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Assessing the Existence of Gravity Model for Bangladesh's Trade: A Panel Data Analysis

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ABSTRACT

Generally, Gravity model has an important dominance in bilateral trade performance. The foremost intention of this paper is to justify the theory of Gravity model on Bangladesh's trade activities with its sixty major bilateral trading partner countries including all members of NAFTA and SAARC by applying panel data estimation approach for data 2001 to 2015. This deed estimates the relationship between the total trade (sum of export and import) of Bangladesh with its trade partner and their size of the economies and the transportation cost of trade as proxy of distance between the trading countries. The findings of the study conclude that the shape of the trading countries' economies has positive significant impact on their bilateral trade and cost of transport is examined a meaningful factor that it has negative impact on Bangladesh's trade. The study comes across with the visualization that gravity theory has persistency with the trade of Bangladesh. In Bangladesh, the country specific effect indicates it is better for Bangladesh to trade with its neighboring countries rather than trading with less distance countries as the dummy coefficient of SAARC member countries is more positive significant than NAFTA member long distance countries.

KEYWORDS

Bilateral trade, Gravity Model, Pooled OLS, Random Effects, Fixed Effects, Hausman test.

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INTRODUCTION

In this modern world, Trade is necessary for every country and it is an undivided part for the national development and growth of every modern economy. The prosperity and the development of any national economy, the contributions of trade become more momentous. It is associated with economic factors (GDP, tariff structure) and non-economic factors (distance, language, culture). With the start of the First World War, the tune of globalization came to associate finish causing deny of liberalization and give birth to the nationalism which in turn led to a depression in global trade. After WW-II the significant advancements in science and technology and substantial innovations in transportation and communication led the different national economies to a global economy and in this way, the whole production is internationalized, capital flows is occurred freely and instantly across countries (Bordo, *et* al.). Over the Second World War, the international trade commenced growing than before. "The Recardian theory of comparative advantage"[1] and "Heckscher-Ohlin model of factor endowment" marked these in the theory of classical and neo-classical economies in international trade (Appleyard Field and Cobb 2008). In the last few decennia, the wide range of theories are attained from these papers to elucidate factors affecting international trade. As the trade is the mode of development of any nation, so every nation eagerly awaited to do trade with other nations. From 1990 the world trade is increase dramatically and the trading nations find a way to the economic development of the countries. And different trading agreements were also signed among the trading countries. Bangladesh also signed some trade agreement for the economic development for our country.

The theory of gravity model which has great influence in trade and become very essential economic trade theory derived from the Newtonian law of gravity. Newtonian law of gravity is applied here in the purpose of international trade. From this theory we state that trade is positively related to the economic shape that means GDP and trade is inversely related to the distance between their physical situations. This trade model was introduced by Jan Tinbergen and Poyhonen in 1963 for the purpose of analyzing the international trade flows. Therefore, trade theory persuades a positive connection with GDP and negative connection with distance. In this case, the incomes earning of the both trading countries have positive impact on trade flows and trading countries transportation infrastructure encourages trade (Martinez-Zarzoso, 2003). Albeit

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better market access, advanced connectivity and transportation, improved colonial links, proximity, access to sea, exchange rate regimes play important role for undertaking bilateral trade potentiality, economy size of the trading countries and the trading cost has become the fundamental pragmatic studies in international bilateral trade (Oguledo & Macphee, 1994).

We know that Bangladesh is a newcomer in trade game, it should make significant journey with its international trading partners simplifying trade barriers. Now a day, it is clear that trade becomes an undivided part of the total development exertion and the massive contributor of economic growth of our country. Foreign trade sector provides tremendous support to abbreviate the deficit in its balance of payment. Gradually Bangladesh has increased its trading partners whole over the world but among them some of the countries predominate. The trade relationships of Bangladesh with few countries could not bring a good allusion for the hopeful contribution for the economic development for our country. Again, some counties contribute a significant role to the developmental effort and economic growth. So, the study helps us to find out the effectiveness of the important factors that generated by gravity model for Bangladesh trade performance with its trading partners. In this paper, major sixty trading partners (in total sum of trade) of Bangladesh has taken to justify the preface of GDP and distance in following the way of this model of trade on the emergence of a stable trade network with Bangladesh. Countries of NAFTA and SAARC have included separately destining the role of distance in trade more apparently.

