln(cl_i+cl_j)_t \ldots\ldots(3)$$

This model differs from model 1 because, Cont=0, as we have contiguous area only with India within the sample, & WTO2 = intercept, OCED1 = intercept.That is both WTO2 & OCED1 are multicollinear with the intercept, therefore have been dropped from this model as all OECD trading partner countries are members of WTO & OECD.

We have estimated model 1 again taking only Developing countries (twenty eight countries) into consideration. This model is as follows:

$$\ln(X_{ijt})=\beta_0+\beta_1 \ln D_{ij}+\beta_2 \ln(Y_iY_j)_t + \beta_3 \ln (Y_iY_j/Pop_iPop_j)_t + \beta_4 Cont_{ij}+ \beta_5 Landl_{ij}+ \beta_6 IsLand_{ij} + \beta_7 \ln(Area_iArea_j)+ \varphi_1 WTO2+ \beta_9 \ln(cl_i+cl_j)_t \ldots\ldots(5)$$

For this model, GSP & OECD1 dummies are zero because trading partners are only developing countries, most of the countries take GSP (general system of preferences) facilities from developed/OECD countries & are not members of OECD.

These three models 1, 3 & 5 have been estimated excluding the time-invariant variables, separately. That is model 1 is estimated again as the following model:

$$\ln(X_{ijt})=\beta_0 + \beta_1 \ln(Y_iY_j)_t + \beta_2 \ln (Y_iY_j/Pop_iPop_j)_t + \beta_3 \ln(cl_i+cl_j)_t \quad \ldots\ldots(2)$$

Similarly, model 3 is estimated again excluding the time invariant variables, which is the following model:

$$\ln(X_{ijt})=\beta_0 + \beta_1 \ln(Y_iY_j)_t + \beta_2 \ln (Y_iY_j/Pop_iPop_j)_t + \beta_3 \ln(cl_i+cl_j)_t \quad \ldots\ldots(4)$$

here, WTO2 & OECD1 are multicollinear with the intercept as trading partners are OECD countries.And model 5 is estimated similarly (dropping the time in-variant variables) & we get model (6), which is as follows:

$$\ln(X_{ijt})=\beta_0 + \beta_1 \ln(Y_iY_j)_t + \beta_2 \ln (Y_iY_j/Pop_iPop_j)_t + \beta_3 \ln(cl_i+cl_j)t \quad \ldots\ldots(6)$$

Distance, contiguous area, Landlocked countries, Islands, Area all are time-invariant variables undoubtedly.

For our data set, GSP is also a time invariant variable because Bangladesh receives GSP facilities from Australia, Canada, EU, Japan, New Zealand & Switzerland & UK in different time. Bangladesh receives GSP facilities from Australia since 1995, from Canada since 1995, from EU since 1990's, from Japan since 1972, from New Zealand since 2000, from UK since 1973. We have assumed that Bangladesh receives GSP facilities from these countries since 1975 & continues up to 2005. Therefore it has become time-invariant variable. Similarly, All trading partners except, Sudan, Syria, Algeria & Iran are members of WTO & all member countries in our sample have become member of GATT/WTO before 1975. So, WTO2 dummy is also time invariant. Similar argument applies to OECD1 dummy variable. Almost all OECD members have become members of this organization before 1975, therefore, OECD1 dummy is time invariant variable.

V. Results & Interpretation

5.1. Regression Results for all Countries

We see that the coefficients of distance variable are economically & statistically significant at 1% level with negative (expected) sign & greater than 1 for pooled OLS & random effects estimation in Table 5.1.1 which shows results of pooled OLS estimation, fixed effects estimation & random effects estimation for model 1. Trade distance elasticity is -1.88%, implying if the distance between Bangladesh & her trading partner increases by 1%, trade volume declines by 1.88%, ceteris paribus on an average index (more than proportionally) for pooled OLS estimation. However, the estimated coefficients become bigger in random effects estimation. Trade distance elasticities are -2.19% & -2.18% for one way random effects estimation & two way random effects estimation respectively. So, coefficient of distance increases in absolute term from -1.88% to -2.19% & -2.18%. It can be said that, when country specific heterogeneity is considered this trade distance elasticity will become larger compared to the pooled OLS estimate .

The product of country i & j gross domestic product in time t is used as a direct measure of the economic mass & since trade is an interacting process, the product is meant to present the economic mass in an "interactive way". This variable is expected to be positively & significantly related to trade. It embodies factors that effect potential supply of exporting countries & potential demand of importing countries, as both are positive functions of national income (GDP). The pooled OLS estimate of GDP variable is significant at 1% level & two way fixed effects estimate of GDP variable is significant at 10% with unexpected (negative) sign. The one way fixed effects estimate & random effects estimates of GDP variable aren't significant.

The coefficients of per capita GDP variable (PCGDP is the proxy for level/stage of development) are significant at 1% level with positive sign for all estimation methods. The trade PCGDP elasticities are 1.40%, 1.55%, 1.12% & 1.11% for fixed effects & random effects estimations, implying as the product of PCGDP of the two countries increases by 1%, trade increases by 1.40%, 1.55%, 1.12% & 1.11% respectively. As the coefficient of PCGDP variable is always greater than 1, trade volume increases more than proportionally with an increase in the economic development of the combined entity defined by the two countries. The pooled OLS estimate (0.70) of PCGDP variable is also significant at 1% level which is lower than fixed effects & random effects estimates of PCGDP.

