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Bangladesh's Trade with Asia: What Do Gravity Models Tell Us?

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External trade has played a crucial role in Bangladesh's strong economic growth and structural transformation, in the backdrop of rising prosperity in Asia as a whole. This paper examines the effect of national incomes and trade costs of three key Asian sub-regions—which "powered" the overall growth and prosperity in Asia as a whole—on Bangladesh's external trade. The paper used the gravity model of international trade to test its validity in explaining Bangladesh's trade with the sub-regions. Alternative empirical specifications of the model were econometrically estimated. The parameter estimates indicate that the central hypothesis of the gravity model is valid, i.e., trade between any two countries is directly proportional to their national incomes and inversely proportional to their trade costs. In line with these predictions, Bangladesh's trade with the three key Asian sub-regions were found to be positively related to their GDPs and inversely related to trade costs. The predictive power of the estimated gravity models is also high. The statistical tests relevant to the econometric estimation of the specified model and the data used were conducted to ensure that the parameter estimates were robust. The model thus provides a solid basis for forecasting medium-term trade growth with the key Asian sub-regions, and hence it has a value to Bangladesh's planners and policymakers. The results also imply that Bangladesh should pay greater attention to reviving trade (and industry) reforms to benefit from growing prosperity in its continental neighbourhood.

Keywords: Asian Sub-regions, Bangladesh, Gravity Model, Trade, GDP, Trade Costs
JEL Classification: F15, F17, F43, R12

I. INTRODUCTION

Strong growth in external trade in the last three decades has been one of the key drivers of Bangladesh's economic growth and social transformation. The sharp increase in readymade garment (RMG) exports and its substitution for jute and jute goods exports contributed to easing the balance of payments constraint. The RMG

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sector currently accounts for over 80 per cent of total export earnings and employs more than 4 million workers, almost 80 per cent of whom are female. The growth of RMG exports also led to structural change in Bangladesh's GDP driving up the share of manufacturing and significantly reducing the share of agriculture in GDP. The manufacturing sector is critical to achieving the government's high growth target of 8 per cent per year. At independence, Bangladesh's exports accounted for a mere 6 per cent of GDP, and its trade-GDP ratio was 19 per cent. These are currently estimated at 15 per cent and 38 per cent, respectively. The trade deficit as a share of GDP declined from 40 per cent in 1972 to 8 per cent in 2018. Mirroring the decrease in import financing requirements, the country's aid-GDP ratio fell to 1.7 per cent at present. Along with the impressive growth of overseas remittances, the changes in the external sector stabilised the balance of payments. The external sector has, therefore, played a significant role in the "Bangladesh growth story."

Given the country's ambitious medium- and long-term growth aspirations—achieving mid-middle income status by 2020, upper middle-income country status and the SDGs by 2030 and developed country status by 2041 (GoB 2018a and GoB 2018b), external trade must play a much greater role in the economy. It requires increasing the share of exports in GDP further as well as increasing the trade-GDP ratio. The relative "inwardness" common across most South Asian countries contrasts sharply with East and South-East Asian countries which have higher trade-GDP ratios, i.e., more open trading regimes. Bangladesh's trade-GDP ratio at 38 per cent currently is even lower than the average for South Asia at 43 per cent. And, the trade-GDP ratios for East Asia and South East Asia are 53 per cent and 156 per cent, respectively.

The emergence of Asian economies, especially China, India and the ASEAN, has dramatically changed the structure of global trade in the past three decades. A closer look at Asian economic growth indicates three sub-regional "growth poles"—China, Japan and Korea in the northeast, the ASEAN10 (referred to as ASEAN hereafter) in the south-east, and South Asia in the south-west. While the importance of Chinese and Indian growth has dominated the discussion on global economic growth since the turn of the present century, the importance of the ASEAN sub-region is of great reckoning as well in the "emerging Asia" story (Rahman 2014). The ASEAN, too, has one of the most impressive records of economic and social progress since the 1970s. Together, their economies are worth \$2.9 trillion compared with India's \$2.7 trillion in 2019. In the past decade, most of the sub-regions' countries have virtually eliminated poverty—the population below the $1.25 per day poverty line has declined to 3 per cent from 14 per cent in the past decade. The sub-region has a population of over 600 million, a large share of which is young and yielding rich demographic dividends. It has deepened trade integration and established a free trade zone intending to achieve a common market. The ASEAN has come a long way towards forging a sub-regional identity and has a high likelihood of becoming an economic "powerhouse" by 2050.

Table I shows changes in the structure of Bangladesh's trade. The country's imports from the three Asian sub-regions increased from 55 per cent in 2005 to 66 per cent in 2018, while its exports rose from 6 per cent to 11 per cent. Export growth in this period is explained almost entirely by East Asia, and more specifically by exports to China, since the exports to South Asia (in this case India) and South East Asia remained at around 2 per cent. Bangladesh is located at the crossroads between South Asia and the other two Asian growth poles and, as such, can effectively leverage the rising prosperity in its wider neighbourhood to achieve its medium- and long-term growth and social objectives.