The following part of this paper is arranged as follows. I present the reviews of the existing Literature in section 2. Section 3 pictures the theoretical background of the study. Section 4 represents the data descriptions and methodology. In section 5 the results are reported. Conclusions and annex are in section 6.

LITERATURE REVIEW

To the event of gravity mode, economic size and trade borders distance between countries plays a significant role in this era. Normally Trade has a propensity to be intensive when countries have well-connected path and contact. Again, this contact tends to come down when spaces are onerous and there is no existence of a good pathway. Extended studies have been done on different aspects and issues of gravity model. Husain and Yasmin (2015) analyzed the gravity model in order to explain Bangladesh's direction of trade with fifty-two major trading partners

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and using data for period 1975-2005. Their study concludes the aggregate trade flows are proportional to the country size which is measured by per capital income and inversely connected to the space, trade cost and trade barriers. Iqbal and Islam (2014) examined the existence of gravity model on trade between Bangladesh and EU for the period of 30 years (1980 to 2010). In this paper they conclude that the interdict on imports of several goods and political and economic instability are the acute obstacle for the promotion of the trade performance of Bangladesh with the EU. They also added that Bangladesh's GDP is increased due to trade.

Roy and Rayhan (2014) studied the factors that affecting the trade flows through gravity model in our country using fourteen countries together with Bangladesh. They collected data for 16 years from 1991 to 2007. In this study they concluded that trade flows of Bangladesh are influenced by the economic size its own and its trading partner economy as well as exchange rate. Moreover, this result showed that border acts also important determinant of trade flows of Bangladesh. Khan *et al.* (2013) find that the impact of trade cost and others factor on trade volume of Bangladesh. They concluded that trade cost has significant impact on volume of trade and the trade cost is negatively related to the volume of trade in our country. Moreover, distance between trading partners and common border plays a important role in bilateral trade. Alam et al. (2009) examined the factors that responsible for unfavorable trade balance in Bangladesh using the gravity model with eight countries. They collected 19 years data from 1985 to 2003. They concluded that the gravity model holds in trade activities of Bangladesh. Rahman (2004) examined the existence of gravity model in Bangladesh and in their study, they find that the volume of trade of Bangladesh is determined by the openness of its trading partners, border act and members of SAARC countries. Hasan (2000) studied the factors that determined the volume of trade between Bangladesh and the members of SAARC. In his study he founds that tariff is inverse related to the volume of trade between Bangladesh and member of SAARC countries.

Karamuriro and Karukuza (2015) examined the gravity model on the key factors of export performance of Uganda and they made a conclusion that they find in this study. They confirmed that real exchange rate; Uganda's GDP and the GDP of its trading partner have significant impact on Uganda's volume of trade. Mohmand *et al.* (2015) studied the trade potentiality of Pakistan based on the gravity trade model and they are able to make good findings. The study concluded that Pakistan has export potentiality and Pakistan can reduce trade deficit by exporting to the neighboring countries. Khans' (2013) studied the trade of Pakistan with its trading partner

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through the gravity model. He concluded that trade in Pakistan is increasing the GDP of Pakistan and its trading partner and it is inversely related to distance and cultural dissimilarity. Hermawan (2011) studied the factors that affecting the Indonesian's textile products exporting through the gravity model. The study concluded that geographical distance and GDP of partner country's significantly influence the pattern of textile, but the GDP of Indonesian's economy is not significant. Banik and Gilbert (2008) studied on the trade between different countries based on gravity model and made conclusion that trade cost is very important determinant of trade. Gani (2008) studied the factor the influence the trade between Fiji and its Asian partner through gravity model. De (2006) examined the significance of transaction cost in volume of trade in Asian countries. The study found that transaction cost is significant determinant of volume of trade in Asian countries.

The prevailing literature, there is no study about the existence of gravity model in our country. Most of the empirical studies focus the import flows, export flows, determinants of bilateral trade and direction of Bangladesh's trade. None of these studies analyzed the existence of gravity model in Bangladesh's trade and its impact on regional trade agreement. So, the main concern of my study is to assess the existence of gravity model in Bangladesh's trade and its impact on regional trade agreement.

