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# **Impact of Trade Cost on Bangladesh's Trade: A Gravity Model Approach**

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## **ABSTRACT**

The paper employed gravity modelling to examine the role of trade cost in Bangladesh's trade by using the recently available trade cost estimates of WB-ESCAP. The paper has undertaken two separate exercises considering the distinct features associated with the country's export and import. Analysis from the study has revealed that trade cost has significant impact for both Bangladesh's export and import. Hence, higher trade cost leads to lower trade volume for Bangladesh. Since the trade cost variable incorporates a number of components including tariff, transport cost, cultural components and trade facilitation issues, it is the case that the future trade policy of Bangladesh will need to address these issues with utmost sincerity. Furthermore, distance between trading partners, trade arrangements and common border being significant determinants of Bangladesh's import, her exports are influenced by the economic condition of partner countries and GSP facilities offered by the developed countries. Modelling and implementation of inclusive and effective trade-related policies should be the contemplation of the day.

*Keywords:* Bangladesh, Trade Cost, Trade, Export, Import, Gravity Model.

## 1. INTRODUCTION

Trade has been long considered the driver of the economic engine. Regional integration as a means to facilitate trade has been prioritized by countries since the advent of globalisation. Irrespective of the level of development of an economy, countries have thrived for integration. This is for the *raison d'être* that openness, implying a reduction in the degree of trade barriers, leads to further access towards diverse global markets. Access to international markets is imperative from the point of view of gathering the momentum of exports. Bangladesh, as a comparatively new player in the trade game, has made considerable progress. Bangladesh's trade growth has been one of the trademark 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. In this context, it is imperative to mention that export has performed strongly in Bangladesh's context with the aid of the booming manufacturing sector. It is to be noted that Bangladesh's exports grew by about five times over the last decade.

Although Bangladesh performed impressively in increasing her exports, but imports at the same time enhanced to a greater degree together with the presence of a narrow export basket<sup>2</sup>. Needless to mention the importance of exports, there are factors affecting the volume of exports from the producer to the final user. It is the case that the destination of the majority of the exports has been the Euro zone (EU 27) and the US. In this connection, 55.13 per cent<sup>3</sup> of Bangladesh's export in 2012 accounted for the Euro zone and 19.28 per cent went to the US; while in contrast, only a meagre 1.22 per cent of Bangladesh's exports catered to the ASEAN (Association of Southeast Asian Nations) region in the same timeframe (Bangladesh's imports from ASEAN stood at 18.8 per cent in the same year) and 2.47 per cent for the South Asian counterpart. It can be observed that more than four-fifths of the export of Bangladesh is diverted to the distant US and Euro zone, while very minimal trade occurs with its neighbouring Asian counterparts. Hence, it can be made out from the argument that trade costs and its associated counterparts play a major role in determining both trade volume and trade destinations.

Although a South Asian country and a member of the South Asian Association for Regional Cooperation (SAARC) (neighbour to the ASEAN region) coupled with the fact that Bangladesh is at the confluence of the giants India and China, the country has not been able to capitalize on her geographical location. This calls for an analysis of the case as to why the trade of Bangladesh is low with other Asian countries, when it is the case

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<sup>2</sup> Woven garments and knitwear accounted for approximately 76 per cent of the export basket in 2007-08, while the figure stood at 79 per cent in 2008-09 and 77 per cent in 2009-10 (Export Promotion Bureau, 2013).

<sup>3</sup> According to data from Trade Map data, International Trade Centre, 2013

that the Asian countries are in close proximity and the neighbouring countries also share similar cultural traits. Hence, it would not be inappropriate to consider the hypothesis that trade cost is one of the determining factors of trade between Bangladesh and her counterparts. With Arvis, Duval, Shepherd and Utoktham (2013) stamping the fact that trade costs are a major hindrance for trade in the developing countries, trade cost have also been determined to be a dynamic foray in Bangladesh's trade. Acknowledging the essence of trade cost in determining trade volumes, the current study takes up the case of analyzing the impact of trade cost on Bangladesh's trade.

The organisation of the rest of the paper is as follows. Section 2 presents the review of relevant literature together with a discussion of the empirical theories relevant for the current study. Section 3 presents a brief descriptive analysis of relevant trade indicators for Bangladesh. Section 4 marks the empirical methodology, based on which the following section, Section 5, reports the empirical results. The concluding section provides summary of results and policy recommendations.

## **2. REVIEW OF RELEVANT LITERATURES**

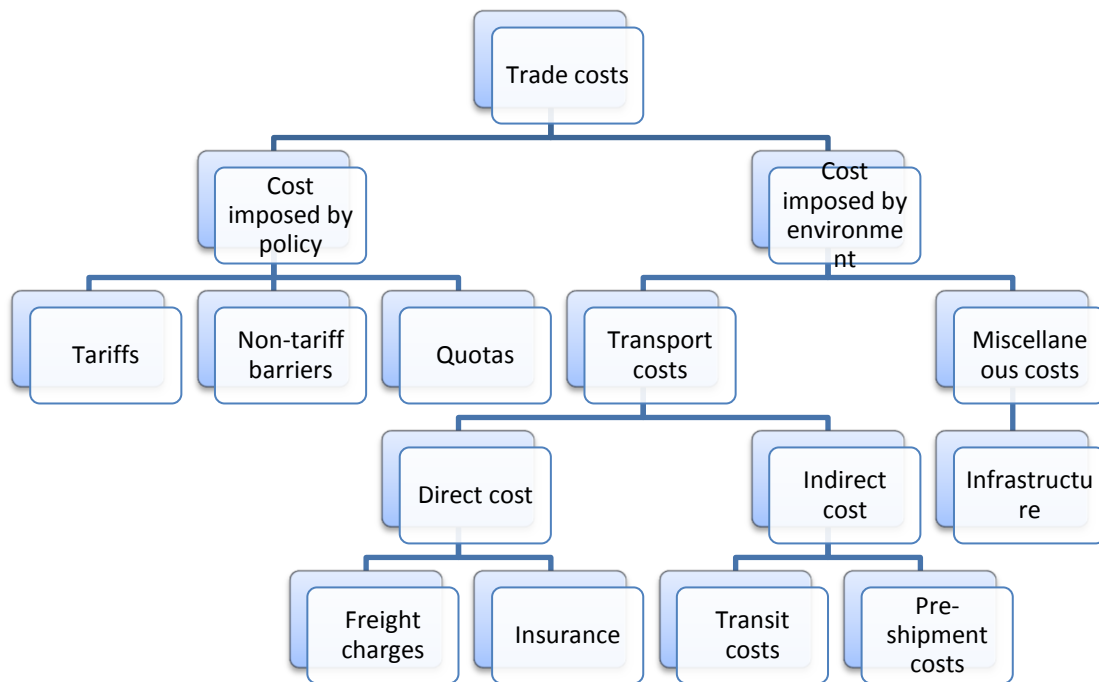
There is an extensive string of studies analyzing trade patterns and other trade aspects of Bangladesh economy. But what is less frequent is the investigation of trade costs which pertain to and from the counterparts. This section of the paper undermines relevant studies relating to the Bangladesh economy in terms of trade, trade costs and the gravity framework.