TABLE I

BANGLADESH'S TRADE WITH ASIA

Trade Indicators	2005	2010	2015	2018
Share of Bangladesh's total export (%)				
South Asia	1.93	2.43	2.33	2.66
East Asia	2.82	4.15	6.69	7.01
Southeast Asia	1.67	0.77	1.21	1.63
Rest of the world	93.58	92.64	89.77	88.69
Share of Bangladesh's total import (%)				
South Asia	14.49	13.37	15.19	16.59
East Asia	26.86	33.33	38.36	35.18
Southeast Asia	14.04	17.33	12.72	14.31
Rest of the world	44.61	35.97	33.74	33.91
Share of Bangladesh's total trade (%)				
South Asia	9.13	8.98	9.59	10.97
East Asia	16.59	21.63	24.56	23.82
Southeast Asia	8.76	10.69	7.70	9.20
Rest of the world	65.53	58.71	58.16	56.01

Source: Authors' calculation based on DOTS (2019) database.

The main question we address in this paper is: what does the rising economic prosperity in Asia (and its key sub-regions) imply for Bangladesh's external trade? The question is important in light of Bangladesh's medium and long term economic objectives. The paper uses the gravity model of international trade since it is an elegant method of estimating the role of national incomes and trade costs in external trade between trading partners. As distinct from most gravity models used in the literature, where the interest has been in trade policy simulations, such as the impact of special trading arrangements on a given country's trade, this paper's central interest is in testing the validity of the model for Bangladesh's trade with some of its most crucial Asian sub-regions. Section II provides a brief review of the relevant literature. Section III discusses the methodology and data used in the paper. Section IV presents the results of the econometric estimation of alternative model specification. And, Section V contains the conclusions and implications for policy.

II. LITERATURE REVIEW

The gravity model is rooted in Newton's law of universal gravitation, which proposes that the force of attraction between two given objects is directly proportional to their mass and inversely proportional to the distance between them. The idea of the model has been used by economists to analyse issues of international trade, migration, and some other areas. It has contributed in particular to the understanding of bilateral trading patterns by indicating that trading costs and national incomes are important in explaining countries' trade behaviour. Among economists, the gravity model was first used by Tinbergen (1962) followed by Poyhonen (1963) to describe the volume of bilateral trade between countries. Since then, it has been used widely in the international trade literature and has experienced a renewed interest in the past two decades. The model has provided some of the clearest and most robust empirical results in the analysis of international and regional trade (Leamer and Levinsohn 1995).

In its basic form, the gravity model of international trade, following Newton's law, proposes that the trade flows between two given countries, X_{ij}, is directly proportional to their national incomes ($GDP_i \; and \; GDP_j$) and inversely proportional to the distance (D_{ij}) between them. The distance variable, however, has been more commonly specified to represent transportation cost—the farther the distance between two trading countries, the more the transport cost is likely to be. The trade between countries involves not only transport costs due to distance, i.e., freight cost, but also other trading costs such as tariff and non-tariffs costs and transaction costs. Thus, the basic specification of the basic gravity model used in international trade is as follows:

$$(X_{ij}) = A\ \frac{GDP_i * GDP_j}{D_{ij}} \quad ;\ i \neq j \tag{1}$$

where i and j are two given trading countries.

Depending on the research question, trade theorists and empirical researchers have used the basic gravity model specified in (1) above or variants of it, to account for factors such as trade and non-trade barriers, borders, institutions, and transactions cost, etc. Per capita GDP rather than total GDP has also been used in augmentations of the basic model. The model is simple and intuitive and has proved to be an "empirical workhorse" due to its ability to predict bilateral trade flows accurately (Krugman 2015). It has been extensively used to study the impact of lowering trade barriers on bilateral trade flows and free trade regimes. Since the early empirical estimations of the basic gravity model, many advances have been made to improve its theoretical underpinnings. Armington (1969) argued that goods traded across regions are imperfect substitutes and hence are not produced in the regions where output price is the lowest. Based on this assumption, Anderson (1979) developed a model where goods are differentiated by country, and consumers had differentiated preferences. The theory implies that regardless of prices, at least a few products of each partner country would be chosen by a country in its consumption basket. The theory further states that the comparative advantage would not be the only criteria for a country to produce goods and services (WTO 2012). Anderson (1979) initiated the formulation of a theoretical gravity model. The earliest gravity model reflecting key propositions of modern trade theory was, however, formulated by Anderson and Wincoop (2003). They proposed that exports from country i to j depends on trade costs across all possible markets, and termed it "outward multilateral resistance." Contrarily, imports of country i from country j depends on the trade costs of all possible suppliers (Khan, Akbar and Sadique 2013). They termed such dependence, "inward multilateral resistance." They included these two additional variables, i.e., outward multilateral resistance and inward multilateral resistance in an augmented gravity model to capture the effect of the two types of dependencies. Other augmented gravity models of interest include Chaney (2013), Helpman, Melitz and Rubinstein (2008), and Eaton and Kortum (2002). The most important limitation of the Gravity Model is that it does not consider factors beyond incomes and trade or transaction costs in explaining trade flows between countries.

