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Abstract

This paper explores the phenomenon of gravity modeling to examine the crucial relationships between the trade balances of Bangladesh with BRICS countries. Specifically, the relative factors determining trade in the popular gravity model have effects on the trade balance model. The trade balance depends on the relative GDP, relative per capita GNI, real exchange rate and import-weighted distance proxies for transportation cost of the partner countries to the home country. Using standard panel data techniques during the 1991-2013 period, the model is empirically tested and the results show significant effects of all the relative factors on the bilateral trade balance of Bangladesh in trading with BRICS countries. The robustness check of the model ensures the validity of the specification. The static panel data analysis explores the cross-country variations as well as the time-invariant country-specific effects on trade balance with heterogeneous economies and finds significant effects of all relative factors on the trade balance of Bangladesh.

Keywords: Bilateral Trade, BRICS, Panel Data Model

JEL Classification: F41, C23

1. Introduction

The BRICS[1] countries are chosen on the basis of their importance as a trading partner of Bangladesh. BRICS has witnessed immense growth in national GDP, contribution to world GDP and contribution to world trade. Starting with a share of a little over 10% in world GDP and 4% in world trade in 1990, currently BRICS contributes about 21% of world GDP and 15% of world trade, 46% of the world's work force, and 19 % of the world´s nominal GDP. Undeniably, China is the largest trade partner for each of the other BRICS countries with a trade share ranging between 72% and 85%, followed by India with a share ranging between 8% and 26% (BRICS, 2014). The increasing trend of growth signifies the economic importance of these countries in international trade and economy as shown in Table 1 (IMF, 2014; World Bank, 2014).

Table 1: Economic and social indicators comparison of BRICS Countries[2] - 2013

Indicators	**Brazil**	**Russia**	**India**	**China**	**South Africa**	**Total BRICS**	**World**	**BRICS as % of World**
Income Group[3]	Upper middle income	Upper middle income	Lower middle income	Lower middle income	Upper middle income			
Area –land (sq. km)	8459.42	16377.74	2973.19	9569.9	1214.47	38594.72	148940	25.91%
Population (mil.)	201	144	1 224	1 357	52	2978	7124	41.80%
Unemployment rate (%)	6.1	5.5	5.3	4.1	25.1	9.2	5.97	
GDP (current prices/billion US$)	2 246	2 096	1 871	9 185	382	15780	75592	20.87%
Per capita GDP (current prices/US$)	11 171	14 604	1 518	6 768	7 810	8374.2	10610.2	
GDP growth rate (%)	2.5	1.3	12.3	7.7	3.5	5.46	2.25	
Consumer price indices (%)	5.9	6.8	11.1	2.6	5.7	6.42	22.74	
Exports of goods and services (bil. US$)	282	590	446	2 248	97	3663	23432	15.63%
Imports of goods and services (bil. US$)	3 04	444	571	2 016	100	3435	22722	15.12%
Total Trade of goods & services (bil. US$)	5 86	1 034	1 017	4 264	197	7098	46154	15.37%
Foreign exchange reserves (bil. US$)	373	473	292	3 311	50	4499		

(Authors' calculation)
Source: BRICS: joint statistical publication, and World Development Indicators from World Bank database, 2014.

A country's overall trade may be balanced, but a country may have bilateral deficits with many of its trading partners (and surpluses with others). The relationship between the overall trade balance and its determinants may not necessarily be the same as with the bilateral trade balances (Khan and Hossain, 2010). It is imperative to mention that export has performed strongly in Bangladesh's context with the aid of the booming manufacturing sector. Although Bangladesh

performed impressively in increasing her exports, but imports at the same time were enhanced to a greater degree together with the presence of a narrow export basket (Rahman, 2006; Rahman 2009). Utmost, it is to be noted that Bangladesh's exports grew by about five times over the last decade (Khan et al., 2013). In this regard, it should be pointed out that the BRICS countries have already shown clear ambitions in foreign trade policies. Thus, BRICS seems to challenge the trade balance of the international position.

Trade balance has been long considered the driver of the economic engine in developing countries. Bangladesh, as a comparatively new player in the trade game, has made considerable progress. Bangladesh's trade growth has been one of the trade-mark characteristics of the country for the last couple of decades. Specifically, export has displayed robust growth in the face of diverse economic and political setbacks, both in the local and the global context. Kowalski and Bottini (2011) mention what country's exports or imports are driven by the expansion of it's (and it's trading partners') income and to what extent they may be driven by trade and other policy influences.

The objective of the research paper is firstly, how to identify the trade gap between Bangladesh with BRICS countries for reduced trade deficit. And secondly, the paper examines how a gravity model for bilateral trade of Bangladesh with BRICS countries may be calibrated using the panel data in a fixed effects approach for promoting international trade.