Table 5.1.1: Gravity Model Estimates: Dependent Variable: log (trade between country pairs)

Independent variables	POLS	FEM (one way)	FEM (two way)	REM (one way)	REM (two way)
Constant	-38.67(-17.27)	-32.96 (-13.75)	-18.49 (-1.69)	-24.07 (-7.04)	-24.65 (-6.62)
Distance	-1.88 (- 26.25)*			-2.19 (-6.96)*	-2.18 (-6.96)*
GDP	0.44 (13.56)*	-0.12 (-1.44)	-0.40(-1.85)***	0.03 (0.46)	0.04 (0.58)
PCGDP	0.70 (13.91)*	1.40 (8.76)*	1.55 (7.91)*	1.12 (8.56)*	1.11 (8.43)*
Cont	-0.50(1.83)***			0.05 (0.05)	0.05 (0.04)
Landl	-0.19 (-1.40)			-0.33 (-0.50)	-0.32 (-0.50)
Island	-0.08 (-0.89)			-0.25 (-0.62)	-0.24 (-0.60)

Area	0.26 (8.40)*			0.52 (4.14)*	0.51 (4.07)*
GSP	0.05 (0.38)			-0.01 (-0.02)	-0.01 (-0.02)
WTO2	-0.10 (-0.76)			0.05 (0.08)	0.05 (0.08)
OECD1	0.26 (1.75)			0.45 (0.73)	0.45 (0.73)
Cl	-0.09 (-0.48)	-0.20 (-1.19)	-0.09 (-0.41)	-0.21 (-1.26)	-0.19 (-1.05)
R^2	0.63	0.84	0.84	0.26	0.21
F test	249.04*	78.39*	50.53*		
SSR	2747.05	1162.48	1126.85	1201.49	1188.04
Hausman test				13.48*	9.88**
LM test		11529.89*			

All variables are expressed in natural logarithms. t statistics are in parentheses. *, **, *** denote significance at 1%, 5% & 10% level respectively

Table 5.1.2 : Gravity Model Estimates: Dependent Variable: log (trade between country pairs)

Independent Variables	**POLS**	**FEM (one way)**	**FEM (two way)**	**REM (one way)**	**REM (two way)**
constant	-66.38(-30.87)	-32.96(-13.75)	-18.49(-1.69)	-39.13(-17.73)	-40.45(-15.24)
GDP	0.75(27.34)*	-0.12(-1.44)	-0.40(-1.85)	0.17(2.49)***	0.20(2.74)***
PCGDP	0.43(8.53)*	1.40(8.76)*	1.55(7.91)*	0.87(6.99)*	0.85(6.80)*
Cl	1.00(5.25)**	-0.20(-1.19)	-0.09(-0.41)	-0.16(-1.00)	-0.13(-0.74)
R^2	0.44	0.84	0.84	0.22	0.17
F test	426.91*	78.39*	50.53*		
SSR	4147.22	1162.48	1126.85	1223.32	1210.63
Hausman test					25.45*
LM test				11529.89*	

All variables are expressed in natural logarithms. t statistics are in parentheses.*** denote significance at 1%, 5% & 10% level respectively.

The pooled OLS estimate of Cont variable is -0.50 (with negative sign), significant at 10%, whereas, the variable isn't significant in random effects estimation. The Landl & Island variables are not significant but the estimated coefficients of these variables give correct (negative) sign. Another variable representing geographical characteristics, Area is always significant at 1% level with positive sign. The pooled OLS, one way & two way random effects estimates of Area are 0.26, 0.52 & 0.51. Therefore, as the Area between two trading partners increases by 1%, trade increases by 0.26%, 0.52% & 0.5% on an average index. The pooled OLS estimate of Area is smaller than random effects estimates of Area. The GSP variable is not significant but gives correct sign in pooled OLS estimation & unexpected sign in random effects estimation due to collinearity (0.64) between PCGDP & GSP variable. WTO2 variable is not significant, but gives correct sign in random effects estimation & unexpected sign in pooled OLS estimation. Pooled OLS & random effects estimates of OECD1 variable are not significant but do give correct sign. Cl variable is not significant but gives correct sign for pooled OLS, fixed effects & random effects estimation.

The R^2 of both one way & two way fixed effects estimation is 0.84, implying 84% of the variation in the dependent variable is explained by the independent variable. This R^2 is greater than the R^2 from pooled OLS & random effects estimation, which are 0.63, 0.26 & 0.21 respectively. We check the poolability of this model by F test which is significant at 1% level & rejects the hypothesis that the country specific effects are jointly zero. The F tests for both one way fixed effects & two way fixed effects are significant at 1% level implying that there exist country specific fixed effects. The Hausman test statistic for both one way & two way random effects are significant at 1% & 5% level respectively, implying fixed effects estimation is preferred to random effects estimation, rejecting the null hypothesis of no correlation between the country specific effects & time specific effects & regressors. Therefore, fixed effects model is a better choice than random effects model as we are interested in estimating typical trade flows between an ex ante predetermined selection of nations (Egger, 2000). The Breuch Pagan lagrangian multiplier test statistic (LM test) is significant at 1% level rejecting the null hypothesis of zero error variance. This test confirms the fact that, random effects estimation is a better choice compared to pooled OLS estimation.