III. METHODOLOGY AND DATA

3.1 Empirical Model

In estimating the gravity model, we used the basic specification (02, below) and some variants, which follow in Section IV.

$$LNTT_t = \beta_0 + \beta_1 LGDPD_t + \beta_2 LGDPF_t + \beta_3 LWTC_t + e_t \quad (2)$$

where,

β_1>0, β_2>0 and β_3<0.

$LNTT$= log of total trade (export plus import) of Bangladesh

$LGDPD$ = log of GDP of Bangladesh

$LGDPF$= log of the trade-weighted GDP of the sub-region concerned

LWTC= log of (trade-weighted) trade costs

e_t= stochastic error term

The empirical model was estimated using both OLS and IV methods. The latter involves a two-stage OLS estimation method. In the first stage, the following OLS regression model is estimated,

$$LGDPD_t = \alpha_0 + \alpha_1 LK_t + \alpha_2 LC_t + \alpha_3 LN_t + \mu_t \quad (3)$$

where,

LK = log of investment-GDP ratio

$LC =$ log of human capital accumulation (log of literacy rate)

$LN =$ log of working-age population

The instrumental variables above are commonly used in first stage regression, and the result is shown in the Appendix (Table A.7).[1] In the second stage, predicted values of the dependent variable (LGDPD) of the first stage regression (i.e. specified in (3)) were used as a regressor in the gravity model specified in (2) to obtain consistent estimates of GDP (Cyrus 2002).

[1] See, for example, Cyrus (2002). This is further explained in Section IV below.

3.2 Data

Most empirical studies have used cross-section data for econometric estimation. Some of the studies also used panel data (Bhattacharya and Bhattacharya 2007). The trade cost data, in both cases, vary substantially across countries. In a departure from this approach, we have used time-series data in estimating the gravity models in this paper. Since the physical distance between trading countries does not vary over time, i.e., it poses a problem for the econometric estimation. However, time-series data on trade-weighted trade cost (as defined above) and trade-weighted physical distance both vary over time, and hence does not pose a problem for the econometric estimation of gravity models using such data.

A second feature of the empirical model estimated in this paper is that it involves sub-regions rather than countries given our interest in investigating Bangladesh's trade with the Asian sub-regions and not individual countries. We, therefore, need to define the subregions used, i.e., which countries are included in each of them, as well as to construct an aggregate income variable for the sub-region. Bangladesh's major trading partners in Asia may be meaningfully grouped by into three sub-regions, i.e., South Asia, South East Asia and East Asia. We also define a fourth region, i.e., South East Asia and East Asia combined. Only the most important trading partners of Bangladesh in Asia were included in each sub-region. Thus, South Asia includes India, Pakistan, Nepal, and Sri Lanka; Southeast Asia includes Indonesia, Malaysia, Singapore, and Thailand; and East Asia includes China, Japan, and South Korea. The dependent variable is the annual total trade (exports plus imports) of Bangladesh in nominal US dollars. The income variable for each sub-region was then computed as the weighted average of the GDP of each country in the concerned sub-region, the weights being each country's trade share in Bangladesh's trade. The sub-regional trade cost was likewise computed as a trade-weighted average cost of trade for each sub-region. We used both the trade cost variables: ((i) trade-weighted physical distance between capital cities and (ii) trade-weighted trade cost in the gravity model estimations.

All data, except the trade cost in the paper, were obtained from the IMF's Direction of Trade Statistics (DOTS 2019), IMF's International Financial Statistics (IFS 2019) and The World Bank's World Development Indicators (WDI 2019). The data on trade costs were sourced from the ESCAP-World Bank Trade Cost Database (ESCAP 2018). Since the trade cost database is available for 1995-2017, the data for the remaining years (1980 to 1994 and 2018) were obtained by extrapolating the three years moving average. The data on the physical distance between countries has been sourced from the CEPII geographical distance database (CEPII 2011).

IV. ECONOMETRIC ESTIMATION OF THE MODEL

Table III shows the OLS results of the econometric estimation of the empirical gravity model specified in (2) above, for all four sub-regions, i.e., South Asia, East Asia, South East Asia and South East Asia and East Asia combined. All variables of the estimated model in Table III are in nominal values, and the trade cost variable is the trading costs (ESCAP 2018) not physical distance. The signs of all estimated parameters are in line with the expectations of the model. In the case of South Asia, the estimated parameters for both GDPs and trade cost are highly significant. For East Asia, the three variables remain significant, although the error probability level for the estimated trade cost parameter is 10%. The results for the two sub-regions are robust and provide evidence in support of the gravity model in explaining Bangladesh's external trade with the two Asian sub-regions. They indicate that Bangladesh's trade volume is positively related to the size of its GDP and the three sub-regional GDPs, and negatively related to the trade costs, as predicted by the gravity model. In other words, Bangladesh's trade increases as the size of the sub-regional economies increase, but higher trade costs reduce Bangladesh's trade volume with the two sub-regions. A corollary to this is that lower trade barriers between Bangladesh and the two sub-regions increase the former's trade volume (Raihan and Khan 2017). The model specified in (2) above, was also estimated with Bangladesh' annual trade volume in real rather than nominal US dollars, where export and import value indexes in US dollars (i.e., of USA) were used as the relevant deflators. The results of model estimations using real values of all variables are shown in the Appendix (see Tables A.11-A.13).