The organisation of the rest of the paper is as follows. Section ii presents the stylized facts of the bilateral trade performance of Bangladesh. Section iii presents model specification and data with a discussion of the theoretical foundation and empirical method of the trade balance model. Section iv shows how the tests of the trade balance model - multicollinearity, heteroscedasticity and autocorrelation - characterize the model for better specification and estimation. The individual test confirms the existence of individual (country specific) effects and the Hausman test results suggest that the Fixed Effects Model of panel estimation is the appropriate model relevant for the current study. Section v reports the empirical results of the trade balance model. The last section vi provides the conclusion and summary of the study.

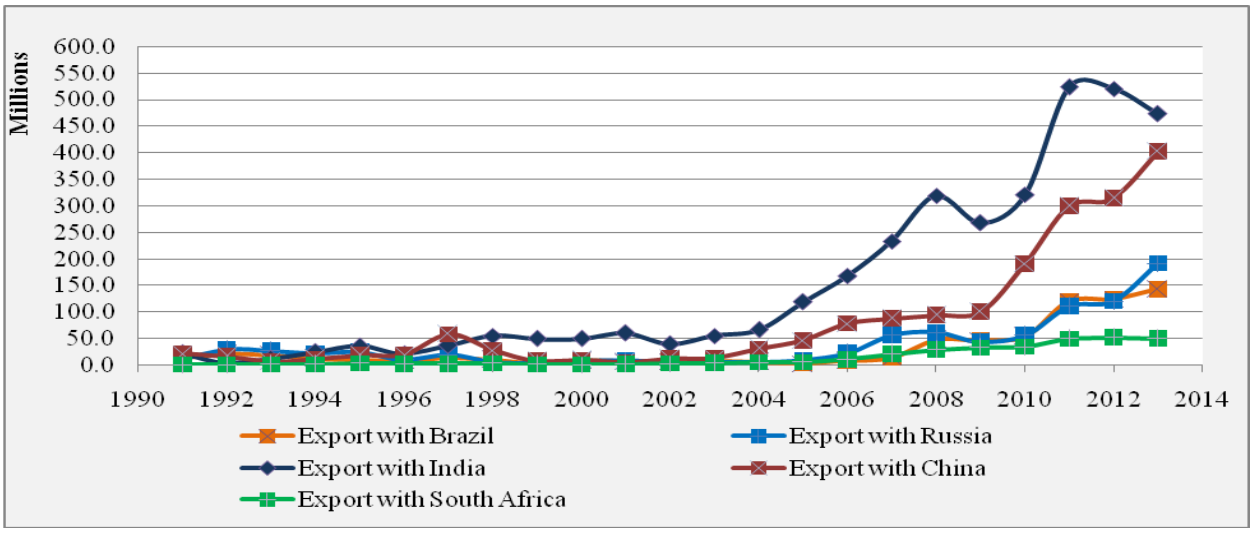
2. Bilateral trade of Bangladesh

2.1. Bilateral export performance

Bangladesh followed an inward looking trade policy and had high anti-export bias in the immediate post-independence period. By the end of the 1970s, Bangladesh partially changed its anti-export bias policies and by the mid-1980s it undertook policies and programmes that resulted in consistent improvement in the incentive to export. By the 1990s Bangladesh became

more export oriented and significant improvements have been made in export policy and administration.

Figure 1: Bilateral export performance of Bangladesh with BRICS countries



Source: Direction of Trade Statistics database from IMF, 2014

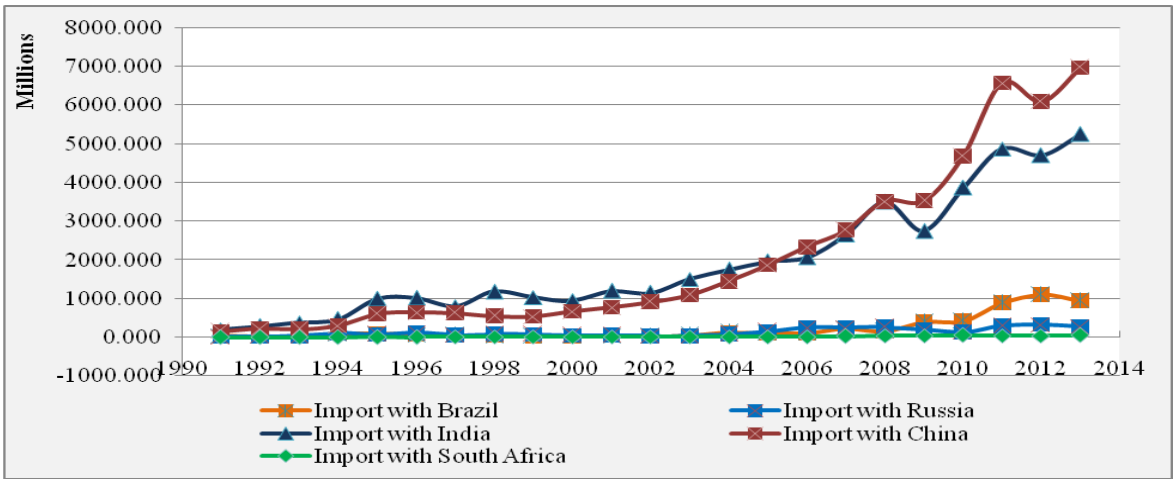
Major export partners of Bangladesh are the USA, the European economy (Germany, UK, France, Belgium, Italy, and the Netherlands), China, India, Canada and Japan. Analysis of BRICS countries exports in Figure 1, shows that despite the debilitating effects of the international trade among BRICS countries, the highest value of which for Bangladesh was with India, where the export earnings of Bangladesh from 1991 to 2002 were sluggish, by 2002 export earnings had a value of 50 US million dollars. Afterwards, the export earnings of Bangladesh with India from 2002 to 2008 rose sharply, with a value of around 325 million US dollars in 2008. In the global financial crisis in 2008 the export growth of Bangladesh with India was falling slightly and again in 2010 export growth was rising (Bhattacharya and Hossain, 2006). And the second highest export earnings of Bangladesh which were with China, rose sharply after 2002. But the rest of the BRICS countries export growth with Bangladesh from 2010 was gradually rising (WDI, 2014). Since the early 1990s, overall growth of exports has been fairly robust with the exception of 1996, 2002 and 2008 when there was a sharp drop in this growth.