THEORETICAL BACKGROUND

The concept of Gravity Model of trade is derived from the law of universal gravitational force of Newton. This trade model postulates that the bilateral trade between two countries is directly proportional to the product of GDP of country 'i' and 'j' and again the volume of trade is inversely proportional to the distance existing between these countries. The basic form of the Model appears as follows:

$$\boldsymbol{T_{ij} = \frac{AY_iY_j}{D_{ij}}} \qquad (1)$$

Here,

T_{ij} is the value of trade between country i and j, A represents constant term, Y_i is the GDP of country, Y_j is the GDP j's country and D_{IJ} represent distance between the i's and j's countries.

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The generalized form:

$$T_{ij}=\frac{AY_{it}^{a}Y_{jt}^{b}}{D_{ijt}^{c}} \qquad (2)$$

Here a, b and c are chosen to fit the actual data as much as possible to close and are not held equal to unity. Above the two forms of Gravity model show other things equal the value of trade between the two countries is positively related to the both countries GDPs and inversely proportional to the distance between them.

In order to get linear format, we are taking log in both sides:

$$\ln T_{ijt} = \ln A + a \ln Y_{it} + b \ln Y_{jt} - c\ ln\ D_{ijt} \qquad (3)$$

DATA DESCRIPTION AND MODEL

1 Data Type and Sources:

Our study designed a total of sixty major trading partner countries of Bangladesh including all the members of NAFTA and SAARC. In this study, we selected the countries those are the important trading partner of Bangladesh and reachable secondary data. We collected data for 15 years from 2001 to 2015. Because of data limitation, we are unable to add more data. GDP are in constant 2010 US dollars are annexes from World Development Indicator (national accounts), Bangladesh's export import data are measured in US dollar Thousands accumulated from United Nations COMTRADE Statistics. And trade costs of Bangladesh with its international trading partners are obtained from ESCAP World Bank Data.

2 The Model:

With intend of estimation, the gravity model is most equivalently constructed by using natural logarithms. Using its log-linear form our expected model can be written:

$$\ln T_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Tr\ Cost_{ijt} + \beta_4\ SAARC + \beta_5\ NAFTA + U_{ijt}$$

Where,

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j = 1, 2,…60 countries

i = Bangladesh

t = year of 2001, 2002,……., 2015

T_{ijt}= Bangladesh's total trade with j countries for t period

GDP_{it} = GDP (Gross Domestic Product) per capita income of Bangladesh at time t

GDP_{jt} = GDP (Gross Domestic Product) per capita income of j country at time t

ln$Tr\ Cost_{ijt}$ = Trade cost between Bangladesh and the j countries at time t

SAARC = 1, if member of SAARC

0, otherwise

NAFTA = 1, if member of NAFTA

0, otherwise

U_{ijt} = Stochastic error term

3 Hypotheses:

i. A higher GDP imply that exporting country has dynamic supply and importing country has increased demand. Hence, it is expected to the coefficients of variable GDP be positive.
ii. Trade costs impede the trade of a country. Trade flows is inversely proportional to the trade costs. So, the coefficients of trade cost expected to be negative.

METHODOLOGY

Panel data estimation techniques are appointed because it has dimension over both cross-sectional and time-series data. Gujarati (2007) lists three advantages of panel data: Firstly, the variation of the dependent variables of cross section and time series are able to find out using panel data models. Secondly, we can also measure observable as well as unobservable effects of the dependent variable using panel data model. Thirdly, panel data give more information because panel data is the combination of both cross section and panel data. So, it represents more variability, less colinearity and more efficiency. So, in this study panel data is preferred in our gravity model of trade estimation as it allow to check for specific effects such as fixed effects or random effects.

The selection of FEM or REM method depends on two main aspects, and one is economic and the other is econometric relevance. From the economic viewpoint, there are unobservable

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random variables which are time invariant and it is very difficult to be quantified. Again, volume of trade and some explanatory variable are influenced simultaneously by it. From the econometric viewpoint, normally the inclusion of fixed effects is preferable to random effects. As the abnegation of the null assumption of uncorrelation of the unobservable characteristics with some explanatory variables is less plausible (Baier and Bergstrand, 2005). The various specification of our model is as: Pooled ordinary least squares, fixed effect estimator (within effect), Random effect estimator and Hausman specification test.

1. Pooled Ordinary Least Square Estimation:

A pooled ordinary least squares estimator can be written as follows:

$$y_{it} = \beta \acute{x}_{it} + \alpha \acute{z}_i + \varepsilon_{it} \quad i = 1,2,\ldots.N,\ t = 1,2,\ldots,\ T \qquad (5)$$

Where,

Y_{it} = Dependent variable

x_{it} = K regressors not including a constant term.