TABLE III

ECONOMETRIC ESTIMATES OF GRAVITY MODEL SPECIFIED IN EQUATION (2)

Variables	(1)	(2)	(3)	(4)
	LNTT	LNTT	LNTT	LNTT
	South Asia	East Asia	South-East Asia	East & South East Asia
LGDPD	0.926***	1.822***	1.711***	1.713***
	(0.315)	(0.114)	(0.217)	(0.109)
LGDPF	0.740***	0.336**	-0.034	0.214**
	(0.179)	(0.158)	(0.114)	(0.101)
LWTC	-1.227**	-1.010*	-1.356	-1.253
	(0.486)	(0.597)	(1.009)	(0.835)
CONSTANT	-8.659***	-13.089***	-6.190	-7.443
	(2.924)	(3.869)	(5.503)	(5.901)
Observations	39	39	39	39
R-squared	0.986	0.989	0.985	0.991

Note: *, ** and *** indicate the significance of the estimated parameters at 10%, 5%, and 1% error probability levels, respectively. Figures in parentheses are robust standard errors. All variables are in logarithms. LNTT is the dependent variable.

Since the model parameters are estimated using time series data, it is imperative to check if the variables are stationary. If the time series is not stationary and not cointegrated, OLS regression will yield spurious parameter estimates. To test for stationarity, we used the Augmented Dickey-Fuller (ADF) test, which indicated that some of the variables are integrated of order one (I(1)). In contrast, others are integrated of order zero (I(0)), i.e., in the level form (Dicky-Fuller 1979). These results are shown in Appendix Tables A.1-A.4. We then did the co-integration test to check for a valid long-run level relationship among the dependent and independent variables (X, Y variables) before re-estimating the gravity models. Since the variables under consideration are a mix of I(0) and I(1), the Autoregressive Distributed Lags (ARDL) Bound Test (Pesaran *et al*. 2001) was used to identify the possible long-run level relationship between the X, Y variables. Another motivation for undertaking the ARDL bound test is that the sample size of our model is rather small (n=39) and the test can identify the valid long-run level relationship among the X, Y variables even in small samples ((Narayan 2005, Majid 2008)). Based on the F and t-statistic of the ARDL Bound Test, we reject the null hypothesis of "no level relationship" among the gravity model variables (see Appendix Tables A.5 and A.6). In other words, the test indicates a valid long-run relationship among the gravity model variables for all sub-regions of our analysis.

The specification of the empirical gravity model has Bangladesh's trade as the dependent variable and its own GDP as one of the independent variables. Due to possible interdependence of these two variables, especially when time series data are used, it is necessary to check for endogeneity between these two variables. Although there is no further a priori grounds to suspect endogeneity between the dependent variable and the other independent variables, i.e., foreign GDP and trade cost, it is advisable to eliminate this possibility in these cases as well. Since endogeneity between the dependent and one or more independent variable(s) of the model will result in misspecification and inconsistent parameter(s) estimates, if OLS regression method is used (Gujarati 2004). Problems of endogeneity between national income and trade are reported in several empirical studies (Kaur, Sarin and Dhami 2017, Abbas 2012, Shakouri and Yazdi 2012, Zestos and Tao 2002, Michael 2002, Cyrus 2002, Amiri and Gerdtham 2012), and Bangladesh (Hossain, Haseen and Jabin 2009).

However, inconsistent parameter estimates obtained from OLS regressions can be corrected by applying the Instrumental Variables (IV) method.[2] Previous studies using the IV method in gravity models have used an array of different variables as instruments. Mankiw, Romer and Weil (1992) and Cyrus (2002), for example, used factor accumulation variables, such as the physical capital accumulation rate (investment-GDP ratio), human capital accumulation rate (share of working-age population in secondary schools) and population growth rate (growth rate of working-age population) as instruments for GDP in gravity regressions. Wei (1996), on the other hand, used the population size as an instrument for the size of the economy (i.e. GDP) in the gravity model. We used the investment-GDP ratio, literacy rate and size of the working-age population as instruments for Bangladesh's GDP.