2.2. Bilateral import performance

In the early 1970s, Bangladesh adopted more restrictive import policies to protect the local import substituting industries. It began to liberalize its import regime in the early 1980s under the Structural Adjustment Policy (SAP) and later in the mid 1980s under the Enhanced SAP, but not

much liberalization was achieved. Trade deficits further widened in most of the developing countries since the early 1990s because of rapid trade liberalization that resulted in a surge of imports, particularly where protection in the past was excessive and import-substitution strategies were not successful in establishing competitive industries. This also happened because the liberalization was not accompanied by appropriate structural or policy changes in the developing countries to adapt to the new challenges.

Figure 2: Bilateral import performance of Bangladesh with BRICS countries



Source: Direction of Trade Statistics database from IMF, 2014

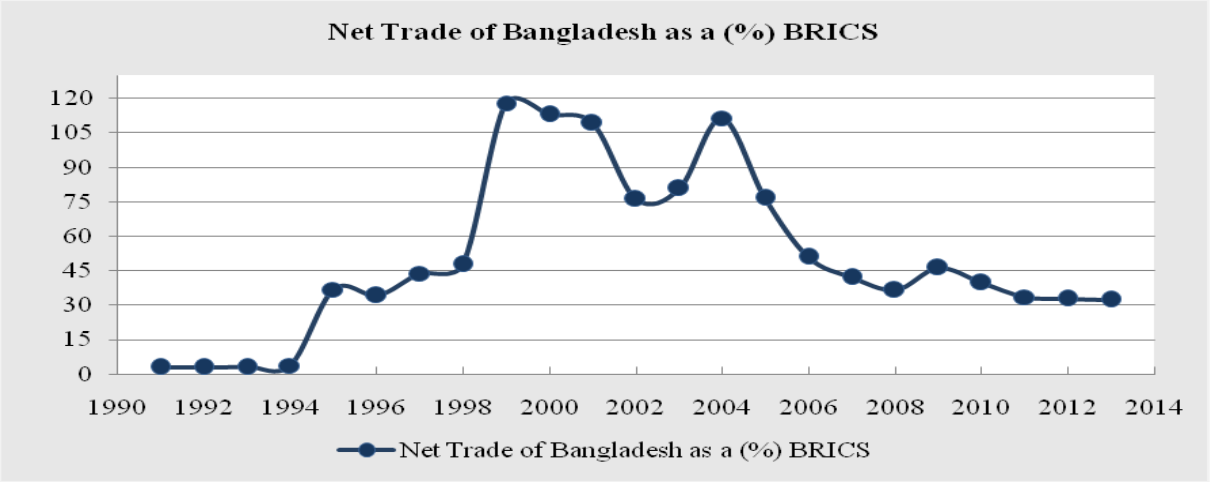
Analysis of BRICS countries imports in Figure 2 shows that the import payments of Bangladesh, which were highest with India from 1991 to 2000, were moderate, the value being around 1,000 million US dollars in 2000. Afterwards, import payments of Bangladesh with India from 2000 to 2005 was sharply rising, to a value of around 2,000 million US dollars in 2005. The second highest import payments of Bangladesh with China from 1991 to 2005 were sharply rising, to a value of around 2,000 million US dollars in 2005. The highest import payments of Bangladesh with China after 2005 were in 2013, when they reached around 7,000 million US dollars. Interesting is that in 2005 and 2008, import payments of Bangladesh with China and India were congruent. For the other BRICS countries import payments of Bangladesh from 1991 to 2000 were negligible and after 2001 were sluggishly rising (WDI, 2014).