### *2.1 Overview of trade cost*

Trade cost, amongst other determinants of the volume of trade, plays a significant role in determining the amount of trade of a nation. Components of trade cost would include "transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs and local distribution costs" (De, 2007). Arvis, Duval, Shepherd and Utoktham (2013) calculated trade costs of agriculture and manufactured goods in 178 countries to show that "trade costs are strongly declining in per capita income". However, the authors make a distinct observation that the rate of decline of trade costs is far quicker in the developed countries than in the developing ones. As a result relative isolation between the developed and developing countries is getting higher by the day. Specifically, the authors found that the Sub-Saharan countries and low-income countries are the one subject to the highest level of trade costs. Maritime connectivity and logistics performance have been further found to be very imperative determinants of bilateral

trade, together with trade policies such as market entry barriers and regional integration agreements (Free Trade Agreements (FTAs), Preferential Trade Agreements (PTAs) and other Regional Trade Arrangements (RTAs)) (Arvis, Duval, Shepherd and Utoktham, 2013). The following diagram (Figure 1), adopted from De (2007), would best demonstrate the components of trade cost which influences trade cost landscape.

Figure 1: Trade cost and its components



Source: De (2007)

It can be observed from the figure that trade cost is a very diverse phenomenon, with the two major sub-twigs forming the costs– costs imposed by policy and costs imposed by the environment. Direct policies regarding tariffs, non-tariff barriers and quotas affect trade to a great extent. An indirect cost of trade is imposed by infrastructure, lack of which leads to escalated trade costs. It is ultimately the transport costs (freight charges, insurance, transit costs and pre-shipment costs) which affect the movement of goods (and services) from origin to destination – hence higher transport costs also affect trade in a significant manner. It is the case that some of the components of trade cost are very hard to quantify such as non-tariff barriers, pre-shipment costs and time costs (not included in the figure).

## 2.2 Trade Cost in Gravity Model

Trade cost, amongst other determinants of trade, plays a significant role in determining the amount of export (also imports) of a particular economy. A number of gravity model studies considering different time periods and assorted countries (including single

country studies) with the employment of different methodologies have documented a negative relationship between trade cost and volume of exports. While early literature proxied trade cost by distance or as border variables (Okubo (2003) and Anderson and Wincoop (2003)), other studies also made use of tariff variables. However, the introduction of a composite measure of trade cost and examining its impact on trade is not very common.

Novy (2011) developed a measure of international trade cost across countries and different time periods. The author carefully devised an estimation procedure with the aid of micro-foundations and showed that the measure can be derived from the Ricardian model by Eaton and Kortum (2002), the classic model by Anderson and Wincoop (2003) or the heterogeneous models by Chaney (2008) and Melitz and Ottaviano (2008). Deducing that trade cost measure declined in the US by approximately 40 per cent between 1970 and 2000, the author referred to the fact that this finding has been particularly relevant for close neighbours of the U.S. – Mexico and Canada. In an attempt to identify strong bilateral growth of US trade, the author finds that income growth is the prominent underlying driving feature. Although significant, Novy (2011) puts decline in bilateral trade costs in the subsequent place.

With very little to differentiate in comparable price indices of tradable goods between the developed and the developing countries, Waugh (2007) performed structural gravity models to assert that “trade costs must be systematically asymmetric with poor countries facing higher costs to export relative to rich countries”. Waugh (2007) stated that asymmetry accounts for at least one-third of the variations in bilateral trade, with distance and other symmetric notions taking up less magnitude. With the author mentioning that such topic requires further research, nevertheless, further conclusion of the paper argued that policies in the developing countries are responsible for the high trade cost restrictions to a grand degree. Export marketing boards prevalent in the African continent could be a source of distortion too. Additionally, drawing from Hummels (2001), he pointed out that asymmetric patterns are evident regarding oceanic freights. This can be explained by the fact that ships have to make more frequent stops at the developing country ports because of the lack of infrastructural facilities. Hence, the time cost of shipping a good from a developing country would be higher than that from a developed country. Hummels, Lugovskyy and Skiba (2007) also stressed on this issue while showing that poor countries have to pay transportation costs which are substantially higher “as a result of the composition of exports and market power by shipping firms” (Waugh, 2007).

Khan and Kalirajan (2011) decomposed trade costs into a number of components – natural costs, behind the border costs, implicit beyond the border costs and explicit beyond the border costs. In an attempt to investigate these notions in the absence of complete information on the home and partner countries, the authors conclude that

Pakistan's growth of export between 1999 and 2004 was mainly brought about by reduction of explicit and implicit beyond the border costs in partner countries.

De (2007) observed that high trade costs are having an adverse impact on Asia's trade. High costs of trade are impacting trade of the region when trade interdependency in Asia is gaining momentum together with the reduction of tariff barriers. With freight costs substantially higher for the developing countries as compared to the developed ones, it is the case that freight costs in developing Asia are 116 per cent higher than in the developed countries. The paper also found evidence that increased auxiliary shipping charges are having an unfavourable impact when ocean freight prices are generally on the decline. De (2007) also estimated an augmented gravity model at the 4-digit HS level for the year 2004 to conclude that infrastructure quality, tariffs and transport costs affect trade patterns significantly in the Asian region. More specifically, the study concludes that a 10 per cent reduction in tariffs and transportation costs would increase bilateral trade by about 2 and 6 per cent respectively. Furthermore, other conclusions of the paper state that Asian neighbours have benefitted from FTAs and common language. The author also showed concerns regarding the poor infrastructure quality of the LDCs and states that their share in world trade would likely decrease if these countries continually lag behind the developed ones.