The OLS results for South-East Asia, shown in Table III, were problematic—neither the sub-region's estimated GDP nor the trade cost parameter had the correct signs. Moreover, neither is statistically significant, while Bangladesh's GDP is statistically significant and has the expected sign. Arguably, these results reflect an endogeneity problem. To check this, the gravity model was re-estimated using the IV method. The results of the estimation are shown in Table IV. The parameter

[2]The idea is to replace the priori "suspect" independent variable with an instrument or proxy which ensures that there is no endogeneity, and hence provides an unbiased parameter estimate. This is the approach taken in the current paper.

estimates and robust standard errors change very little. For South Asia and South East Asia, they are almost identical for East Asia, East and South East Asia combined. Since we did not find much difference between the coefficients of OLS and IV models, we performed the Durbin Score Test (Durbin 1954) and Wu-Hausman Test (Wu 1974 and Hausman 1978) of instrumental validity to check the validity of the instruments used in the gravity model. The results (see Appendix Tables A.8 and A.9) of both tests suggest that the null hypothesis of "no endogeneity" cannot be rejected. Hence, we conclude that there is no problem of endogeneity in the OLS estimates of Table III.

TABLE IV

INSTRUMENTAL VARIABLE REGRESSION RESULTS OF THE BASIC GRAVITY MODEL

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LNTT	LNTT	LNTT	LNTT	LNTT	LNTT	LNTT	LNTT
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	South Asia		East Asia		Southeast Asia		East & Southeast Asia	
LGDPD	0.926***	1.073***	1.822***	1.823***	1.711***	1.818***	1.713***	1.720***
	(0.315)	(0.296)	(0.114)	(0.111)	(0.217)	(0.297)	(0.109)	(0.106)
LGDPF	0.740***	0.659***	0.336**	0.336**	-0.034	-0.094	0.214**	0.210**
	(0.179)	(0.173)	(0.158)	(0.151)	(0.114)	(0.150)	(0.101)	(0.097)
LWTC	-1.227**	-1.092**	-1.010*	-1.009*	-1.356	-1.188	-1.253	-1.240
	(0.486)	(0.433)	(0.597)	(0.566)	(1.009)	(1.021)	(0.835)	(0.788)
CONSTANT	-8.659***	-9.685***	-13.089***	-13.088***	-6.190	-7.382	-7.443	-7.526
	(2.924)	(2.600)	(3.869)	(3.665)	(5.503)	(5.830)	(5.901)	(5.569)
Observations	39	39	39	39	39	39	39	39
R-squared	0.986	0.985	0.989	0.989	0.985	0.985	0.991	0.991

Note: *, ** and *** indicate 10%, 5% and 1% level of significance respectively. Values in parentheses are robust standard errors. All variables are in logarithms. LNTT is the dependent variable.

Again, given that our econometric estimates are based on time-series data, we checked if multicollinearity was causing the estimates of sub-regional GDP and trade cost to have large standard errors in Table III. In the presence of multicollinearity, the parameter estimates would still be unbiased but not efficient. The model would thus still be a valid tool for analysis and forecasting. We, nevertheless, used three tests to check for the presence of multicollinearity among the independent variables of the estimated gravity model: (i) Variance Inflation Factor (VIF), (ii) Tolerance (i.e. the inverse of VIF), and (iii) correlation of coefficients. The test parameters indicated a high degree of multicollinearity among the two national income variables in the case of South Asia and South East

Asia but a moderate or low degree of multicollinearity in the case of other sub-regions namely, East Asia and East and South East Asia combined (see Appendix Table A.10).

Multicollinearity is a difficult problem to correct and econometricians, therefore, tend to ignore it. We, however, attempted to correct it by estimating a variant of the gravity model in which the domestic GDP variable was excluded—a simple fix. The gravity models thus estimated are shown in Table V. The results generally improve for all sub-regions but markedly for South East Asia for which both the foreign GDP and trade cost variables not only have the expected signs but are also highly significant. We recognise that excluding any one of the two GDP variables—in this case, the domestic GDP—alters the basic notion of "gravity" in the gravity model. To economists interested in forecasting and policy analysis the models in Table V are nevertheless meaningful. They also show that the basic hypothesis of the gravity model, i.e., Bangladesh's trade is directly proportional to the three sub-regional GDPs and inversely proportional to trade costs with South East Asia, holds for all sub-regions. Further, the results indicate that Bangladesh' trade is the most sensitive to increases in South East Asia's trade costs, among all the sub-regions.

TABLE V

REGRESSION RESULTS OF THE GRAVITY MODEL (CORRECTED FOR MULTICOLLINEARITY)

VARIABLES	(1)	(2)	(3)	(4)
	LNTT	LNTT	LNTT	LNTT
	South Asia	East Asia	South East Asia	East & South East Asia
LGDPF	1.256***	2.195***	0.926***	1.347***
	(0.044)	(0.197)	(0.145)	(0.250)
LWTC	-2.081***	-1.777*	-4.057***	-4.493**
	(0.434)	(1.026)	(1.286)	(1.705)
CONSTANT	-2.186	-15.616**	12.921*	11.784
	(2.004)	(6.571)	(6.405)	(12.311)
Observations	39	39	39	39
R-squared	0.981	0.899	0.956	0.919

Note: *, ** and *** indicate 10%, 5% and 1% level of significance respectively. Values in parentheses are robust standard errors. All variables are in logarithms. LNTT is the dependent variable.