2.3. Net trade performance

Trade deficits further widened in most of the developing countries since the early 1990s, and growth of exports has been fairly robust with the exception of 1996, 2002 and 2008 when there was a sharp drop in this growth. The robust growth of exports put the country in the league of top

20 countries demonstrating the fastest export expansion (Bhattacharya and Hossain, 2006). At the same time, Bangladesh was in the process of graduating from a predominantly aid-dependent economy to a trading economy in this decade as pointed out earlier.

Figure 3: Bilateral net trade balance of goods of Bangladesh with BRICS countries



Source: Direction of Trade Statistics database from IMF, 2014

We have analysed the bilateral net trade balance of goods value of Bangladesh as a percentage of BRICS countries in Figure 3. Since 1991 to 1994, the net trade balance of goods value of Bangladesh as a percentage of BRICS countries is stagnant, and after that the net trade balance of goods value direction is rising sharply in 1999. On the contrary, the net trade balance of goods value is falling from 2000 to 2013 but the net trade balance of goods value is rising in 2004-05. This also happens because liberalization is not accompanied by appropriate structural changes in the developing countries to adapt to the new challenges. Finally, the net trade of goods deficit has gradually shrunk, and the current account balance of merchandise items has reached a steady situation near the first half of the 2020s.

3. Model specification and data

3.1. Theoretical foundation

The *Gravity Model* of trade pioneered by Tinbergen (1962), Poyhonen (1963), Linneman (1966) and Anderson (1979) also represents a reduced form of a four-equation partial equilibrium model of export supply and import demand as in former approaches. The Gravity model is a bilateral trade model and in its most rudimentary form relates trade between two countries to their size (measured by national income and population) and the geographical distance between them (as a proxy of transport costs and home bias).

We have used the Gravity model specified by Deardorff (1997), Matyas (1997), and Anderson and Wincoop (2003) to estimate the trade balance function for Bangladesh. Volume of trade is a function of a country's income (GNPs or GDPs), population and distance (proxy for transportation costs). The gravity model was originally formulated in multiplicative form and also the model was assumed by fixed relative prices[4]. It denotes the relative prices - the price of a country's exports relative to the foreign price of related goods expressed in a common currency. The overall inflation or rise in the price level raises the real effective exchange rate and hence affects the trade (Roy and Rayhan, 2011).

The basic idea of the new approach is that in bilateral trade the *"absolute size"* of the country in terms of income and population is not so important, rather the "*relative size"* of the trading partners determines the export supply and import demand. The extended model of Khan and Hossain (2010) expresses the bilateral trade balance of country-*i* with partner country-*j* (TB_{ij})[5] as the ratio of exports over imports (X_{ij}/M_{ij}), which according to Bahmani-Oskooee (1991), Bahmani-Oskooee (2001), Thapa (2002), Hussain et al. (2003), and Shepherd (2012) is unit free and can be interpreted as nominal or real trade balance, and it allows focusing on the specific causes of trade imbalance between a country and its major trading partners. The extended model is presented as follows:

$$TB_{ij} = TB_{ij}\left(\frac{Y_i}{Y_j}, \frac{y_i}{y_j}, RER_{ij}, MWD_{ji}\right)$$

$$TB_{ij} = TB_{ij}(RGDP_{ij}, RPGNI_{ij}, RER_{ij}, MWD_{ji} \quad (1)$$

Where, $RGDP_{ij}$ = Relative GDP = $Y_i/Y_j = GDP_i/GDP_j$

$RPGNI_{ij}$ = Relative per capita income = y_i/y_j

RER_{ij} = Real exchange rate between country-*i* and country-*j,* and

MWD_{ji} = Import-weighted distance between country-*i* and country-*j*

3.2. Empirical method

In general, the bilateral trade balance of Bangladesh with BRICS countries is used in the empirical estimation based on different estimation techniques of static panel data analysis. To test empirically, ordinary least square (OLS) regression is applied to log-linear transformed for estimation, and adding time subscripts (t) and an error term (u_{it}) to equation (1) the of trade balance in the following way:

$$ln(TB_{ij}) = \beta_0 + \beta_1 ln(RGDP_{ij}) + \beta_2 ln(RPGNI_{ij})_t + \beta_3 (RER_{ij})_t + \beta_4 ln(MWD_{ji})_t + u_{it} \quad (2)$$

We have introduced $RGDP_{ij}$, $RPGNI_{ij}$, *and* MWD_{ji} in natural log (ln) forms but semi-elasticity of the trade balance (TB_{ij}) with respect to the RER_{ij}. That can reduce the problem of heteroskedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference.