De (2010) argued that "price barriers have taken a new shape which may likely to generate differential impact on trade flows". The major conclusion which follows from the study was that 'price' barriers still play a more significant role in determining Asia's trade and regional integration than the 'non-price' barriers. Similar to De (2007), the author reported that a 10 per cent increase in transport and tariff hindrances would lower trade by approximately by 6 per cent. Additionally, the study also concluded that the incidence of inland transportation costs is elevated in comparison to international transportation costs. Taking into consideration massive infrastructure bottlenecks in the Asian countries, it is thought that policy-makers should concentrate on complementary trade policies focusing on both 'price' and 'non-price' barriers to enhance trade and integration in the post-crisis era.

### *2.3 Bangladesh's Trade Cost and Gravity Model*

It should be mentioned at this outset that work has already been carried out in the arena of Bangladeshi trade deploying gravity models – examples would include Rahman and Dutta (2012), Rahman, Shadat and Das (2006), Rahman (2003, 2009) and Roy and Rayhan (2011). Rahman (2009) employed gravity models (panel data) to analyze the determinants of import in the Bangladesh economy. Results of the study show that Bangladesh's imports are influenced by inflation rate, per capita income and openness of trading partners of Bangladesh (exchange rate was determined as non-influential in

the analysis). The author found that neighbouring countries have greater authority on Bangladesh's imports, together with Bangladesh-India border having a major impact. Rahman (2009) recommended inflation to be controlled through tight fiscal and monetary policies as inflation affects a country's imports heavily. Additionally, import of capital goods should be encouraged, which would in turn, complement the export capacity. Also, other recommendations have been put forward by the author including diversification of exports, improvement of the quality of exports and enhancement of exports with neighbouring countries, especially, India.

Employing the gravity model approach, Rahman (2003) analyzed Bangladesh's bilateral trade with her major trading partners with an aim to make available a theoretical justification. Estimating an aggregate (sum of exports and imports) gravity model together with disaggregated models of export and import, the study finds that Bangladesh's trade is positively influenced by per capita Gross National Product (GNP), the dimension of partner economies, openness and income differential of the trading partners. Furthermore, exchange rates, openness of the Bangladesh economy and import demand of partner countries' were determined as the primary determinants of Bangladesh's exports (positive impact). Concluding exchange rate as insignificant, Rahman (2003) decided on inflation rates, per capita income differentials and openness of partner countries as the major determinants of Bangladesh's imports. Additionally, transport cost was found to be a significant factor in impacting Bangladesh's trade negatively. More innovative results include the fact that multilateral resistance factors affect Bangladesh's trade (specifically exports) positively and that her imports are greatly influenced by border trade with India.

Results of Rahman and Dutta (2012) have been found to be very similar to those of Rahman (2003). Rahman and Dutta (2012) employ a generalised gravity model (panel data estimation) to analyse Bangladesh's bilateral trade. Results of the study indicate that per capita Gross Domestic Product (GDP) differential, size of economies and openness of partner countries influence Bangladesh's trade in an optimistic manner. Exports are positively determined by its own GDP, openness and import demand of partner countries and negatively affected by domestic inflation and partner country's GDP. On the other hand, imports are positively impacted by GDP and openness of partner countries and hindered by inflation in the destination country.

With the aid of a gravity model, Roy and Rayhan (2011) investigated into the factors of trade flows which contribute to the Bangladesh economy. Contradicting findings of Rahman (2003) and Hossain (2009), the authors concluded that regional dummy variables including SAARC and the contiguity factor border variable are significant (SAARC dummy is significant with a negative coefficient). Having compared pooled Ordinary Least Square (OLS) regression, random effects estimation and fixed effects



estimation and pursuing the best model (fixed effects estimation) to perform the estimations, the authors concluded that Bangladesh's trade flows are determined by the size of the economy, exchange rate and openness.

### **3. SUMMARY OF BANGLADESH'S TRADE**

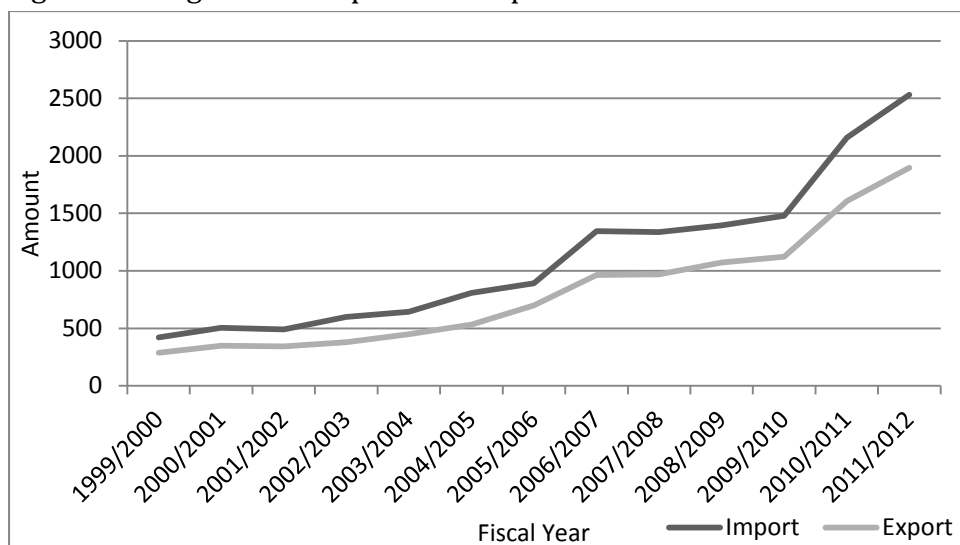
Since the present study revolves predominantly around trade costs, it is worthwhile to present a descriptive synopsis of the major trade indicators of Bangladesh.