$\alpha' z_i$ = the heterogeneity or individual effect

z_i = Constant term and a set of individual or group specific variables, which may be observed or unobserved, all of which are taken to be constant over time t.

Ordinary least Squares does not allow to measures the individual heterogeneity which may causes biased results because of the presence of correlation between few explanatory variables and few unobservable characteristics.

2. The Fixed Effects Estimator:

$$Y_{it} = X_{it}\beta + \alpha_i + \varepsilon_{it}\ ;\ i = 1,2,\ldots..n;\ t = 1,2,\ldots\ldots\ldots T; \qquad (6)$$

The ordinary least squares will provide consistent and efficient estimator, if only $\alpha_i = \alpha$ contains a constant term. The least squares estimator of β will be biased and inconsistent as if α is unobserved but correlated with X_{it}. In the regression model, the fixed effects approach receives α_i to be a group-specific constant term.

Assumption of unobserved terms:

1: α_i freely correlated with X_{it} .

2: E $(X_{it}U_{is}) = 0$ for s = 1, 2,…, T.

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The fixed effect estimator solved the endogeneity problem and it would contaminate the OLS estimates. First taking the average over time of (6) for each individual this gives:

$$\overline{Y_i} = X_i\beta + \alpha_i + \overline{\boldsymbol{\varepsilon_i}} \qquad (7)$$

Now subtract (6) from (5)

$$Y_{it} - \overline{Y}_i = \left(X_{it} - \overline{X}_i\right)\beta + (\varepsilon_{it} - \overline{\boldsymbol{\varepsilon}}_{\boldsymbol{i}}) \qquad (8)$$

Here α_i is eliminated from the equation. So, we are able to estimate consistently by using OLS on equation (8). This is the Fixed Effects estimator.

3. Regression with the Fixed Effects Model:

A fixed effect is tested by F-test[2]. In order to observing the impact of the fixed effect model, we also find that it can improve the goodness-of-fit, and both fixed effect model and OLS are compared by F test. In order to analyze, its need to be executed a joint test. If all dummies for all countries are equal to zero a joint test has been executed. In null hypothesis, all dummy parameters are zero. On the other hand, at least one dummy parameter is not zero in alternative hypothesis. If it rejected the null hypothesis, there at least one group or time specific intercept is not zero. So, fixed effects are needed which is better than the pooled OLS.

4. The Random Effects Estimator:

$$Y_{it} = X_{it}\beta + \alpha_i + u_i + \varepsilon_{it} \text{ i=1, 2,…, n; t=1,…,T} \qquad (9)$$

In this equation, there is k regressors that included a constant term. This single constant term is the mean of the unobserved heterogeneity. Here u_i represents the random component of heterogeneity that specifies the ith observation and is constant through time. Assumptions:

$E[\varepsilon_{it}\backslash X] = E[u_i\backslash X] = 0\ E[\varepsilon_{it}^2\backslash X] = \sigma_\varepsilon^2$,

$E[u_i^2\backslash X] = \sigma_u^2$, $E\left[\varepsilon_{it}u_j\backslash X\right] = 0$,

$E\left[\varepsilon_{it}\varepsilon_{js}\backslash X\right] = 0$

[2] F = where are unrestricted and are unrestricted coefficient of determination, m is number of omitted parameter, n is sample size, k is number of parameters estimated in unrestricted model.

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$E[u_i u_j \backslash X] = 0$, [For all i, t and j]

5. Breusch-Pagan Lagrange Multiplier Test:

Breusch and Pagan's test and Lagrange multiplier test are applied to examine the Random effect. Breusch and Pagan's test and LM test is examined when the individual or time specific variance components are zero. The chi-square distribution is followed by the LM statistics and degree of freedom is one. In LM test the null hypothesis is that variances across entities are zero. If null hypothesis is rejected, we can conclude that random effect model is able to deal with heterogeneity.

6. Hauseman Test:

The Durbin-Wu-Hausman test evaluates the consistency of an estimator. It helps one evaluate if a statistical model corresponds to the data.

The Wu-Hausman statistics is:

$$H = (b_1 - b_0)'(\mathrm{Var}(b_0) - \mathrm{Var}(b_1))^t (b_1 - b_0) \quad (10)$$

In this test, the statistic has asymptotically the chi-squared distribution with the number of degrees of k freedom equal to the rank of matrix $\mathrm{Var}(b_0) - \mathrm{Var}(b_1)$ under the null hypothesis.