If we consider model 2, we see pooled OLS estimate of GDP variable is significant at 1% level. Both one way & two way random effects estimates of GDP variable are significant at 10% level. But fixed effects estimates (both one way & two way) of GDP variable are neither significant nor give expected sign, almost similar to the findings of model 1's GDP variable. The pooled OLS , fixed effects & random effects estimates of PCGDP variable are significant at 1% with positive (correct) sign. The trade PCGDP elasticities are 1.40% & 1.55% for one way & two way fixed effects estimations implying trade increases more than proportionally with an increase in the economic development of the combined entity defined by the two countries. The coefficients of PCGDP variable of fixed effects estimation are similar to model 1 given in Table 5.1.1. But the coefficients

of PCGDP variable of pooled OLS & random effects estimations of model 2 are smaller than model 1's pooled OLS & random effects estimates of PCGDP variable. Fixed effects & random effects estimates of civil liberty variable are not significant (Cl) but do give correct sign (negative). The coefficients of one way & two way fixed effects estimations of GDP variable are negative for both model 1 & 2, because there is moderate collinearity (0.48) between GDP & PCGDP variable. R^2 of both one way & two way fixed effects estimations is 0.84. For model 2, all F tests are significant at 1%. Poolability of model 2 is rejected at 1% level. Both one way & two way country specific fixed effects exist (F tests are significant at 1% level). Both Hausman test statistic & LM test statistics are significant at 1%, confirming the fact that fixed effects estimation is preferred to random effects estimation & random effects estimation is preferred to pooled OLS estimation.

5.2. Regression Results for OECD countries:

If we consider model 3, we see that trade distance elasticity is significant at 1% with correct (negative) sign for all estimation methods. Pooled OLS estimate of GDP variable is significant at 1% & two way random effects estimate of GDP variable is significant at 10%. Two way fixed effects estimate & one way random effects estimate of GDP variable are not significant, but do give correct sign. But one way fixed effects estimate of GDP variable is neither significant nor gives correct sign, due to moderate collinearity between GDP & PCGDP (0.41) and GDP & Area (0.46). Pooled OLS, one way fixed effects & random effects estimates of PCGDP variable are 0.56, 2.02, 1.00 & 0.96, all are significant at 1% level & two way fixed effects estimate of PCGDP variable is 1.85, which is significant at 10% level . Only fixed effects (one way) estimate of trade PCGDP elasticity is greater than 1, implying trade increases more than proportionally with an increase in the economic development of the combined entity defined by the two countries. Estimates of Landl variable do give correct sign (negative) for pooled OLS & random effects estimations. Estimated coefficients of Landl variable do give correct sign (negative) for pooled OLS & random effects estimations but are insignificant.

Random effects estimates of Island variable are neither significant nor give correct sign whereas Pooled OLS estimate of Island variable is significant. Pooled OLS estimate of Area variable is significant at 1% & random effects estimate of Area variable is significant at 10%. GSP variable is not significant & gives unexpected sign for random effects estimation.

Pooled OLS estimate of Cl variable is significant at 1% with correct sign, implying as the Cl between Bangladesh & her trading partner increase by 1% (here, higher value of civil liberty index indicates lower freedom), trade declines by 1.3%, ceteris paribus. Fixed effects estimate & random effects estimates of civil liberty variable are not significant but do give correct sign. R^2 of pooled OLS, fixed effects & random effects model (both one way & two way) are 0.65, 0.88, 0.88, 0.43 & 0.35. All F tests are significant at 1% level, rejecting the poolability of the model & accepting the fact that there exist both one way & two way fixed effects. Hausman test statistic & LM test statistic are significant at 1%, indicating that fixed effects estimation is preferred to random effects estimation & random effects estimation is preferred to pooled OLS estimation.

Table 5.2.3: Gravity Model Estimates: Dependent Variable: log (trade between country pairs)

Independent variables	**POLS**	**FEM (one way)**	**FEM (two way)**	**REM (one way)**	**REM (two way)**
constant	-57.29(-15.66)	-35.75(-7.39)	-82.11(-4.01)	-33.52(-4.18)	-36.21(-4.70)
distance	-1.86(-10.96)*			-2.24(-2.48)**	-2.18(-2.62)*
GDP	0.83(20.46)*	-0.36(-1.50)	0.36(0.73)	0.25(1.60)	0.31(1.99)***
PCGDP	0.56(5.05)*	2.02(4.98)*	1.85(3.33)**	1.00(3.73)*	0.96(3.68)*
Cont					
Landl	-0.17(-1.25)			-0.34(-0.47)	-0.33(-0.49)
Island	0.39(3.66)*			0.32(0.55)	0.33(0.63)
Area	0.17(4.59)*			0.42(2.17)***	0.39(2.20)***
GSP	0. 009(0.08)			-0.09(-0.15)	-0.07(-0.13)
WTO2					
OECD 1					
Cl	-1.30(-4.79)*	- 0.17(-1.02)	0.03(0.12)	-0.23(-1.35)	-0.21(-1.08)
R^2	0.65	0.88	0.88	0.43	0.35
F test	175.14*	78.09*	35.52*		
SSR	892.4	305.17	285.99	318.47	314.50
Hausman				7.91**	21.93*
LM test		4624.70*			

All variables are expressed in natural logarithms. t statistics are in parentheses.*** denote significance at 1%, 5% & 10% level respectively.

Table 5.2.4: Gravity Model Estimates: Dependent Variable: log (trade between country pairs)

Independent variables	POLS	FEM (one way)	FEM (two way)	REM (one way)	REM (two way)
Constant	-73.41(-20.57)	-35.75 (-7.39)	-82.11(-4.01)	-51.40(-16.40)	-53.77 (-15.31)
GDP	0.90(24.88)*	-0.36(-1.50)	0.36(0.73)	0.42(2.98)***	0.46(3.37)**
PCGDP	0.46(3.99)**	2.02(4.98)**	1.85(3.33)**	0.73(3.06)***	0.71(3.02)***
Cl	-1.11(-3.90)**	-0.17(-1.02)	0.03(0.12)	-0.24(-1.40)	-0.22(-1.11)
R^2	0.58	0.88	0.88	0.42	0.34
F test	351.44*	78.09*	35.52*		
SSR	1069.63	305.17	285.99	322.20	317.86
Hausman test				13.18*	25.65*
LM test					4624.70*

All variables are expressed in natural logarithms. t statistics are in parentheses.*** denote significance at 1%, 5% & 10% level respectively.