It should be mentioned upfront that Bangladesh introduced trade policy reforms in the early 1990s with substantial reduction and rationalization of tariffs, the removal of quantitative restrictions and shifting from a multiple exchange rate system towards a unified exchange rate regime. Additionally, the current account was allowed to be converted together with an outward orientation of the trade policy management (World Bank, 2013). Additionally, such policy reforms were carried out by Bangladesh's neighbours in South Asia, "although with non-uniform phasing and sequencing of the respective reform programs" (Rahman, 1997). As a result of the changing policies, trade-GDP ratio increased from a mere 18 per cent in 1990 to 43 per cent in 2008 (World Bank, 2013). Over the last decade, Bangladesh's exports grew by 558.46 per cent in the 1999-00 to 2011-12 (increasing from 12.2 per cent of GDP to 20.7 per cent of GDP) timeframe (Figure 1 illustrates the growth of Bangladesh's export for the last decade). Driven by the private-sector led machinery and textiles sectors, Bangladesh made commendable advancements in trade. But the poignant aspect of the robust growth of Bangladesh's trade has been the lack of diversification of both the trade basket and the trade destinations. As mentioned earlier, Bangladesh's major exporting destinations include the US, the Euro zone and some countries of the Middle East<sup>4</sup>. This is where the rationale for the current study steps in with the notion that trade costs have been such considerable in magnitude that Bangladesh could not commence high-octane trade with its nearby counterparts, but has to maintain the same relationship with its distant neighbours. Nevertheless, laudable progress of Bangladesh in the trade sector is evident from the impressive improvement in trade-GDP ratios and other trade indicators. While it is true that informal trade between Bangladesh and India is bulky, but this scrutiny together with the narrow export base of Bangladesh is out of the scope of the current study.

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<sup>4</sup> Bangladesh Bank (2013) reports United States of America, Germany, United Kingdom, Turkey, France, India, Spain, Italy, Canada, Netherlands, Belgium, Japan and the United Arab Emirates as the major export destinations for Bangladesh.

Figure 1: Bangladesh's export and import trend over the last decade



Note: Export and import figures expressed in billion Taka

Source: Economic Indicators, Ministry of Finance, Bangladesh, 2013a

Import growth has not been lagging by any margin. Import growth of Bangladesh, to accommodate the growing demand for foreign commodities and capital machinery, have been growing as well. Import of Bangladesh has grown by 500.55 per cent in the 1999-00 to 2011-12 period. As percentage of GDP, import was 17.8 per cent in 1999-00 and then increasing to 27.7 per cent in 2011-12. Growth of imports in the Bangladesh economy can also be observed from Figure 1.

Having perceived robust performance of exports and imports, it is worth observing trade balance of the economy over the last decade. It can be observed from Table 1 that, although Bangladesh has been performing strongly in the export sector, trade balance has been negative throughout the last decade. Even though trade balance has been consistent throughout, but even then this poses an indication that there is ample opportunity for the economy to make further progress in the export front by venturing into new markets, differentiating products<sup>5</sup>, promoting the establishment of local import-substituting industries and a range of other dimensions.

Table 1: Trade balance of Bangladesh (as percentage of GDP) over the last decade

Trade balance	199-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
e	-5.6	-6.1	-5.4	-6.0	-5.8	-7.5	-4.7	-8.1	-6.7	-5.3	-5.1	-6.9	-6.9

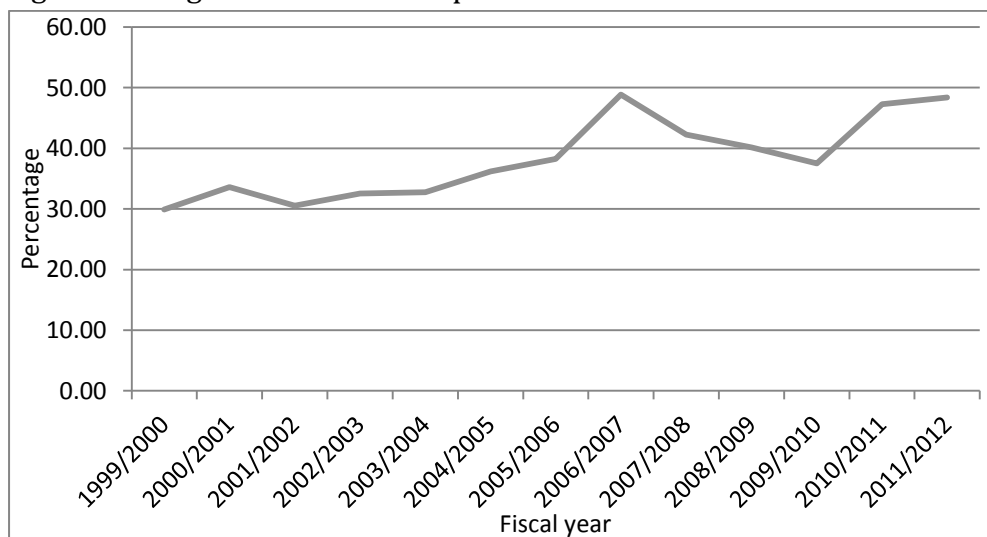
Source: Economic Indicators, Ministry of Finance, Bangladesh, 2013a

<sup>5</sup> The major export basket of Bangladesh over the last decade includes very narrow primary and manufactured commodities. Major classification of primary commodities include raw jute, tea, frozen food and agricultural products while manufacturing commodities include manufactured goods, jute goods, leather, readymade garments, knitwear, naptha, furnace oil, bitumen, chemical products, shoe, handicrafts and other engineered products.

Furthermore, it would be interesting at this point to perform an exercise of trade openness of the Bangladesh economy. Figure 2 shows the trade openness of Bangladesh (considering both exports and imports). Similar to Figure 1, where both export and import volumes experienced slack during 2007-08 to 2009-10, the openness graph in Figure 2 vividly shows this limp over the same time period. Disregarding the period of the financial crisis, openness of Bangladesh has improved throughout the last decade, and it can be expected that the trend would continue in the future with proper policies and measures aimed towards the trade sector.

To discuss trade policies in the Bangladeshi economy in a nutshell, it is the case that trade policies undertaken in the past two decades have induced export-led growth with the successful emergence of export-oriented industries (Moazzem et al., 2011). However, other enterprises were wiped out in the process of globalisation as these firms failed to take advantage of the anti-export bias or could not compete with the imports. While it is often argued that trade-related policies and instruments in Bangladesh lack focus and efficiency, this aspect ultimately hinders overall development of the country in its true sense. In this respect, Moazzem et al. (2011) rightly points out that “Lack of policy coherence is one of the major weaknesses of trade-related policies which results in poor implementation and outcomes”.

Figure 2: Bangladesh’s trend of openness over the last decade



Source: Economic Indicators, Ministry of Finance, Bangladesh, 2013a

Another notable feature of Bangladesh trade is that destinations of exports (and imports too) have been concentrated. While US and the Euro zone have emerged as the major trading partners, trade with Asian counterparts and other neighbouring countries has not been encouraging. Specifically probing into the regional agreements involving Bangladesh, it is evident that trade within SAARC and South Asian Free Trade Agreement (SAFTA) region has not been even close to satisfactory. Table 2 presents a

disaggregation of the major export destinations of Bangladesh over the last couple of years. Needless to mention that trade cost is one of the key players of such an outcome (conferring from the notion that trade with neighbouring countries are stumpy in spite of the shorter distance), however, it is also the case that Bangladesh is at the confluence of India together with non-existent direct shipping lines between Bangladesh and her counterparts (Hassan (2001), Tumbarello (2006) and Hirantha (2004)).