$H_0 =$ Random effect model is appropriate

$H_1 =$Fixed effect model is appropriate

If the test statistics reject the null hypothesis in favor of fixed effects, it means that country-specific effects are correlated with regression. And the random effects model would be estimated inconsistently.

7. Cross Sectional Dependence in the Fixed Effect:

When the residual is correlated across entities, Pasaran Cross-Sectional Dependence (CD) test is used. It is also called as contemporaneous correlation. if the residual is correlated, Paseran CD test has been applied.

8. Serial Correlation in the Fixed Effect:

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By serial correlation we mean that the error for one time period is correlated with the error for a subsequent time period. In panel data analysis the standard error is biased due to serial correlation and it makes the results less efficient. In order to seeing the existence of first-order autocorrelation in the fixed effect model, we performed Wooldridge test for serial correlation. And there is no first order autocorrelation under null hypothesis.

9. Heteroscedasticity in the Fixed Effect:

Heteroscedasticity describe a situation where the error term varies with all values of the explanatory variable. This would result in an inefficient and unstable regression. In regression analysis, we should deal with data that are homoscedastic that means variance of the errors are constant. Therefore, Heteroscedasticity corrected FGLS regression has been performed.

EMPIRICAL FINDINGS

In the sake of estimation of gravity model, we treat panel data estimation procedure. We are dealing with balanced panel data for our analysis. We have done various specification of our desired model such as pooled ordinary least square (POLS), Fixed Effect (FE), Random Effect (RE) and Hausman Specification Test. To visualize whether they are Fixed or Random we have conducted Hausman specification test. The Hausman specification test point out fixed effect model is the appropriate model of our analysis. Further, we applied Paseran CD test, Wooldridge autocorrelation test, Modified Wald test in the fixed effect regression model.

A pooled model would be estimated by employing usual OLS. The assertion of this method is that a constant coefficient across time. As the constant coefficient exists, it does not illustrate optimal estimation.

Table 1: *Pooled OLS without dummy*

Dependent Variable = $LnTrade_{ijt}$

Variables	**Coefficients(t-ratio)**	**P value**
lnBanangladesh's GDP	0.92***(3.26)	0.002
lnpartner's GDP	0.41***(8.84)	0.000

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lnTrade Cost	-5.29***(-15.23)	0.000
Constant	5.04**(0.60)	0.547
Adjusted R^2	**0.909**	
F- Statistics	**300.42**	
Prob*(F-statistics)*	**0.000**	

Note: ***, ** indicates the level of significance at 5% and 10% respectively.

The result presented in Table 1 shows the estimation of pooled OLS where the coefficients of Bangladesh's GDP and importer's GDP are positive as expected. In other words, they are statistically significant. The variable trade cost has anticipated negative sign and are statistically significant. The pooled OLS explains about 91% variations of Bangladesh's trade.

The following table (2) represents the estimation of fixed effect. The detail results are annexes in table (A2) in appendix. The fixed effect explains about 81% variations of Bangladesh's trade.

Table 2: *Fixed Effect within Group*

Dependent Variable = $LnTrade_{ijt}$

Variables	**Coefficients(t-ratio)**	**P value**
lnBanangladesh's GDP	2.11***(4.81)	0.000
lnpartner's GDP	0.32**(2.59)	0.045
lnTrade Cost	-1.80***(-3.44)	0.001
Constant	-39.98***(-3.93)	0.000
R^2(within, between, overall)	**0.76,0.92,0.82**	
F- Statistics	**83.18**	
Prob*(F-statistics)*	**0.0000**	

Note: ***, ** indicates the level of significance at 5% and 10% respectively.

The coefficients of Bangladesh's GDP are statistically significant and positively related and it is consistent with the hypothesis is being formed. The findings give a hint that, higher GDP leads to higher production capacity and dynamic supply which in turn stimulate the capacity to export more. The coefficient value of 2.11 notify that when the Bangladesh's GDP increases 1% then the value of its trade increases by an amount of 2.11% on average. The coefficients of partner's

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GDP hold a positive sign which are accorded with the expectations. This implies that if the GDP of partner's country increases, the countries demand for import increases. The coefficient values of .32 notify that the value of trade increases approximately 0.32% if the partner's GDP increases by 1%.