We noted above that the basic gravity model was also estimated, i.e., one in which the trade cost variable in the model is the physical distance between the two trading countries—in our case, the trade-weighted physical distance, rather than the tariff, non-tariff, transport cost and other transactions cost. The results of the estimations are shown in Table VI and may be compared to those shown in Table III.

TABLE VI

REGRESSION RESULTS OF THE GRAVITY MODELS (WITH NOMINAL TRADE VOLUME AS DEPENDENT VARIABLE AND PHYSICAL DISTANCE AS PROXY OF DISTANCE BETWEEN COUNTRIES)

Variables	(1)	(2)	(3)	(4)
	LNTT	LNTT	LNTT	LNTT
	South Asia	East Asia	South East Asia	East & South East Asia
LGDPD	1.207**	0.898**	1.968***	1.452***
	(0.466)	(0.367)	(0.196)	(0.230)
LGDPF	0.710*	0.899***	-0.067	0.480***
	(0.404)	(0.196)	(0.152)	(0.132)
LDIST	0.772	-3.679***	-0.428	-2.265*
	(2.010)	(1.304)	(0.996)	(1.155)
CONSTANT	-20.384	11.564	-11.042	-0.791
	(12.640)	(11.081)	(6.604)	(8.060)
Observations	39	39	39	39
R-squared	0.983	0.990	0.983	0.990

Note: *, ** and *** indicate 10%, 5% and 1% level of significance respectively. Values in parentheses are robust standard errors. All variables are in logarithms. LNTT is the dependent variable. LDIST is the log of weighted physical distance between Bangladesh and sub-regions.

The results show little change in the estimated income variable parameters. However, for South Asia, the sign of the parameter estimate of the trade cost variable (weighted physical distance) becomes positive, i.e., the opposite of what the gravity model predicts. Thus, the results are better for the specification we used, i.e., where the trade cost variable includes all costs (ESCAP 2018), rather than the physical distance between Bangladesh and the trading regions.

V. CONCLUSIONS AND IMPLICATIONS FOR POLICY

The paper investigates Bangladesh's trade with its Asian trading partners, in the backdrop of rising prosperity across the continent, which has dramatically changed the structure of global trade. It uses the gravity model of international trade in the analysis. The model permits investigation of the influence of trade of a country with other countries which have larger incomes, while also considering the effect of costs on trade. The model predicts that countries with larger incomes will positively affect Bangladesh's trade, while the trade costs involved would have the opposite effect. Alternative specifications of the model were econometrically estimated, and problems commonly associated with the econometric estimations using time series data were assessed through rigorous tests to obtain robust parameter estimates. The estimated models fit the data well, and hence provide a sound basis for predicting Bangladesh's total trade.

The results show the strong role that emerging Asia and its sub-regions play in Bangladesh's trade growth and overall economic growth. Significantly, Bangladesh's trade is the most sensitive to trade costs of its immediate neighbours. Most importantly, the gravity model results capture the effect of trade costs on Bangladesh's trade. Since these include trade and non-trade barriers, the results suggest a need to intensify trade reforms in the country, as well as the need for policymakers to step up trade negotiations to reduce "behind the border" barriers to trade. The government strategy, in this regard, should consider negotiating bilateral or sub-regional, or regional trade accords with South East Asian and East Asian countries, especially in the backdrop of a slowdown in global trade negotiations. Such regional trade accords are also important, especially in the context of Bangladesh's ambitious growth objectives.

Although there has been some recent progress in obtaining greater market access for RMG exports to the Indian market, Bangladesh's trade deficit with India remains large, suggesting that more robust engagement to increase market access is required. Access to the large Chinese market also remains a concern for Bangladesh—trade deficits are largest with China at $16.8 billion, followed by India at $7.9 billion. The issue with regard to the trade deficit is not so much that deficits with individual countries are large, but rather that the deficits can be caused by restrictive trade practices in the partner countries, because a country can still have an overall surplus in trade. Bangladesh has a significant trade deficit (8.3 per cent of GDP in 2018) and the two countries account for over 90 per cent of it—the trade deficit with China being twice that of India's given the much higher trade volume with the former. It puts pressure on Bangladesh's exchange rate. The country needs greater reciprocity in market access to maximize its trade-GDP ratio and gains from trade.