Table 2: Bangladesh’s exports disaggregated by region

Region	2007-08	2008-09	2009-10
European Union	52.69%	52.3%	52.3%
American region	31.61%	33.3%	33.3%
Asian region	7.34%	8.8%	8.8%
Middle-East region	1.52%	2.5%	2.5%
African region	0.97%	0.6%	0.6%
Oceania region	0.62%	0.3%	0.3%
East European region	2.51%	0.3%	0.3%
Other regions	2.74%	1.8%	1.8%

Source: Export Promotion Bureau, Bangladesh, 2013b

#### 4. METHODOLOGY AND DATA

The current paper employs the gravity model with a focus on examining the impact of trade cost for Bangladesh’s export and import. The *raison d’être* for the consideration of the gravity model and which makes this model more attractive than other methodologies is – the intuitive appeal of the model, the model fitting important stylized facts, real data employment with ease to explain trade flows in relation to the policy factors and that the model is estimated using OLS regression. With an aim to establish the intuitive gravity model, Tinbergen (1962) and Pöyhönen (1963), the forerunners of the gravity model, utilized the basic concept to explain the volume of bilateral trade flow between countries. Recent times have witnessed gravity models incorporating variables beyond the traditional measures such as regulatory and institutional policies together with infrastructure characteristics. In this connection, Leamer and Levinsohn (1995) stated that the gravity model has generated “some of the clearest and most robust findings in empirical literature” of trade.

Picking up from the basic concept of physics, gravitational force depends on two object’s masses and is inversely proportional to the square of the distance between them. Similarly, trade (exports, imports or a combination of both) between two countries is determined by their economic sizes (GDP and/or GNP) and is inversely related to the distance between them. This forms the basis of the gravity model and would typically take the following form:

$$X_{ij} = C \frac{Y_i Y_j}{t_{ij}}$$

where  $X_{ij}$  = trade (exports and/or imports) from i to j

$C$  = constant

$Y_i Y_j$  = economic mass of the respective countries (GDP)

$t_{ij}$  = distance between i and j

An intuitive gravity model follows from the above-mentioned equation in a linear outline (this is the basic form of a gravity model):

$$\log X_{ij} = C + \beta_1 \log Y_i + \beta_2 \log Y_j + \beta_3 \log t_{ij} + \varepsilon_{ij}$$

The linear intuitive model, or the basic gravity model, demonstrates two stylized facts of international trade for a generalized economy: (1) Countries with higher economic masses trade more and (2) Countries which are distant encompass lower trade. This aspect of the basic gravity model has been documented in Shepherd (2012), WTO (2012) and every text describing or analysing the gravity concept. However, the basic intuitive gravity model is not sufficient to incorporate more inclusive and critical concepts. Taking reference from Shepherd (2012), it can be observed that the basic model would be void if countries enter into a PTA, which will unambiguously affect a third country engaged in trade with the recently PTA adopted countries. Additionally, the model would also be inaccurate if two countries share common border and/or share a common language. Another example contradicting economic theory is observed when transport cost is reduced across each and every region and route. With the basic gravity model indicating that trade would be enhanced as a result of decrease in trade costs, this would not actually be the outcome in this case as relative prices would remain unchanged across countries and markets.

As a result of the limitations faced by the intuitive gravity model, advanced concepts were developed together with the innovation of theoretical constructs. Anderson (1979) provided the initial attempt to provide a theoretical basis for gravity models. Assuming the Armington assumption, Anderson (1979) developed a model where goods were differentiated by country and consumers had differentiated preferences. The theory implied that a country would consume at least some of the products from each partner country (regardless of the price) and each country would not be producing in terms of their comparative advantage only (WTO, 2012). Alternative theoretical foundations of the gravity model were presented by Krugman (1979), Helpman and Krugman (1985), Bergstrad (1985, 1990), Deardorff (1998) and Anderson and Mercouiller (1999). With Anderson (1979) taking up the initiative to motivate a theoretical gravity model, it was Anderson and Wincoop (2003) who formulated the

modern day theory-backed gravity model. The authors included two additional variables, namely, outward multilateral resistance and inward multilateral resistance. Outward multilateral resistance captures the fact that exports from country  $i$  to  $j$  depends on trade cost across all possible markets. Alternatively, inward multilateral resistance essentially captures the dependence of imports of country  $i$  coming from country  $j$  on trade cost relating to all possible suppliers. Since the basic gravity model does not incorporate these variables, there is effectively the problem of omitted variable bias. Hence, this model is ought to have significant implications, even though the resistance terms cannot be included in the model as data points. Together with the model devised by Anderson and Wincoop (2003), other theoretically sound gravity models would include Chaney (2008), Eaton and Kortum (2002) and Helpman et al. (2008).

A typical Anderson and Wincoop (2003) model would take the following form:

$$\log X_{ij} = \log Y_i + \log E_j - \log Y + (1 - \sigma)[\log \tau_{ij} - \log \omega_i - \log P_j]$$

$$\omega_i = \sum_{j=1}^c \left\{ \frac{\tau_{ij}}{P_j} \right\}^{1-\sigma} \frac{E_j}{Y} \quad Y = \sum_{i=1}^c Y_i$$

$$P_j = \sum_{i=1}^c \left\{ \frac{\tau_{ij}}{\omega_i} \right\}^{1-\sigma} \frac{Y_i}{Y}$$

$$\log \tau_{ij}^k = b_1 \log \text{distance}_{ij} + b_2 \text{contig} + b_3 \text{comlang}_{off} + b_4 \text{colony} + b_5 \text{comcol}$$

where  $X$  is exports indexed over countries ( $i$  and  $j$ )