The signs for the estimators associated with the variables in the model are expected to be similar to traditional theoretical expectations. That is, β_1 is expected to be negative. In other words, an increase in GDP of partner country-*j* relative to GDP of home country-*i* ($RGDP_{ij} = GDP_i/GDP_j$) will see a deterioration in the trade balance of the home country. If country-*j* (partner country) demands more of her domestic goods due to higher relative per capita GNI ($RPGNI_{ij}$) then demands more of country-*i*'s goods due to this income (absorption) rise, the sign of β_2 will be positive. It is expected that the effects of the real exchange rate (RER_{ij})[6] on trade balance is positive and the sign of β_3 will be positive. The more the real exchange rate (RER_{ij}) index raise the more there is a depreciation of the exporter's (country-*i*'s) currency with respect to the currency of her trading partner (country$_{j's}$), hence the trade balance (TB_{ij}) improves with increasing export competitiveness (elasticity approach). In our model we take bilateral import-weighted distance (MWD_{ji})[7] as a proxy for transportation (Khan and Kalirajan, 2011). The effects of import-weighted distance (MWD_{ji}) has a negative impact on the trade balance and the sign of β_4 will be negative.

3.3. Data

For the purpose of econometric analysis, the bilateral trade balance of Bangladesh comprising trade with her major trading partner BRICS countries, the data were collected from various sources from the period 1991 to 2013. Country-specific annual data required in the analysis relate to Gross Domestic Product (GDP at a constant 2005 US$ value), per capita Gross National Income (GNI at a constant 2005 US$ value), consumer price index (CPI at a constant 2005 value) and official exchange rates (units of foreign currency per BDT) for exporting and importing countries. Data on GDP, per capita GNI, exchange rates and CPI are obtained from the *World Development Indicators (WDI)* from the World Bank database, 2014. And also the geographical distance between Dhaka (capital of Bangladesh) and capital cities of respective partner countries-j are obtained from the World Bank website (www.econ.worldbank.org).

Data on Bangladesh's bilateral export to and import from the sample trading partners during the study period have been collected from the *Direction of Trade Statistics (DOT)* database from the International Monetary Fund (IMF) website. There were some missing data, which are filled in from the Bangladesh Bank publications - *Export Receipts* and *Import Payments* (various issues). The econometric software package *Eviews 7* is used to do the analysis. In the case of estimation of some of the techniques that are modified *MS Excel* has been used.

4. Test of the trade balance model[8]

To test the presence of the individual effects we must first estimate the unrestricted specification of the model in equation (2) that includes the effects of interest. The test results, the Eviews output, are displayed in Table 2. There are three sets of tests - the first set consists of two tests that evaluate the joint significance of the cross-section effects using sums-of-squares (*F*-test) and the likelihood function (*Chi-square* test) (Wooldridge, 2006). The two statistical values (7.78) and (43.14) and the associated *p*-values strongly reject the null that the effects are redundant. It indicates the presence of strong individual effects (country-specific effects).

Table 2: Test of individual effects

Redundant Fixed Effects Tests
Test Cross-Section and Period Fixed Effects
Dependent Variable: LNTB
Sample: 1991 2013; Periods: 23; Cross-sections: 6
Total panel (balanced) observations: 138

Effects Test	Statistic	d.f.	Prob.
Cross-section F	7.78	(5,106)	0.00
Cross-section Chi-square	43.14	5	0.00
Period F	3.70	(22,106)	0.00
Period Chi-square	78.75	22	0.00
Cross-Section/Period F	4.33	(27,106)	0.00
Cross-Section/Period Chi-square	102.63	27	0.00

The second set also consists of two tests that evaluate the joint significance of the period effects using the same two tests (*F*-test and *Chi-square* test). The two statistical values and the associated *p*-values also reject the null that the period effects are redundant. It means there is also the presence of period effects. The third test result evaluates the joint significance of all of the effects using the same two tests statistics. The results suggest that the corresponding effects are statistically significant. Therefore, cross-section specific (*i.e*. country-specific) effects tests of the model have been performed, and the presence of this type of effect is confirmed by the test result.

Table 3: Hausman test

Correlated Random Effects - Hausman Test
Test Cross-Section Random Effects
Sample: 1991 2013; Periods: 23; Cross-sections: 6
Total panel (balanced) observations: 138

Test Summary		Chi-Sq. Stat.	Chi-Sq. d.f.	Prob.
Cross-section random		22.87	4	0.00
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
LNRGDP	0.99	-8.56	14.724	0.01
LNRPGNI	-1.81	8.17	13.655	0.00

LNMWD	-0.68	-0.79	0.0018	0.00
RER	-0.01	0.02	0.0003	0.04

To perform the Hausman test, first a model with random effects specification has to be estimated (Hausman, 1978). The Eviews output in Table 3 presents the high value of Hausman Chi-square statistics (that is, low *p*-value) favour Fixed Effects Modelling and the low value of Hausman Chi-square statistics (that is, high *p*-value) favour Random Effects Modelling. Results show that there is a difference between the two estimators, with only the exception of RER. These results suggest that the Fixed Effects Model (FEM) is the appropriate panel data estimator for the present study, since the statistic provides no evidence against the null hypothesis that there is no misspecification.