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APPENDIX

Table A.1: ADF Unit Root Test Results of Different Variables Used in the Analysis of South Asian Countries

Variable	ADF coefficient	P-Value	I(0) or I(1)?	D(Variable)	ADF coefficient	P-Value	I(0) or I(1)?
LNTT	-4.980530	0.0014	I(0)	D(LNTT)	-8.525878	0.0000	I(0)
LRTT	-5.842250	0.0001	I(0)	D(LRTT)	-6.546753	0.0000	I(0)
LGDPD	6.183149	1.0000	I(1)	D(LGDPD)	-4.489644	0.0056	I(0)
LGDPF	-2.351834	0.3975	I(1)	D(LGDPF)	-8.724535	0.0000	I(0)
LWTC	-2.028352	0.5671	I(1)	D(LWTC)	-5.834443	0.0001	I(0)
LDIST	-1.673024	0.4365	I(1)	D(LDIST)	-7.247412	0.0000	I(0)
LK	-2.495289	0.3284	I(1)	D(LK)	-4.118760	0.0133	I(0)
LC	-2.660214	0.2579	I(1)	D(LC)	-4.350300	0.0073	I(0)
LN	-2.282139	0.4327	I(1)	D(LN)	-3.123461	0.1160	I(0)

Note: D(Variable) indicates the first difference form of the variable under consideration.

Table A.2: ADF Unit Root Test Results of Different Variables Used in the Analysis of East Asian Countries

Variable	ADF coefficient	P-Value	I(0) or I(1)?	D(Variable)	ADF coefficient	P-Value	I(0) or I(1)?
LNTT	1.110695	0.9969	I(1)	D(LNTT)	-5.650898	0.0000	I(0)
LRTT	1.249311	0.9979	I(1)	D(LRTT)	-5.475550	0.0001	I(0)
LGDPF	-2.351834	0.3975	I(1)	D(LGDPF)	-8.724535	0.0000	I(0)
LWTC	-1.485498	0.5300	I(1)	D(LWTC)	-6.913654	0.0000	I(0)
LDIST	-2.124607	0.5161	I(1)	D(LDIST)	-4.011697	0.0184	I(0)

Note: D(Variable) indicates the first difference form of the variable under consideration.

Table A.3: ADF Unit Root Test Results of Different Variables Used in the Analysis of Southeast Asian Countries

Variable	ADF coefficient	P-Value	I(0) or I(1)?	D(Variable)	ADF coefficient	P-Value	I(0)or I(1)?
LNTT	0.375105	0.9792	I(1)	D(LNTT)	-6.779752	0.0000	I(0)
LRTT	0.498917	0.9845	I(1)	D(LRTT)	-6.635713	0.0000	I(0)
LGDPF	-2.226508	0.2006	I(1)	D(LGDPF)	-7.589067	0.0000	I(0)
LWTC	-3.769000	0.0295	I(0)	D(LWTC)	-9.006271	0.0000	I(0)
LDIST	-4.691365	0.0030	I(0)	D(LDIST)	-11.21913	0.0000	I(0)

Note: D(Variable) indicates the first difference form of the variable under consideration.

Table A.4: ADF Unit Root Test Results of Different Variables Used in the Analysis of East and Southeast Asian Countries

Variable	ADF coefficient	P-Value	I(0) or I(1)?	D(Variable)	ADF coefficient	P-Value	I(0) or I(1)?
LNTT	1.107022	0.9969	I(1)	D(LNTT)	-5.941125	0.0000	I(0)
LRTT	1.306683	0.9982	I(1)	D(LRTT)	-5.630620	0.0000	I(0)
LGDPF	1.840034	0.9997	I(1)	D(LGDPF)	-5.101303	0.0010	I(0)
LWTC	-3.227196	0.0945	I(0)	D(LWTC)	-7.156074	0.0000	I(0)
LDIST	-2.184258	0.4823	I(1)	D(LDIST)	-6.632313	0.0000	I(0)

Note: D(Variable) indicates the first difference form of the variable under consideration.

Table A.5: ARDL Bound Test Results of Gravity Model (i.e. equation 2), with Nominal Trade Volume

Sub region	F-statistic	t-statistic	Decision
South Asia	5.939	-4.444	Long-run level relationship exists at 5% level of significance
East Asia	11.041	-5.906	Long-run level relationship exists at 1% level of significance
Southeast Asia	4.316	-3.606	Long-run level relationship exists at 10% level of significance
East & Southeast Asia	4.982	-3.593	Long-run level relationship exists at 10% level of significance

Note: Unrestricted intercept and no time trend (case 03) of Pesaran, Shin and Smith (2001) test has been considered and reported. Since the sample size is small (39), Narayan (2005) critical values for F test have been used.

Table A.6: ARDL Bound Test Results of Gravity Model (i.e. equation 2), with Real Trade Volume

Sub region	F-statistic	t-statistic	Decision
South Asia	6.493	-4.984	Long-run level relationship exists at 5% level of significance
East Asia	6.975	-4.738	Long-run level relationship exists at 1% level of significance
Southeast Asia	4.250	-3.703	Long-run level relationship exists at 10% level of significance
East & Southeast Asia	4.773	-3.664	Long-run level relationship exists at 10% level of significance

Note: Unrestricted intercept and no time trend (case 03) of Pesaran, Shin and Smith (2001) test has been considered and reported. Since the sample size is small (39), Narayan (2005) critical values for F test have been used.