$Y$  is GDP

$E$  is expenditure (not necessarily similar to GDP on a sectoral basis)

$$Y = \sum_{i=1}^c Y_i$$

$\sigma$  is the intra-sectoral elasticity of substitution

and  $\tau_{ij}$  is trade cost

The current paper, in an attempt to evaluate trade cost and its relatedness to the Bangladesh economy, employs a range of gravity models. Firstly, the paper employs the OLS estimation. OLS is a logical estimation to start with because OLS is econometric equivalent to a hypothetical line of best fit incorporating an association between trade, GDP, distance and other related variables. For OLS to be an consistent, unbiased and efficient estimator, the error term would have to have a mean of zero and be uncorrelated to the regressors (the orthogonality assumption), the error term would have to be independently drawn from a normal distribution with a fixed variance (the homoskedasticity assumption) and none of the explanatory variables should be a linear combination of the other variables (the assumption of full rank) (Shepherd, 2012). Hence, robust measures are incorporated in the following regressions to accommodate

any pattern of heteroskedasticity and orthogonality in the data. Together with other standard measures, the OLS estimator is corrected for by using heteroskedasticity-consistent (hc3) standard error estimator according to the Davidson and MacKinnon (1993) methodology. Another measure, which is very common in the gravity literature, is an adjustment which allows for the correlation of the error term within specific groups to be defined by a specific variable. Moulton (1990) states that failure to account for the clustering in data with multiple levels of aggregation can result in biased understated standard errors. A typical variable to take up the role of the clustering variable would be 'distance'.

If the error term of the OLS estimation is heteroskedastic, then the expected value of the error term would depend on one or more of the explanatory variables (because of the inclusion of variance). This would make the estimations inconsistent and unbiased. Shepherd (2012) states that "this kind of heteroskedasticity cannot be dealt with by simply applying a robust covariance matrix estimator, since it affects the parameter estimates in addition to the standard errors". To ensure the robustness of the results obtained from OLS estimations, the Poisson Pseudo<sup>6</sup>-Maximum Likelihood Estimator (PPML) have been estimated<sup>7</sup>. The PPML estimator has been used for gravity analysis because, apart from providing consistent estimates of the nonlinear model, the PPML is also consistent in the presence of fixed effects and the model automatically include observations for which the observed trade value is nil (which are dropped in OLS estimations). The latter is one of the striking and important features of this model because it is the case that not all partners would trade all products with all their counterparts (Haveman and Hummels, 2004).

Two augmented gravity models would be estimated at the current juncture<sup>8</sup>:

1. Import model
2. Export model

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<sup>6</sup> It is not necessary that the data be distributed as Poisson.

<sup>7</sup> The existence of multiplicative error term in a non-linear gravity model can be accounted through the Poisson Pseudo-Maximum Likelihood Estimator (Silva and Tenreiro, 2006).

<sup>8</sup> Other variables were also considered to be included as regressors to the gravity models - these would include remoteness, Global Competitiveness Index (GCI) index, weighted applied tariff and dummies for landlocked countries, countries sharing a common colonial background and for Asian countries. However, for the reason of better fit of the model, correcting for the problem of autocorrelation and multicollinearity and presenting an overall rationale, the variables have been excluded from the present regressions. Additionally, disaggregated measures of infrastructure variables (road density, rail density, passengers carried by air, air freight, electric power consumption, internet users, container port traffic, mobile cellular subscription and landline usage) were also considered. However, this leaves scope for taking up a more detailed research at a future date.

The augmented import model would take the following form:

$$\ln\_IM_{ij} = \alpha + \beta_1 \ln\_GDP_j + \beta_2 \ln\_TC_{ij} + \beta_3 \ln\_dist + \beta_4 \text{infra} + \beta_5 \text{contig} + \beta_6 \text{rta\_pta} + \varepsilon_{ij}$$

where i and j are country of origin and destination respectively

$\ln\_IM_{ij}$  represents log of import of country i from country j (at current USD)

$\ln\_GDP_j$  represents log of GDP of the partner countries (at current USD)

$TC_{ij}$  is ad-valorem trade cost between country i and j (ESCAP-World Bank Trade Cost Database)<sup>9</sup>

$\ln\_dist$  represents the log of distance between country i and j

infra represents infrastructure quality of the partner countries

contig is a dummy variable equal to unity for countries which share a common border

rta\_pta is a dummy variable equal to unity if the country pairs share bilateral or regional trade agreements

The augmented export model would take the following form:

$$\ln\_EX_{ij} = \alpha + \beta_1 \ln\_GDP_j + \beta_2 \ln\_TC_{ij} + \beta_3 \ln\_dist + \beta_4 \text{infra} + \beta_5 \text{contig} + \beta_6 \text{gsp} + \beta_7 \text{rta\_pta} + \varepsilon_{ij}$$

where i and j are country of origin and destination respectively

$\ln\_EX_{ij}$  represents log of exports of country i from country j (at current USD)

gsp is a dummy variable equal to unity if the importing country offers GSP (Generalised System of Preference) to the exporting nation (Bangladesh in this case)

and other variables are same as in the preceding model

The dependant variables of both the models are straight-forward.  $\ln\_EX_{ij}$  and  $\ln\_IM_{ij}$  represent the aggregate exports and imports of Bangladesh respectively, at current prices. Although the basic gravity model states that both the reporting and partner country's GDP is likely to influence bilateral trade, but it is the case that only Bangladesh's partner (all the exporters when Bangladesh is importing and all the importers when Bangladesh is exporting) countries' GDP have been taken into account at the current juncture. This is because the current study specifically wants to concentrate on Bangladesh's importing and exporting partners and their characteristics, and not vice versa. In this respect, Bangladesh's GDP can be considered to be constant throughout the sample period.

Quantifying trade costs is a common predicament in gravity literature. Almost every quantification has led the author concluding that the methodology might not have been inclusive and there might have been variables left out of the practice (expectedly

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<sup>9</sup> Methodology and data of Duval and Uthoktham (2012) has been followed



influencing trade cost). A special emphasis need to be laid on the fact that the trade cost indicator employed in the current study is a comparative trade cost measure. The measure of trade cost is a new dimension in the field of gravity modelling, which follows from Duval and Uthoktham (2012). The authors have complied inclusive components of trade cost, creating an index to represent the overall causality. The bilateral trade cost measure is comprehensive in the view that “it includes all costs involved in trading goods internationally with another partner (i.e. bilaterally) relative to those involved in trading goods domestically (i.e., intranationally)” (ESCAP-WB, 2013). The measure not only incorporates transport costs across the border and tariffs, but also other direct and indirect components of trade cost including costs associated with differing languages, currencies together with cumbersome import or export procedures. The basic assumption for this bilateral trade cost indicator is such that it assumes, for a particular country pair, trade cost is same in both direction<sup>10</sup>.