All variables in the model are tested for multicollinearity. To check whether there is multicollinearity in the model we adopt the following procedure. We take the first column of Table 4, this gives the correlation of LNTB with the other LNRGDP, LNRPGNI, RER and LNMWD.

Table 4: Coefficients of Correlation Matrix

	LNTB	LNRGDP	LNRPGNI	LNMWD	RER
LNTB	1.00				
LNRGDP	0.62	1.00			
LNRPGNI	0.63	0.99	1.00		
LNMWD	-0.80	-0.89	-0.89	1.00	
RER	-0.01	-0.31	-0.30	0.30	1.00

Where 0.62 is the correlation between TB and RGDP, 0.63 is the correlation between LNTB and LNRPGNI, and so on, suggesting that there is no collinearity problem. As we can see, several of these pair-wise correlations are quite high, suggesting that there may be a severe collinearity problem. Only the correlation coefficient between LNTB and LNRPGNI is a bit higher, though it is still less than 0.80 (r = 0.63). Therefore it can be concluded that there is no severe multicollinearity in the model. And also we measure covariance as a multicollinearity problem of the relationship between LNTB with the LNRGDP, LNRPGNI, RER and LNMWD. As we expect, the values of the covariance indicates that the *p-value* is statistically significant, and are presented in Table 5.

Table 5: Analysis of Covariance Matrix

	LNTB	LNRGDP	LNPRGNI	LNMWD	RER
LNTB	2.20				

LNRGDP	1.06	1.32			
	(0.00)	---			
LNRPGNI	1.05	1.29	1.28		
	(0.00)	(0.00)	---		
LNMWD	-2.63	-2.26	-2.22	4.87	
	(0.00)	(0.00)	(0.00)	---	
RER	-0.15	-3.55	-3.44	6.64	100.42
	(0.00)	(0.00)	(0.00)	(0.00)	---

In the panel data analysis homoscedasticity is an underlying assumption. To test the heteroscedasticity in the model the Park test method has been adopted, which has good power of detecting herteroscedasticity of unknown form (Gujarati et al., 2009). The Park test of model (2) has detected the existence of heteroscedasticity in the observations within the group and in every observation. So, the most popular remedy for heteroscedasticity called - heteroscedasticity corrected standard errors technique is used for estimation of fixed effects of the model as shown in Table 6. It focuses on improving the estimation of the standard errors of estimators without changing the estimates of the slope coefficients.

The Eviews output of the estimation results of the fixed effects model provide the Durbin-Watson (DW) test statistics. The DW statistic in the fixed effect estimation output is about 0.71 which indicates the presence of serial correlation in the residuals. To remedy the first-order serial correlation – the Generalized Least Squares (GLS) estimator – is used to yield unbiased and efficient parameter estimates. The Eviews output of the Autocorrelated Error Structured Fixed Effect Model is shown in Table 6.

Table 6: Autocorrelated Error Structured Fixed Effects Model

Dependent Variable: LNTB
Method: Panel Least Squares
Sample: 1991 2013; Periods: 23; Cross-sections: 6
Total panel (balanced) observations: 138
Convergence achieved after 6 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRGDP	-15.46	3.33	-4.64	0.00
LNRPGNI	15.25	3.43	4.45	0.00
LNMWD	-0.83	0.09	-8.94	0.00
RER	0.03	0.02	2.01	0.04
C	-0.41	0.12	-3.38	0.00
AR(1)	0.71	0.06	12.41	0.00
R-squared	0.91	Mean dependent var		-1.74
Adjusted R-squared	0.90	S.D. dependent var		1.46
S.E. of regression	0.45	Akaike info criterion		1.29
Sum squared resid	25.70	Schwarz criterion		1.42
Log likelihood	-79.31	Hannan-Quinn criter.		1.34

F-statistic	248.49	Durbin-Watson stat	1.88
Prob(F-statistic)	0.00		
Inverted AR Roots	0.71		

As a rule of thumb, with 132 panel (balanced) observations and only four independent variables, the DW statistic value is D_L=1.679 and D_U= 1.788. Computed DW, d =1.884, is greater than D_U= 1.788. Thus there is no evidence of positive first-order serial correlation. In this error corrected model *AR(1)* tends to have better behaved standard errors differing slightly causing different t-scores) and the estimates of the slope coefficients tend to be identical and have similar signs, depending on the convergence characteristics.

5. Trade balance of Bangladesh - the empirical results

In the present model, the bilateral trade balance of Bangladesh with BRICS countries is used in the empirical estimation based on different estimation techniques of static panel data analysis. To test empirically, the intercept term β_o is considered to be country-specific and the slope coefficients are considered to be the same for all countries. The country-specific fixed effects are reported in Table 7.