Analyzing equation 4,we see pooled OLS estimate of GDP variable is significant at 1% level, random effects estimates of GDP variable are significant at 10% & 5% level (both one way & two way). Two way fixed effects estimate of GDP variable isn't significant but gives correct sign. But one way fixed effects estimate of GDP variable is neither significant nor gives correct sign, due to collinearity between GDP & PCGDP (0.41).The pooled OLS, one way fixed effects, two way fixed effects,one way random effects ,two way random effects estimates of PCGDP are (trade PCGDP elasticity) 0.46%,2.02%,1.85%, 0.73% & 0.71% with correct (positive) sign, significant at 5%,5%,5%,10%,10% respectively. Fixed effects estimates of (both one way and two way) PCGDP are greater than 1,whereas pooled OLS and random effects estimates are less than 1. Fixed effect estimates of PCGDP are 2.02% & 1.85%, implying trade increases more than proportionally with an increase in the economic development of the combined entity defined by the two countries. Pooled OLS estimate of civil liberty variable is significant at 5% whereas, other estimates of this variable are not significant.R^2 of pooled OLS, fixed effects & random effects are 0.58, 0.88, 0.88, 0.42 & 0.34. All F tests are significant at 1%, rejecting the poolability of the model & confirms the fact that both country & time specific heterogeneity exist. Hausman test & LM test statistics are significant at 1% & confirms the fact that fixed effects estimation is preferred to random effects estimation & random effects estimation is preferred to pooled OLS estimation.

5.3. Regression Results for NON-OECD Countries:

Table 5.3.5 shows that trade distance elasticities are -2.15%, -2.29% & -2.29% for pooled OLS, one way random effects & two way random effects estimation & significant at 1% level with correct (negative) sign. Trade distance elasticity of pooled OLS implies if the distance between Bangladesh & her trading partner increases by 1%, volume of trade declines by 2.15%, ceteris paribus. Trade distance elasticities of one way & two way random effects imply if the distance between Bangladesh & her trading partner increases by 1%, trade declines by an average index of 2.29% & 2.29% respectively. For this model, trade volume responds more than proportionally to distance (since, the coefficient is greater than 1).

Pooled OLS, fixed effects & random effects estimates of GDP variable are not significant & do give unexpected sign for fixed & random effects estimates due to collinearity between GDP & Area (0.69). Even if we drop Area & estimate model 5 again, pooled OLS estimate of GDP variable is significant with correct sign but fixed effects estimates of GDP variable (both one way & two way) are still insignificant with unexpected sign. The pooled OLS, one way fixed effects & random effects estimates (both one way & two way) of PCGDP variable are significant at 1% & two way fixed effects estimate of PCGDP variable is significant at 5% level with correct sign. For model 5, trade PCGDP elasticities of one way & two way fixed effects estimations are greater than 1, that is trade responds more than proportionally to PCGDP. Here also these fixed effects estimates imply that trade increases more than proportionally with an increase in the economic development of the combined entity defined by the two countries. The pooled OLS & random effects estimates of Cont variable are not significant, but do give negative sign.

The pooled OLS estimate of Cont variable is also negative for model 1. As we are considering model 5, which takes into account developing countries as their trading partners, we would say that trade between Bangladesh & India (India is the only country in our data that shares border with Bangladesh) is not reported, as there is a huge amount of illegal trade across the porous borders. Thus, there is bound to be a lot of reporting biases in the data. This negative sign can thus also be put down to errors in observations. Bangladesh does not have very cordial relations with India.

Table 5.3.5 : Gravity Model Estimates: Dependent Variable: log (trade between country pair)

Independent variables	POLS	FEM (one way)	FEM (two way)	REM (one way)	REM (two way)
constant	-19.10(-6.18)	-30.59(-9.37)	-26.70(-1.30)	-17.44(-4.18)	-17.48(-4.08)
distance	-2.15(-25.81)*			-2.29(-7.65)*	-2.29(-7.58)*
GDP	0.06(1.31)	-0.07(-0.71)	-0.13(-0.29)	-0.003(-0.04)	-0.002(-0.03)
PCGDP	0.77(13.75)*	1.13(5.50)*	1.13(2.91)**	0.97(6.24)*	0.97(6.18)*
Cont	-0.08 (-0.29)			-0.22(-0.20)	-0.22(-0.20)
Landl	0.01(0.04)			0.12(0.10)	0.11(0.10)
Island	-0.63 (-4.82)*			-0.77(-1.48)	-0.77(-1.47)
Area	0.49(9.29)*			0.56(3.42)*	0.55(3.38)*
GSP					
WTO2	0.36(2.65)**			0.21(0.40)	0.21(0.40)
OECD1					
Cl	1.04(3.50)*	-0.09(-0.34)	0.0017(0.00)	-0.06(-0.21)	-0.05(-0.18)
R^2	0.67	0.80	0.80	0.21	0.20
F test	194.87*	69.88*	33.82*		
SSR	2862.47	846.54	812.89	868.76	864.65
Hausman test				4.60	0.50
LM test		6009.36*			

All variables are expressed in natural logarithms. t statistics are in parentheses.*** denote significance at 1%, 5% & 10% level respectively.