Distance is the next variable in the model. Although there are criticisms in literature regarding the consideration of nominal distance, however this measure is effective in capturing the remoteness of a country relative to its counterparts. The distance variable captures geo-distance (or air distance). Distance has been accounted for from the CEPII database, a database extensively pursued in gravity literature. Infrastructure variable is an infrastructure index estimate based on a perception study regarding a country’s quality of trade related infrastructure (ports, rails, roads, information technology and the like). Data ranges from 1 (lowest) to 5 (highest) and has been derived from World Development Indicators (WDI), World Bank.

Contig, GSP, RTA\_PTA are dummy variables, taking a value of unity (or zero otherwise), representing the sharing of a common border, GSP provisions between the reporting and partner countries and the presence of RTAs and PTAs (including GSP) between counterparts respectively.

The current analysis takes the route of a cross-sectional analysis for the Bangladesh economy. A light form of gravity database is used for the purpose of the analysis. All the feasible indicators<sup>11</sup> were averaged over a period of 2003 and 2007 to transform the database to a cross-sectional panel from an unbalanced one. The data has been deliberately kept at this juncture because this period is an apt point in time to capture trade cost and its implications on Bangladesh trade. This is so because the period marks a decade of the implementation of trade related policy changes (in terms of opening up of the economy) of Bangladesh and also because data from 2008 onwards would be intermingled with the effects and after-effects of the global financial crisis. Data are included in the regression estimates for only the partners with whom Bangladesh has

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<sup>10</sup> It would not be unwise to presume that such an assumption may inflate criticism.

<sup>11</sup> Based on recent gravity literatures

trading statistics (even for a single year over the study timeframe). This procedure effectively includes the effectual traders of Bangladesh economy and restricts the zero trade problem at a minimum level. This course of action may also partially account for the vastly known multilateral resistance term setback.

## **5. EMPIRICAL RESULTS**

As mentioned earlier (refer to the methodology section), two independent set of models are employed to serve the purpose of the study. While the first set relates to imports, the latter relates to exports in the Bangladesh context. The focus is to provide classified emphasis of the impact of trade cost on export and import pattern separately. Moreover, two different estimation techniques (robust OLS regression [corrected for robust variance-covariance estimator] and PPML) have also been applied to both of the models to determine the regressors of trade. Taking the investigation one step further, a complete model and a reduced model have also been observed for each of the estimation techniques to compare any distinctive distortion arising from omitted variable bias.

The models incorporate different regressors from a versatile choice of fields (refer to the methodology section). While it includes the economic mass of the partner countries, proxy of their infrastructural condition, it also incorporates the added cost of import (or export), the geographical distance, cultural factors and institutional trade facilitating arrangements. Although, according to recent literature, sufficient components of trade cost remain unnoticed till date, the WB-ESCAP developed indicator incorporates a whole lot of necessary components of the trade cost dimension.

The study starts with the import model and investigates the explanatory components that augment (or restrict) average volume of import. Table 3 presents the regression estimates for the import model, where models 1 and 3 display the complete model with OLS and PPML estimations respectively and models 2 and 4 show reduced model with OLS and PPML estimations. One of the primary observations is that the data fits the model very well, with  $R^2$  in the range of 71 per cent for the OLS estimations and 73 per cent for the PPML estimations. Another indication that the model is performing very well is that that the model's F-test is highly statistically significant, rejecting the hypothesis that all coefficients are jointly zero. Number of sample observations remains the same across the estimations (compare Model 1 and 3 or 2 and 4). Excluding 'infrastructure index' and 'contiguity' variables, the number of sample observations increase at the cost of explanatory power of the comparing models (compare Model 1 and 2 or 3 and 4).

It can be observed that partner countries' GDP is significant at the 1 per cent significance level for each of the estimations. Considering the 'contig' variable, it is seen that this variable is also significant at 1 per cent level in both the estimations (only included in the complete model). Hence, it can be inferred that partner country's GDP and countries sharing border with Bangladesh are imperative from the point of view of enhancing the volume of import. Trade cost, donning a negative coefficient, is significant at 1 per cent level in all the estimations. This observation leads us to infer at the outset that trade cost hinders the volume of imports in the Bangladesh economy. Distance and RTAs and PTAs are also found to significantly influence Bangladesh's imports negatively. While trade cost, geographical distance and RTAs (and/or PTAs, FTAs) significantly impact import negatively, however, the impact of infrastructure of the exporters (to Bangladesh) is found to be ambiguous. This is because the infrastructure index is insignificant in both the estimations. However, one may argue that the impact of trade agreements, found negatively significant in the study (significant in each of the estimation techniques), needs explanation. One explanation to this aspect could be that import-related trade agreements in Bangladesh are not operationalised in full swing and thus, undermines its beneficial impact on import.

Table 3: Import Model

Dependent variable: ln\_IM

Regressors	OLS				PPML			
	Model 1		Model 2		Model 3		Model 4	
	Coef.	St. Error	Coef.	St. Error	Coef.	St. Error	Coef.	St. Error
ln_GDP	0.48***	0.12	0.55***	0.10	0.03***	0.01	0.03***	0.01
ln_TC	-1.86***	0.44	-1.87***	0.42	-0.11***	0.03	-0.11***	0.02
ln_dist	-0.70***	0.22	-0.74***	0.22	-0.04***	0.01	-0.05***	0.01
infra	0.28	0.26			0.02	0.01		
contig	1.66***	0.39			0.07***	0.02		
rta_pta	-0.82***	0.29	-0.68**	0.29	-0.05***	0.02	-0.04***	0.02
constant	20.93***	3.55	20.00***	3.68	3.07***	0.21	3.02***	0.20
R <sup>2</sup>	0.7212		0.7119		0.7345		0.7298	
Observations	92		96		92		96	

Note: \*\*\* represents significance at the 1% level

\*\* represents significance at the 5% level

\* represents significance at the 10% level

Table 4 presents the export model. From the export model front, the impact of the regressors over volume of export (log of the dependent variable) is quite different. Similar to the previous table specification, models 5 and 6 present the complete models for OLS and PPML estimations respectively and models 7 and 8 present the reduced-form models for OLS and PPML. With the number of observations remaining identical for each of the estimations, the R<sup>2</sup> is very impressive and stands at above 86 per cent. This indicates that the fit of the models have been satisfactory. The model F-test is

highly statistically significant, and this also indicates that the model is performing robustly. It should be noted upfront that an additional regressor, GSP, has been employed in the export model (all the other variables remain similar to the import model).