Table 7: Country-Specific Effects

Country	Effect
Bangladesh	1.70
Brazil	-0.80
China	-1.64
India	-0.22
Russia	0.06
South Africa	0.90

Table 8 reports the regression result. The coefficient of relative GDP (*RGDP*) is negative (-8.14) and highly significant (*p-value* is 0.02). This implies that the trade balance of Bangladesh deteriorates when the GDP of partner countries increases relatively more than that of Bangladesh. This happens when the GDP of the partner country increases at a higher rate than that of Bangladesh. This means the partners' production and exporting capacity increase at a higher rate than that of Bangladesh. In bilateral trade, this usually results in more exports to Bangladesh or fewer imports from Bangladesh, and hence, adversely affects the balance of trade of Bangladesh.

Table 8: Hetero-Corrected Fixed Effect Model

Dependent Variable: LNTB
Method: Panel Least Squares

Sample: 1991 2013; Periods: 23; Cross-sections: 6
Total panel (balanced) observations: 138
White cross-section standard errors & covariance (no d.f. correction)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRGDP	-8.14	3.57	-2.27	0.02
LNRPGNI	7.01	2.59	2.71	0.01
LNMWD	-0.73	0.04	-16.07	0.00
RER	0.04	0.02	2.10	0.03
C	-2.27	0.77	-2.93	0.00
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.82	Mean dependent var		-1.68
Adjusted R-squared	0.81	S.D. dependent var		1.49
S.E. of regression	0.65	Akaike info criterion		2.05
Sum squared resid	54.46	Schwarz criterion		2.26
Log likelihood	-131.66	Hannan-Quinn criter.		2.14
F-statistic	65.08	Durbin-Watson stat		0.59
Prob(F-statistic)	0.00			

The coefficient of the relative per capita GNI is positive (7.01) and also highly significant as expected. Since the per capita GNI is the determinant of the absorption capacity of a country, the, higher relative per capita GNI (*RPGNI*) implies a higher absorption capacity of the country. Due to the increase in absorption capacity, it is expected that the country imports more. Trading partners of Bangladesh with higher *RPGNI* relatively import more from Bangladesh, improving its balance of trade. The relative per capita GNI gives the income differential between country pairs, denoting the differences in factor endowment between trade pairs. So, from the trade perspective, the positive sign of this coefficient also indicates that the *Heckcher-Ohlin effect*[9] dominates the *Linder effect*[10] in the case of Bangladesh.

The positive sign of the coefficients of real exchange rate (*RER*) is consistent with *a priori* expectations. The coefficients are highly significant, though their value is low at 0.04. The positive sign of the coefficient of the real exchange rate (RER_{ij}) implies that the more the index of RER_{ij} increase the more there is depreciation of the Bangladeshi Taka (as the exporter's currency) with respect to the currencies of her partners. This will increase the export competitiveness of Bangladesh and hence will improve her trade balance (TB_{ij}).

On the contrary, the negative sign of the coefficients of the import-weighted distance (*MWD*) is consistent and highly significant, though their value is at -0.73. The import-weighted distance (MWD_{ji}) as a proxy of transport cost represents an obstacle (or 'resistance') to trade. The significant negative value of the coefficient of MWD_{ji} indicates that Bangladesh tends to import relatively more from neighbouring countries than it exports and this results in a negative effect on her trade balance. But the elasticity of transport cost (proxied by MWD_{ji}) is not high (-0.73), indicating that the trade balance of Bangladesh is not very sensitive to transport cost. The value of the coefficient -0.73 indicates that when the distance between Bangladesh (country-*i*) and

partner country (country-*j*) increases by 1%, the bilateral trade balance, expressed as a ratio of export to import, decreases by 0.73%.

Table 7 reports the country-specific effects (fixed effects) of White's heteroscedasticity corrected model. The estimates of the country specific effects do not report the standard errors, since Eviews treat them as nuisance parameters for the purpose of estimation. The reported *R*-square and *F*-statistics of the regression output of Table 8 are based on the difference between the residuals sums of squares from the estimated model, and sums of the squares from a single constant-only specification, not from a fixed-effect-only specification. As a result, the interpretation of these statistics is that they describe the explanatory power of the entire specification, including the estimated fixed effects reported in Table 7. The *R*-square is 0.82 and *F*-statistics are highly significant, in which the *p-value* is 0.00. This implies that including estimated fixed effects, the entire model explains 82 percent of variations in the trade balance.

The autocorrected error structured model of Table 6 also supports the above analysis though the values of the coefficient are slightly different for explanatory variables. The reason might be that the estimation drops one observation for each cross-section (country) when performing autocorrelation correction *AR(1)* differencing. The magnitude and the sign of the coefficients are very similar.