The trade cost variable's coefficient is statistically significant and has anticipated negative sign. Here trade costs are the proxy of distance. Trade cost has an inverse relationship with the country's trade as bear negative sign. Higher trade cost lower the amount of trade. The coefficient value of -1.80 express that when the trade cost of Bangladesh and her trading partner increases by 1% then the value of trade to this destination decreases by an amount of 1.80%.

Table 3: *F-Test for Fixed Effect*

F-Test or Wald test for Fixed Effect		
$H_0 : \mu_1 = \mu_2 = \ldots = \mu$		
F (5,81)	=	18.30
Prob>F	=	0.0000

From the test of group effect, it can be seen that null hypothesis of all the unobserved effects are zero are rejected. Therefore, fixed effect model is significant than the pooled OLS.

Table 4: *Random Effect Model*

Dependent Variable = $LnTrade_{ijt}$

Variables	**Coefficients(z-ratio)**	**P value**
lnBanangladesh's GDP	1.57***(6.24)	0.000
lnpartner's GDP	0.609***(5.93)	0.000
lnTrade Cost	-2.87***(-5.77)	0.000
Constant	-28.82***(-3.30)	0.001
R^2(within, between, overall)	**(0.74, 0.89, 0.87)**	
Wald Chi-Square	**315.36**	
Prob *(Chi-square)*	**0.0000**	

Note: ***, ** indicates the level of significance at 5% and 10% respectively.

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The results of random effect show that the coefficients are bearing anticipated sign and statistically significant. We can summarize that 1% increase in GDP leads to increase in Bangladesh import demand 1.57% and partner's country's export supply by an amount of 0.61%. The R-square can explains 74% of total variations. The between R-square can explain 89% of variations. The overall R-square signifies 87% of variations.

Table 5: *Breusch-Pagan Lagrange Multiplier Test for Random Effect*

Breusch-Pagan Lagrange Multiplier Test(LM) for Random Effect		
$H_0 : Var_{ui} = 0$		
chi(01)	=	30.34
Prob>chibar2	=	0.0000

From the estimation results of Breusch-Pagan Lagrange Multiplier (LM) it can be seen that null hypothesis of zero error variance have been rejected in favored of pooled OLS. Therefore, random effect model is significant, and it is capable to deal with heterogeneity better than does the pooled OLS.

In order to decide whether fixed or random effect model is appropriate we consider Hausman Specification Test.

Table 6: *Hausman Specification Test*

Hausman Specification Test for Fixed or Random Effect		
H_0= difference in coefficients not systematic		
chi2(3)	=	42.04
Prob>chi2	=	0.0000

Here, Hausman Specification Test = 42.04, Prob> chi2 = 0.0000

The Hausman Specification test rejects the null hypothesis and accepts the fixed effect model which signifies correlation between regressors and unobserved effect.

Table 7: Cross Section Results with Country Dummy

Dependent Variable = Individual Effect

Variables	**Coefficients(t-ratio)**	**P value**

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SAARC	2.902***(-4.11)	0.000
NAFTA	0.4935**(2.11)	0.040
Constant	13.81***(43.91)	0.000
Adjusted R^2	**0.34**	
F- Statistics	**24.37**	
Prob*(F-statistics)*	**0.0000**	

Note: ***, ** indicates the level of significance at 5% and 10% respectively.

Both of the estimated coefficient of the dummy variables, SAARC and NAFTA are positive and significant which implies that Bangladesh manages a good trade relationship with the SAARC and NAFTA member countries and the coefficient of SAARC is higher than the coefficient of NAFTA which infers that it is better for Bangladesh to trade with its neighboring countries rather than trading with less distance countries.

Table 8: *Testing for Cross Sectional Dependence in the Fixed Effect Regression Model*

Pesaran CD Test		
H_0 = Cov $(v_{it}, v_{jt}) = 0$		
Cross-Sectional Independence	=	0.514
Pr	=	0.6076

The results of Pasaran CD test shows that pr = 0.6076 >0.05. Therefore, we accept the null hypothesis and can conclude that residual is not correlated.

Table 9: *Testing for Serial Correlation in the Fixed Effect Regression Model*

Wooldriage Test for Autocorrelation		
H_0 = No First-Order Autocorrelation		
F(1,5)	=	3.753
Prob> F	=	0.1105

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The test results of serial correlation show that prob>F = 3.753 and it is greater than 0.05. Therefore, we accept the null hypothesis and can conclude that there is no first-order autocorrelation.