Table 5.3.6: Gravity Model Estimates

Independent variables	POLS	FEM (one way)	FEM (two way)	REM (one way)	REM (two way)
Constant	-65.41(-22.01)	-30.59(-9.37)	-26.70(-1.30)	-33.29(-10.35)	-33.75(10.07)
GDP	0.70(18.27)*	-0.07(-0.71)	-0.13(-0.29)	0.12(1.43)	0.14(1.58)
PCGDP	0.37(5.46)**	1.13(5.50)**	1.13(2.91)***	0.77(4.54)**	0.75(4.45)**
Cl	2.93 (8.49)*	-0.09(-0.34)	0.001(0.00)	- 0.02(-0.09)	-0.01(-0.04)
R^2	0.35	0.80	0.8	0.13	0.12
F test	157.65*	69.88*	33.82*		
SSR	2754.85	846.54	812.89	887.03	884.92
Hausman test					4.41
LM test				6009.36*	

All variables are expressed in natural logarithms. t statistics are in parentheses.*** denote significance at 1%, 5% & 10% level respectively.

Thus political factors also have their due share in the sign. Moreover, we have checked the correlation matrix, which shows Cont variable doesn't have any collinearity with other variables worth mentioning. The estimated coefficient of Cont is 0.08 means that, when the dummy is equal to 1, volume of trade decreases, ceteris paribus by 8.3% ($e^{0.08}$-1=0.083). If we consider the random effects estimate of Cont variable, which implies when the dummy is equal to 1, trade volume decreases, ceteris paribus by 24.6% ($e^{0.22}$-1=0.246) as both one way & two way random effects coefficients of Cont dummy is -0.22. Moreover, Cont dummy has no collinearity worth mentioning with any other variables for both models 1 & 5 (two models, which contain Cont variable). Estimates of Landl variable are neither significant nor do give expected sign.

Pooled OLS estimate of Island variable is significant at 1% level with correct (negative) sign & one way & two way random effects estimates of Island variable are not significant with correct (negative) sign.

Pooled OLS & random effects estimates of Area variable are significant at 1% level with correct sign. The estimates are 0.49, 0.56 & 0.55, implying, if the Area between Bangladesh & her trading partner increases by 1%, trade increases by 0.49%, 0.56% & 0.55%. So, there is a tendency for Bangladesh to trade more with larger countries.

Though pooled OLS estimate of WTO2 variable is significant at 5% level, random effects estimates of WTO2 variable are not significant. Fixed effects & random effects estimates of civil liberty variable have correct sign (negative), but insignificant. Though Hausman test is insignificant at 10% level, overall goodness of fit (R^2) is 0.80 for both one way & two way fixed effects models, implying 80% of the variation in the dependent variable is explained by the independent variables. F tests for both one way & two way fixed effects are significant at 1% level suggesting that fixed effects estimation is preferred to random effects estimation. As usual, the LM test is significant at 1% level implying random effects estimation is preferred to pooled OLS estimation.

If we consider model 6, depicted in Table 5.3.6, fixed & random effects estimates of GDP variable aren't significant with wrong sign whereas pooled OLS estimate of GDP variable is significant at 1%. Pooled OLS, random effects & one way fixed effects estimates of PCGDP variable are significant at 5% with correct (positive) sign. And two way fixed effects estimate of PCGDP variable is significant at 10%, with correct

(positive) sign. For model 6, fixed effects estimates (both one way & two way) of PCGDP variable are greater than 1. So, it can be said that trade increases more than proportionally with an increase in the economic development of the combined entity defined by the two countries. R^2 of fixed effects estimation method is 0.80 (for both one way & two way fixed effects). F test for no fixed effects (both one way & two way) are significant at 1% level.F test for the poolability of the model is rejected at 1% level & LM test statistic is significant at 1% level.

Finally it should be noted that distance & common border variables are involved in the analyses as traditional proxies for one of the impeding trade factor that is transportation costs. Converging distance cost to transportation, has been criticized as exclusive since it leaves out other costs caused by distance such as risk of damages or losses of the goods, time-related costs, communication cots, cultural distance etc. Despite there critics, distance variable, as reported by Leamer & Levinsohn's (1994) survey on empirical evidence on international trade, offers one of the most clearest & robust effects on explaining bilateral trade. The estimates show that underlying gravity model works well. Geographic distance reduces trade, while greater economic "mass" (real GDP and / or GDP per capita) expands it. The effects are economically & statistically significant. Overall therefore the gravity model performs well for Bangladesh & both level of development 'proxied' by per capita GDP & distance play important roles in shaping Bangladesh's direction of trade. More specifically, volume of trade responds to distance more than proportionally ($\beta_1 > 1$) . If country specific & time specific heterogeneity both are considered, volume of trade always responds to level of development more than proportionally ($\beta_3 > 1$).

As, $\beta_3 > 1$, positive & significant, indicating Bangladesh trades more with richer countries than with poorer countries (given Bangladesh's per capita GDP). A large per capita GDP promotes division of labor & this means there is economies of scale in production & opportunities as well as desire to trade with greater variety of goods. Bangladesh's direction of trade pattern is also strongly governed by geographical characteristics; such as Area (always significant at 1% level for all models) implying Bangladesh has a tendency to trade with larger countries. Given the strong under valuation of certain countries GDP, it is worthwhile to estimate the model with GDP PPP.