6. Summary and conclusions

The analysis shows that the economy of Bangladesh in recent years has improved its growth performance and strengthened its macroeconomic structure, despite an unfavourable trade balance position. The factors determining trade in the popular gravity model have effects on the trade balance model. The trade balance depends on the relative size of a country measured by the relative GDP, and relative absorption capacity of a country measured by the relative per capita GNI of the partner countries to the home country. It also depends on the conventional variables like real exchange rate and import-weighted distance of the partners. Here import-weighted distance proxies for transportation cost which is more appropriate than the absolute distance in the gravity model. The static cross country panel data analysis of the bilateral trade balance of Bangladesh has been the main focus of the study.

In static panel data models, Fixed-Effects estimators are used. Bangladesh's trade with her trading partner BRICS countries over the period from 1991 to 2013 has applied a static panel data analysis technique. The individual test confirms the existence of individual (country specific) effects and the Hausman test results suggest that the Fixed Effects Model of panel estimation is the appropriate model for the study. The coefficients of correlation and covariance matrix do not detect the existence of multicollinearity of the explanatory variables of the model. The White's test detected heterscedasticity in the observations within the group and in each

observation. Accordingly, White's heterscadasticity corrected covariance matrix estimator, which is considered as a robust method, is used for estimation of the fixed effects model.

The empirical result shows that the coefficient of relative GDP ($RGDP_{ij}$) is negative and highly significant, implying deterioration of the trade balance of Bangladesh with the increase in the relative GDP of partner countries. The significant positive impact of relative per capita GNI ($RPGNI_{ij}$) implies that an increase in partners' per capita income differential with Bangladesh improves the trade balance of Bangladesh, since it increases the absorption capacity of the partners comparatively, inducing them to import more. The positive sign of the coefficient of the real exchange rate (RER_{ij}) implies that an increase in the index of RER_{ij} with respect to the currency of her partner will increase the export competitiveness of Bangladesh and hence will improve her trade balance (TB_{ij}). The significant negative sign of import weighted distance (MWD_{ji}) indicates that the greater the MWD_{ji} the lower the trade. The results also provide some useful insights into the trade balance of Bangladesh and the effects of trade regime change on her trade balance. The static panel data analysis explores the cross-country variations as well as the time-invariant country-specific effects on trade balance with heterogeneous economies and finds significant effects of all relative factors on the trade balance of Bangladesh.

Notes:

1. BRICS -- coined by Jim O'Neill of Goldman Sachs in 2001 in the context of forecasting global economic trends -- has actually brought together leaders from disparate countries - Brazil, Russia, India, China and South Africa to form a global alliance of emerging economies.

2. Table-1 shows all data in 2013. Here exports and imports of goods and services (bil. US$) in 2012, and South Africa in 2011; foreign exchange reserves (bil. US$) in 2012; GDP (current) of South Africa in 2012; per capita GDP (current prices/US$) and growth rate of South Africa in 2011; Trade ratio of goods and services (%) in 2012; economically active population (%) in 2012; unemployment rate (%) Brazil and South Africa in 2012.

3. The groups are all classified World Bank member economies. These are: low income, $995 or less; lower middle income, $996–3,945; upper middle income, $3,946–12,195; and high income, $12,196 or more. Other analytical groups based on geographic regions are also used. Geographic classifications and data reported for geographic regions are for low-income and middle-income economies only. Low-income and middle-income economies are sometimes referred to as developing economies.

4. Relative price is a reasonable assumption for Bangladesh at the aggregate level as the terms of trade (TOT) has moved around 100 for a long time with some deterioration in recent years.

5. The "*relative size"* of the trading partners determines the export supply and import demand. Since the trade balance of a country is denoted by the ratio of her exports and imports (X_{ij}/M_{ij}), in bilateral trade the GDP of country-*i* relative to her partner country-*j* has impact on her trade balance. The trade balance can be expressed as $TB_{ij} = X_{ij}^{s} / M_{ij}^{d}$.

6. Data on exchange rates are available in national currency per US dollar for all countries. These rates are converted into the national currency of all countries in terms of Bangladesh's currency, which is per BDT exchange rate (ER_{ij}). In measuring RER_{ij} (= $1/ER_{ij}$ .P_i/P_j), P_i/P_j is proxied by CPI_i/CPI_j== Real exchange rate between country-*i* and country-*j*.

7. Import-weighted distance: In measuring import-weighted distance between country-*i* and country-*j* (MWD_{ji}), the weight (W_{ji}) is the ratio of bilateral import volume from respective partners to total import volume of Bangladesh. MWD_{ji} = ratio of bilateral import volume of country-*i* and country-*j* × distance.

8. After operating the analysis in software *EViews 7* version, we got a significant result and observing the obtained result we can illustrate the macroeconomic variables in Bangladesh.

9. The proposition of the Heckscher-Ohlin effect is that a country has "comparative advantage" in the production of that commodity which uses more intensively the country's more abundant factor.

10. Linder hypothesis suggests that, the demand structure in two countries will be similar for the similarities of per capita income.

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