Table 10: *Testing for Heteroscedasticity in the Fixed Effect Regression Model*

Modified Wald Test for GroupWise Heteroscedasticity		
H_0 = Sigma(i)^2 = Sigma^2 for all i		
chi2(7)	=	42.77
Prob> chi2	=	0.0000

The results presented in Table 10 the null hypothesis of homoscedasticity or constant variance is rejected and the test suggests the existence of heteroscedasticity. In the face of heteroscedasticity, FGLS regression may be applied. It is applied in order to obtain homoscedastic panels.

Table 11: *Cross-Sectional Time-Series FGLS Regression in the Fixed Effect Regression Model*

Feasible Generalised Least Square (FGLS) regression		
Panels: Homoscedastic		
Correlation: No Autocorrelation		
Wald chi2(1)	=	419.62
Prob> chi2	=	0.0000

The results presented in table 11 shows that the panels are homoscedastic and there is no first-order autocorrelation.

CONCLUSION

The main destination of this study was to investigate the consistency of the gravity model in Bangladesh's trade performance. Several factors such as geography, magnitude of income, infrastructural facilities, trade barriers, and size of population influences heavily on country's extent of trade. In our analysis, we assigned variables GDP and trade cost in order to verified

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Bangladesh trade from the sense of gravity model of trade. To the result of estimation, we find that both the Bangladesh's and partner's GDP has significant positive impact on trade. As the more income of a country it demands more goods and services which in turn leads to export and import possibility. The findings of the study focus Bangladesh is interested to trade a lot of with enriched economies than do with less enriched economies. From the estimation result we also find that Bangladesh's trade negatively originated by trade cost which referred as significant factor. The anticipation of gravity model theory falls in with our estimation result. In addition, the country specific effect indicates for Bangladesh is that trading with its neighbor countries rather than trading with less distance countries as the dummy coefficient of SAARC member countries is more positive significant than NAFTA member long distance countries. Some policy recommendation can be implemented based on the findings. it is urgent for our country. Bangladesh should try to make an impression with its trading partners to make trade platforms more favorable. A significant increase in trade volume can be raised by following normalized relationship with its regional trading partner countries. As regional trade agreement behaves like meaningful part in Bangladesh's trade performance therefore it is emergent to bear in mind while formulating trade policies. To alter image of Bangladesh's trade in global ground revaluation of policy measure should be taken. Moreover, Bangladesh should attempt to acquire a pair of regional trade agreement with the light of negotiation in order to sustain its trade potential sector.

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Appendix

Table A1: Fixed Effect Model

Fixed-effects (within) regression				Number of obs = 90
Group variable: country				Number of groups = 6
				min = 15
R-sq:				avg = 15.0
within = 0.7550				max =15
between = 0.9165				F(3,81) = 83.18
overall = 0.8132				Prob > F = 0.0000
corr(u_i, Xb) = 0.6643				
lntradeijt	Coef.	Std. Err.	t	P > t
lngdpit	2.108012	0.4385044	4.81	0.000
lngdpjt	0.3210405	0.5418592	2.59	0.055
lntradecostijt	-1.801681	0.5238064	-3.44	0.001
_cons	-39.97241	10.17619	-3.93	0.000

Table A2: Random Effect Model

Rndom-effects GLS regression				Number of obs = 90
Group variable: country				Number of groups = 6
R-sq:				Obs per group:
within = 0.7428				min = 15
between = 0.8977				avg = 15.0
overall = 0.8690				max = 15
				Wald chi2(3) = 315.36
corr(u_i, X) = 0 (assumed)				Prob > chi2 = 0.0000
Lntradeijt	Coef.	Std. Err.	z	P > z
Lngdpit	1.570719	.2518725	6.24	0.000
Lngdpjt	.6089067	.1026388	5.93	0.000
Lntradecostijt	-2.867122	.4970165	-5.77	0.000
Cons	-28.82263	8.740789	-3.30	0.001

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Table A3: Hausman Test

	Coefficient			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fixed	Random	Difference	S.E.
lngdpit	2.108012	1.570719	.537293	.3589517
lngdpjt	.3210405	.6089067	-.2878663	.5320495
lntradecost	-1.801681	-2.867122	1.065442	.1643368

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 42.04
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

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