Table A.7: First stage Regression Result of IV Approach

Variables	(1) LGDPD
LK	0.747** (0.334)
LC	2.905*** (0.465)
LN	1.140** (0.426)
CONSTANT	-3.599 (2.608)
Observations	39
R-squared	0.982

Note: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.8: Results of Instrument Validity Test (Durbin Score test)

Region	Chi-square statistic	p-value	Decision
South Asia	1.006	0.315	LGDPD is exogenous
East Asia	0.001	0.967	LGDPD is exogenous
Southeast Asia	0.552	0.457	LGDPD is exogenous
East & Southeast Asia	0.496	0.481	LGDPD is exogenous

Note: LGDPD is exogenous means that the null hypothesis of "no endogeneity" cannot be rejected.

Table A.9: Results of Instrument Validity Test (Wu-Hausman test)

Region	F statistic	p-value	Decision
South Asia	0.875	0.356	LGDPD is exogenous
East Asia	0.001	0.969	LGDPD is exogenous
Southeast Asia	0.508	0.480	LGDPD is exogenous
East & Southeast Asia	0.484	0.491	LGDPD is exogenous

Note: LGDPD is exogenous means that the null hypothesis of "no endogeneity" cannot be rejected.

Table A.10: Results of Multicollinearity Tests of Model 2

	South Asia		East Asia		South East Asia		East & South East Asia	
Variables	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance
LGDPD	41.21	0.024	9.46	0.11	28.47	0.04	9.76	0.10
LGDPF	33.02	0.03	7.35	0.14	19.88	0.05	9.20	0.11
LWTC	3.1	0.322	3.94	0.25	5.75	0.17	6.76	0.15
Mean VIF	25.78	--	6.92	--	18.04	--	8.57	--

Note: Values of VIF greater than 10 and Tolerance less than 0.10 indicate severe multicollinearity. Values of the correlation of coefficients (results are available on demand) also confirmed the similar conclusions regarding multicollinearity.

Table A.11: Econometric Estimates of Gravity Model Specified in Model 2 (with real trade data)

Variables	(1)	(2)	(3)	(4)
	LRTT	LRTT	LRTT	LRTT
	South Asia	East Asia	South East Asia	East & South East Asia
LGDPD	0.456***	0.702***	0.707***	0.668***
	(0.103)	(0.049)	(0.073)	(0.047)
LGDPF	0.247***	0.190***	-0.077*	0.098**
	(0.061)	(0.056)	(0.041)	(0.040)
LWTC	-0.289*	-0.148	-0.753*	-0.396
	(0.160)	(0.138)	(0.375)	(0.247)
CONSTANT	-4.164***	-6.397***	-0.920	-3.156*
	(0.975)	(0.959)	(2.025)	(1.743)
Observations	39	39	39	39
R-squared	0.987	0.988	0.986	0.989

Note: *, ** and *** indicate 10%, 5% and 1% level of significance respectively. Values in parentheses are robust standard errors. All variables are in logarithms. LRTT is the dependent variable.

Table A.12: Regression Results of the Gravity Model with Real Trade Data ('corrected' for multicollinearity)

Variables	(1)	(2)	(3)	(4)
	LRTT	LRTT	LRTT	LRTT
	South Asia	East Asia	South East Asia	East & South East Asia
LGDPF	0.500***	0.906***	0.319***	0.540***
	(0.019)	(0.075)	(0.058)	(0.087)
LWTC	-0.709***	-0.444	-1.869***	-1.660***
	(0.161)	(0.424)	(0.512)	(0.605)
CONSTANT	-0.979	-7.370***	6.974***	4.344
	(0.779)	(2.638)	(2.552)	(4.353)
Observations	39	39	39	39
R-squared	0.981	0.901	0.953	0.917

Note: *, ** and *** indicate 10%, 5% and 1% level of significance respectively. Values in parentheses are robust standard errors. All variables are in logarithms. LRTT is the dependent variable.

Table A.13: Regression Results of the Gravity Models with Real Trade Volume as Dependent Variable and Physical istance as Proxy of istance between Countries

VARIABLES	(1)	(2)	(3)	(4)
	LRTT	LRTT	LRTT	LRTT
	South Asia	East Asia	South East Asia	East & South East Asia
LGDPD	0.636***	0.449**	0.890***	0.615***
	(0.176)	(0.165)	(0.081)	(0.102)
LGDPF	0.135	0.325***	-0.139**	0.169***
	(0.154)	(0.087)	(0.067)	(0.058)
LDIST	-0.329	-0.994	0.357	-0.524
	(0.780)	(0.599)	(0.449)	(0.551)
CONSTANT	-3.751	1.041	-7.549**	-2.380
	(4.847)	(5.044)	(3.001)	(3.826)
Observations	39	39	39	39
R-squared	0.986	0.989	0.981	0.988

Note: *, ** and *** indicate 10%, 5% and 1% level of significance respectively. Values in parentheses are robust standard errors. All variables are in logarithms. LRTT is the dependent variable. LDIST is the log of weighted physical distance between Bangladesh and sub-regions.