Among the time invariant variables, sign of Cont dummy & its significance has clear interpretation. Area variable is significant at 1% level with positive sign. Landlocked, Island, GSP, WTO2 & OECD1 dummies are dropped in fixed effects estimation, whereas, the procedure of including trading partners in the data tells us to give more attention to the fixed effects estimation. So we run second stage regression, where results (country specific fixed effects) of one way fixed effects estimation are regressed on time-invariant variables. The regression results are reported in Table 5.3.7. The reason for using only the estimations from one way fixed effects method is, all dummies like Cont, Landl, Island, Area are time invariant variables. For our data, GSP, WTO2 & OECD1 dummies, are also time-invariant, as they do not vary over our sample period 1975-2005. They only vary across country pairs.

Table 5.3.7 : Cross-section Regression Results : Individual Effects Regressed Over Distance & Dummies

Independent Variables	FE from model 1 (GDP, PPP constant 2000 International $)
Constant	11.66 (26.35)
Distance	-1.90 (-36.27)*
Cont dummy	-0.49 (-2.34)**
Landl dummy	-0.01 (-0.15)
Island dummy	-0.15 (-2.25)**
Area	0.33 (16.21)*
GSP dummy	0.71 (5.97)*
WTO2 dummy	-0.0004 (-0.00)
OECD1 dummy	-0.31 (-2.68)**
Adjusted R^2	0.53
SSR	1721.2

Note : All variables except dummies are expressed in natural logarithms. t statistics are in parentheses. *,**,*** denote significance at 1%, 5% & 10% level respectively

Coefficient of distance is-1.90, which is significant at 1% level. Cont dummy variable is significant at 5% level with negative sign. Landlocked dummy is insignificant, but shows expected (negative) sign.

Island dummy is significant at 5% level with expected (negative) sign. Area is significant at 1% level with expected (positive) sign. GSP is also significant at 1% level with expected (positive) sign. WTO2 dummy is insignificant with negative sign. OECD1 dummy is significant at 5% level with expected (negative) sign.

VI. Trade potentials

Calculating trade potential is a line of research that has been used intensively with the gravity model where the average speed of convergence is defined as the average growth rate of potential trade divided by average growth rate of actual trade between the years of observations:

$$\frac{\text{Average growth rate of potential trade}}{\text{Average growth rate of actual trade} \times 100\text{-}100} \quad \ldots\ldots\ldots\ldots(7)$$

Accordingly, we posit convergence if growth rate of potential trade is lower than that of actual trade & the computed speed of convergence is negative. We have the divergence in the opposite case. The argument for the prominent efficiency of this method over the point estimated method is that the speed of convergence exploits the dynamic structure of the data during the estimation, which offers more reliable analysis than the analysis of point estimates. The convergence measure is proved to be quite robust with different methodologies such as pooled estimation, fixed effects & random effects in Jakab et al's (2001) paper.

In our paper, the residual of the estimated equation is interpreted as the difference between potential and actual bilateral trade relations which is commonly known as in-sample projection approach (Egger 2002).

In estimating the trade potential between Bangladesh & her major fifty two trading partners, we use residuals obtained from regression of equation 1 with Pooled OLS & estimate the speed of convergence for each country using equation 7. The speed of convergence is calculated as ratio of average growth rate of potential trade & growth rate of actual trade over thirty one years of study. In Table 6.1, we present the average speed of convergence for the fifty two trading partners of Bangladesh.

Bangladesh's trade with her trading partners presents an interesting situation separating trade partners into two groups, the first group characterized by an overtrade situation & the second one reflecting potentials to develop trade. Bangladesh has convergence in trade with thirteen countries & divergence with other thirty nine countries. In other words, Bangladesh has not exploited all the potentials in trading with her trading partners. Trade between Bangladesh & her thirteen trading partners still has large room for growth.

Table 6.1 : Average speed of convergence

Country	With GDP PPP	Country	With GDP PPP
Algeria	0.0122	Malaysia	0.0049
Argentina	0.0066	Mexico	0.011
Australia	-0.0004	Netherlands	-0.0146
Austria	0.011	New Zealand	0.0068
Brazil	0.0062	Nigeria	0.0071
Cameroon	0.0078	Norway	0.0075
Canada	-0.0063	Pakistan	-0.0002
Chile	0.0097	Papua New Guinea	0.0097
China	-0.0056	Peru	0.0104
Cote Divoire	0.0061	Philippines	0.0121
Denmark	0.0012	Portugal	0.0103
Egypt	0.0052	Saudi Arabia	0.0036
Finland	0.012	Singapore	-0.0407
France	-0.0004	Spain	0.0098
Germany	-0.0311	Sri Lanka	0.0086
Ghana	0.0073	Sudan	0.0021
Greece	0.0119	Swaziland	0.0071
Hungary	0.0085	Sweden	0.0047
India	-0.0135	Switzerland	-0.0003
Indonesia	0.0063	Syria	0.0037
Iran	0.0062	Thailand	0.0113
Ireland	0.0096	Tunisia	0.0094
Italy	-0.0006	Turkey	0.0078
Japan	0.2563	UAE	-0.0059
Kenya	0.0009	UK	-0.0719
Korea	0.0011	US	0.0483

Bangladesh has unexploited trade potential for thirteen trading partners of Bangladesh (countries which have negative sign for the convergence measure) & has exploited trade potential for the rest thirty nine countries (countries which have positive sign for the convergence measure). Bangladesh has unexploited trade potential with Australia, Canada, China, France, Germany, India, Italy, Netherlands, Pakistan, Singapore, Switzerland, UAE & UK. The amount of unexploited trade potentials are given in Table 6.2.