Analysis of the export model reveals that importer's GDP, trade cost and GSP provision are the only significant variables. Importer's GDP (positive coefficient) and trade cost (negative coefficient) are significant at 1 per cent level for each of the estimations. GSP provision, on the other hand, is significant at 5 per cent level with the exception of the PPML estimation employing the complete model (significant at 10 per cent level) (Model 7). Regardless of the level of significance, it can be observed that these regressors impact volume of export for different estimation techniques as well as different combination of regressors. Additionally, PPML estimation of complete model (Model 7) suggests the contiguity factor to be significant at 10 per cent level of significance. This notion of negative contiguity factor border variable's impact on Bangladeshi export may require attention to enhance the potential of export opportunity regarding her proximities.

Table 4: Export Model

Dependent variable: ln\_EX

Regressors	OLS				PPML			
	Model 5		Model 6		Model 7		Model 8	
	Coef.	St. Error	Coef.	St. Error	Coef.	St. Error	Coef.	St. Error
ln_GDP	0.50***	0.10	0.51***	0.10	0.03***	0.01	0.03***	0.01
ln_TC	-3.00***	0.54	-2.99***	0.53	-0.20***	0.03	-0.20***	0.03
ln_dist	-0.11	0.22	-0.10	0.22	-0.01	0.01	-0.01	0.01
infra	0.25	0.28	0.25	0.27	0.01	0.02	0.01	0.02
contig	-0.23	0.33			-0.03*	0.02		
gsp	0.68**	0.34	0.70**	0.33	0.04*	0.02	0.04**	0.02
rta_pta	0.05	0.25			0.01	0.02		
constant	19.66***	4.10	19.52***	4.16	3.09***	0.26	3.06***	0.26
R <sup>2</sup>	0.8619		0.8618		0.8631		0.8619	
Observations	112		112		112		112	

Note: \*\*\* represents significance at the 1% level

\*\* represents significance at the 5% level

\* represents significance at the 10% level

Nevertheless, trade cost, as an explanatory variable, keeps a high intensity of negative impact across each of the models observed. On the other hand, other regressors of the export model namely, geographic distance, infrastructure condition of partner countries or regional associations like different RTAs (and/or FTAs, PTAs) do not affect Bangladeshi export significantly. In this respect, an insignificant 'distance' variable yields indirect conclusions in the sense that Bangladesh does not trade more with neighbouring countries and/or trade less with distant countries. This would violate the

gravity concept and imply that other factors are impacting trade further than geographic distances. Considering price indices and other macro-economic indicators to be constant, it can be inferred from the analysis that trade cost is one of the major determinants of export volume in the Bangladesh context.

Concluding the empirical findings, it can be stated that estimates of the regressors for both import and export led models, by means of estimation techniques, match the business-as-usual scenario. Controlling for the heteroskedastic complexity of error terms, the models are found to be robust and provides goodness of fit. However, the study cannot conclude regarding elasticity nature of the variables (specifically partner countries' GDP, export, import and trade cost).

## **6. CONCLUSION AND RECOMMENDATION**

The paper has used gravity model to examine the role of trade cost in Bangladesh by utilising the recently accessible trade cost estimates of WB-ESCAP. In this connection, the paper has undertaken two separate exercises considering the distinct features associated with the country's export and import. With the aid of a range of estimation techniques, it has been unearthed that trade cost has significant impact for both Bangladesh's export and import. Additionally, it is also found that variables such as distance, trade arrangements and common border have significant roles with respect to Bangladesh's import. In contrast, country's export is positively associated with the economic condition of partner countries, measured by GDP and GSP facilities offered by the developed countries (in addition to the significance of trade cost). Curiously, RTAs and PTAs do not influence Bangladesh's export.

The findings of the study bring forward a number of central policy recommendations for Bangladesh. First, it is learned from the study that higher trade cost leads to lower trade volume for Bangladesh. Since the trade cost variable used in the models include a number of components including tariff, transport cost, cultural components and trade facilitation issues, future trade policies of Bangladesh will need to address these issues with earnest. In the context of Bangladesh, it is often the case that difficulties in the implementation of policies arise from their non-binding nature, lack of coordination and interlinkage of policies, inability to employ trade policies for the betterment of domestic-market oriented and import-substituting industries and the lack of initiative towards strengthening of trade promoting and trade diplomacy associated institutional bodies (Moazzem et al., 2011). In this backdrop, a rethinking of the trade-related policies of Bangladesh is essential, to benefit from the changing scenario of both the domestic and global grounds. To ensure maximum possible welfare for the country, trade policies of Bangladesh should immediately reflect her priorities and developmental needs.

While the preceding discussion predominantly considered trade in goods, it is the case that trade in services is an equally important contributor to the domestic economy. Having deduced that trade cost is an influential factor in determining the trade volume of goods, there is also urgent necessity of policy directions to enhance the competitiveness of service given the growing importance of service trade in the Bangladesh economy. Second, the RTAs and/or PTAs with which Bangladesh are associated are largely ineffective, at least until 2007. The major limitation lies in the quiescent SAARC Preferential Trade Arrangement (SAPTA), SAFTA and SAARC negotiations. Bangladesh should try to influence its partners in these RTAs and/or PTAs to make these platforms more trade-friendly. Third, GSP, which offers duty-free market access to developing countries by some of the developed countries, is an important factor pertaining to Bangladesh's export. This implies that Bangladesh should urge the developed partners for an early harvest of Doha Development Round (DDR) and more duty-free-quota-free access for the countries like Bangladesh.

In conclusion, progression towards the reduction of trade costs facilitating her own trade should be the primary ambition for a developing country like Bangladesh. Although the nation has come a long way from resolving numerous bottlenecks of trade cost including the key factor of non-transparency in customs procedures<sup>12</sup>, however, Bangladesh should take the road towards enhanced human and financial resources, better infrastructure facilities and apposite political support from the part of the politicians. For a low-income developing country<sup>13</sup> like Bangladesh, it is hence recommended that she balance the cost and benefit aptitude of trade facilitation and act in view of that. Hence, the need of the day is the integration of inclusive and effective trade-related policies.

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<sup>12</sup> Complex nature of customs documentation, requirement of longer spans of time in releasing and clearing goods from ports and corrupt customs personnel have been documented as major hurdles for carrying out trade in Bangladesh (Bhattacharya and Hossain, 2006).

<sup>13</sup> Bangladesh is categorised as a Least Developed Country (LDC).

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