Table 6.2

Country	Unexploited trade potentials
Australia	0.0585
Canada	0.6847
China	0.3611
France	0.0559
Germany	1.4428
India	0.5744
Italy	0.08
Netherlands	1.5736
Pakistan	0.03311
Singapore	1.8959
Switzerland	0.0551
UAE	0.743
UK	2.2719

Is actual trade converging toward equilibrium ?

In order to be able to use the estimated level of trade as some kind of equilibrium level, we ascertain that there is a tendency for actual trade to converge toward the estimated levels. For this purpose, we estimate a simple error correction model by regressing the change in actual trade values on the difference between actual & potential data in the previous period.

For convergence to occur, the estimated coefficient should be negative & significant. The estimation results can be found in Table 6.3. The coefficients for the explanatory variable are negative & highly significant. Hence, there is convergence of actual trade toward the estimated level in our sample, which is evident from the following Table.

Table 6.3 :Convergence of actual trade toward potential trade*

Estimation Method	Trade Volume
Pooled	-0.806
OLS	(-22.55)*

The β co-efficient of $TRADE_{ijt} = \alpha+\beta\ (TRADE_{ij,t-1} – POTENTIAL_{ij,t-1}\ )$ regression, t statistics are in parentheses, *,**,*** denote significance at 1%, 5% & 10% level respectively.

VII. Policy implications

The policy implications of the results obtained are that all kinds of trade barriers in countries involved, especially in Bangladesh, must be liberalized to a great extent in order to enhance the Bangladesh's trade. There remains considerable scope, for broad-based trade liberalization measures to spur trade between Bangladesh & developed (industrial) countries, thereby increasing opportunities for technology transfers. Proper quality of the goods & services must be maintained as well as the varieties of goods & services must be increased as the Bangladesh's exports largely depend on foreign demand. The finding of untapped trade potential calls for proactive export promotion policies, e.g. bilateral & multilateral agreements, trade facilitation etc. There are some difficulties that exporters may face in exploiting the export destinations. These include among others, very high import tariffs, lack of Bangladesh's diplomatic mission in the trading partner country, country not being a member of WTO, lack of trade agreement with the country. There is therefore a need for the ministry of industry & trade to work on these issues with a view to making it easy for members of Bangladeshi exporters association to export. A number of authors have recently shown that political instability is partly the outcome of bad economic performance & poverty. Political instability has a direct impact on trade flows. This is in line with the literature on countries like Bangladesh which shows that improving economic governance fosters exports & therefore growth. The results of this study indirectly suggests that Bangladesh has the potential of expanding its trade & current account imbalances with Australia, Canada, China, France, Germany, Switzerland, UAE & UK. Although these results may seem undesirable from the balance of payments perspective, they do give some

useful insights about the countries / regions with which Bangladesh can consider more integration through the signing of bilateral & multilateral trade agreements. Most importantly, it is found that geographical distance has significant impact on imports of Bangladesh which means transport cost & other transaction costs, such as the probability of surviving intact of perishable goods etc still have significant impacts on its imports, as Bangladesh mostly imports consumer goods rather than capital goods. An important outcome of the model & of relevance to policymakers, is the significant influence of distance in trade. Projects which contribute to decreasing of these costs should be placed high priority by the governments. At this point, reducing the distance costs refers not to improvements of the physical infrastructure only, market access measures, border procedures, movement of people, development & dissemination of information are important dimensions of the distance costs that needs to the improved. Improvement in physical & technological infrastructures are especially important for the development of trade. Economic growth of the individual economies will also strongly influence both export & import potentials. Therefore stabilization policies & establishment of a conducive, attractive business environment for private development which ensure high growth rates shall be high on the agenda of policy makers. Although "money" doesn't seem to strongly affect trade in long term, we would caution that due to different monetary policy regimes on Bangladesh attention shall be paid to exchange rate management. The establishment of the FTA through the network of the bilateral free trade agreements might offer new invention to fostering regional integration. FTA will potentially induce more trade creation while the presence of "overtrade" with neighboring countries may also lead to some trade diversion. It is reasonable to believe that an increase in trade intensity will not happen in all sectors. Increase in trade relations will be higher in industries where the presence of multinationals is more significant & where economies of scale & technology spillover effects prevail. Trade flows will tend to increase as income levels converge, demand structures get more similar & international production networks expand. As a consequence, it is expected that significant changes continue to occur in the comparative advantage patterns, which will depend on the countries position in the labor division & on their competitive performance. Improving domestic policies may raise trade between members of SAARC countries & hence contribute to regional spillovers. As, an increasing number of SAARC countries engages in a process of economic reform & promotes openness & competition, more promising outcomes in terms of intra-regional trade are to expected. All partner countries' propensities to export & import must be taken into account sufficiently & adequately when trade policy is set as the Bangladesh's trade is not independent of country specific effects. A more attractive business environment together with market reorientation from government could help Bangladesh to overcome the slow down in trade with her trading partners.

VIII. Conclusion

The main results indicate that the bilateral trade flows between Bangladesh & her fifty two trading partners are driven by proxy for the stage of development or level of development (PCGDP), distance & geographical characteristics like Area. According to the result of the gravity model, PCGDPS' of both the exporter & importer countries have positive effects on the trade flows. This result agrees with the expectations in theory. The more the incomes of these countries rise, the more rise in the demands of goods & service & in the export & import potential would be experienced. Trade volume also responds to level of development more than proportionally, implying Bangladesh trade more with richer countries than with poorer countries. The distances between Bangladesh & the capital cities of trading partners of Bangladesh have a negative effect on trade flows, since augmentation of distance among countries will extend the transportation time, the transportation costs will increase. More specifically, trade volume responds to distance more than proportionally. Bangladesh's direction of trade pattern is also strongly governed by geographical characteristics, such as Area, implying Bangladesh has a tendency to trade with larger countries. Other geographical characteristics such as Landlocked dummy has insignificant impact on trade but Island dummy has significant impact on trade. GSP dummy variable has significant impact on trade. Membership in OECD countries has significant impact on trade. Membership in WTO doesn't have significant impact on volume of trade. Fundamental rights, such as civil rights has insignificant impact on trade implying higher freedom implies more trade with trading partners.

Although Bangladesh has exploited trade potentials with thirty nine countries, Bangladesh in general has unrealized trade potentials with thirteen of her trading partners including Australia, Canada, China, France, Germany, India, Italy, Netherlands, Pakistan, Singapore, Switzerland, UAE & UK. This finding is important for policymakers because exploiting these trade potentials are expected to contribute to trade diversification for Bangladesh. It is suggested that Bangladesh needs to sign bilateral trade agreement with each of these above mentioned countries. Bilateral trade agreement such as the case of Bangladesh & China trade agreement would increase trade substantially. Moreover, besides trading with large countries, increasing trade with small economies which have trade potentials such as Singapore, UAE, Netherlands would also be of priority. We have also tested whether actual trade converges toward potential trade & found the coefficient of convergence as significant with correct sign. It should be noted that the period under consideration is a period when policies

played a very important role in shaping Bangladesh's trade. Indeed, throughout most of the period Bangladesh followed a conservative trade regime. To the extent that the gravity model is policy neutral, the relative success of the model is not entirely on the expected lines, Bangladesh's trade continued to be guided by natural forces to a large extent throughout the independence of Bangladesh.

References

[1]. Alam, Md. Mahmudul., Uddin, Gazi Md. Salah., Taufique, Khan Md. Raziuddin. (2009). "Import inflows of Bangladesh : The Gravity Model Approach". International Journal of Economics & Finance, 1(1),131-141.

[2]. Anaman, K.A. & Al-Kharusi. (2003). "Analysis of trade flows between Brunei Darrussalam & The European Union". ASEAN Economic Bulletin,20(1), 60-73.

[3]. Anderson, J.E. (1979). "A Theoretical Foundation for the Gravity Equation". The American Economic Review, 69,106-116.

[4]. Batra, A. (2004). " India's Global Trade Potential : The Gravity Model Approach". Working Paper No. 151. Indian Council for Research on International Economic Relations.

[5]. Bergstrand, J.H. (1985). "The Gravity Equation in International Trade : "Some Microeconomic Foundations & Empirical Evidence". The Review of Economics & Statistics, 71, 143-153.

[6]. Blomquist H, C. (2004). "Explaining Trade Flows in Singapore". ASEAN Economic Journal, 18(1), 25-46

[7]. Caetano, J. and Galego, A.(2006). "Trade Flows among CEEC and EU Countries: What are the Future Perspectives?". Revista De Economia Mundial,15,65-87.

[8]. Cheng, I.H.and Wall H.J. (1999). "Controlling for heterogeneity in Gravity models of Trade" Working Paper No.99-110 A. Federal Reserve Bank of St. Louis.

[9]. Coe. D, and Hoffmaister, A. (1999). "North South Trade : Is Africa unusual?" Journal of African Economies, Vol. 8, No. 2,Centre for the study of African Economics, Oxford, UK.

[10]. Eaton, J.& Kortum, S. (2001). "Technology, Geography & Trade." Econometrica, 70 (5), 1741-1779.

[11]. Egger, Peter. (2002), "An Econometric View on the Estimation of Gravity Models & the Calculation of Trade Potentials". The World Economy, 25 (2), 297-312.

[12]. Eita, J.H. and Jordan, A.C. (2007). "South Africa's Wood Export Potential using a Gravity Model Approach". Journal for studies in Economics & Econometrics,31(3),81-85.

[13]. Filippini, C. and Malini, V. (2003). "The Determinants of East Asian Trade Flows : A Gravity Equation Approach". Journal of Asian Economics, 14(5), 695-711 (17).

[14]. Jakab, K. & Oszlay, A. (2001). "How Far has Regional Integration Advanced ? : An analysis of the Actual & Potential trade of three Central & European Countries". Journal of Comparative Economics, 29, 276-292.

[15]. Longo, Roberto. and Sekkat, Khalid. (2001). Obstacles to Expanding Intra-African Trade, Working Paper No. 169. OECD DEVELOPMENT CENTRE.

[16]. Martinez-Zarzoso, I. and Nowak-Lehmann, F.D. (2003). "Augmented Gravity Model : An Empirical Application to Mercosur-European Union Trade Flows." Journal of Applied Economics, 6(2), 291-316.

[17]. Mátyás, L. (1997). "Proper Econometric Specification of the Gravity Model". The World Economy, 20 (3), 363-368

[18]. Oguledu, I. and Macphee, C.R. (1994). "Gravity Models : A Reformulation and an Application to Discriminatory Trade Arrangements." Applied Economics, 26(2),107-120.

[19]. Rahman, M. (2004). The determinants of Bangladesh's Trade : Evidence from the Generalized Gravity Model. The Economic society of Australia's 33 Conference of Economists, University of Sydney, Australia

[20]. Rose, Andrew. (2003). "Which International Institutions Promote International Trade?." Review of International Economics, 147(3), 1-18

[21]. Sapir, A. (1981)."Trade benefits and EEC Generalized System Preferences." European Economic Review, 15(3), 339-355

[22]. Tinbergen,J.(1962). Shaping the world Economy : Suggestions for an International Economic Policy. New York : The Twentieth Century Fund.