QUANTIFYING THE IMPACT OF EMERGING TRADE ISSUES AND NON-TARIFF MEASURES ON BANGLADESH

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ABSTRACT

The overall aim of this thesis is to quantify the impact of emerging trade issues, including non-tariff measures (NTMs), for Bangladesh. This thesis focuses on how trade costs, mostly NTM-related trade costs, impact international trade. NTMs are policy-related trade costs that arise in addition to tariffs, and they are of particular interest as they can constitute a large share of trade costs, particularly for developing countries.

My research involves both econometric and computable general equilibrium modelling analysis. I developed a unique NTM dataset for Bangladesh, at the HS 6-digit product level, which is used to econometrically estimate the impact of NTMs on imports. Global computable general equilibrium modelling is then used for quantifying the impact of changes in trade costs.

This thesis comprises four applications of trade cost analysis. The first (chapter two) estimates the bilateral trade costs between Bangladesh and its leading trading partners, before investigating the factors that influence Bangladesh's import costs. To measure implied bilateral trade costs, I first deploy an inverse gravity equation. I then estimate the determinants of import trade costs at the HS 6-digit product level, applying PPML estimation techniques to a gravity model, using a unique new NTM database developed for this thesis. The results show that imports to Bangladesh are related in an expected way to common trade cost proxies and that NTMs negatively impact imports.

In the second application, I use the MyGTAP model, an extension of the well-known GTAP model which allows household disaggregation, to analyse the impact of eliminating export subsidies using a computable general framework. Export subsidies can be significant NTMs and important trade policy instruments for many developing countries. The simulations indicate that elimination of export subsidies has a positive effect on GDP. If we reduce the export subsidy by 50 percent and transfer this amount of money from the government to the targeted seven low-income household groups, real GDP may increase by about one percent. Government transfers to households lead to an increase in real income to all households, especially rural households, where incomes on average rise by 2.5 percent. This study suggests there are substantial opportunity costs to export subsidies, and household income could be enhanced by redirecting the spending to more productive channels.

In the third application, I again employ the MyGTAP model to estimate the potential market access costs of Bangladesh's least developed country (LDC) graduation. Bangladesh is an important case study of an emerging trading nation that will graduate from the LDC status to a developing country by 2026. The findings show that if developed countries impose a standard generalized system of preferences (GSP) tariffs while importing from Bangladesh and at the same time Bangladesh eliminates its export subsidies, Bangladesh's Gross Domestic Product (GDP) may drop by about 0.38 percent and exports could fall by about six percent. The ready-made garment sector could be affected severely, and exports may decline by about 14 percent. The analysis indicates that the income of urban households could decrease by three percent, and household consumption may shrink by about four percent.

In my fourth application, I explore how Bangladesh is dealing with balancing its relationship with its two important neighbours, India and China. China now holds the position of Bangladesh's top trading and investment partner, while India is its second-biggest trading partner. Bangladesh has substantial comparative advantages in the apparel, jute, and leather sectors, and at the same time, both countries offer generous tariff elimination for imports from Bangladesh. However, various NTMs and a lack of trade facilitation present mounting barriers to exporting to the giants' markets. Computable general equilibrium modeling simulations indicate that if India and China reduce NTMs through increased trade facilitation by 50 percent, Bangladesh's exports may increase by three percent to these two markets.

My thesis contributes to the improved understanding of emerging trade issues for Bangladesh. Using my new NTM dataset, I demonstrate the high costs of NTMs for Bangladesh. I then estimate the opportunity cost of export subsidies and the potential impacts of Bangladesh's LDC graduation, including on different households. Finally, I highlight the importance of improved trade facilitation between Bangladesh and the huge neighbouring economies of China and India.

ACKNOWLEDGEMENTS

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CHAPTER I: INTRODUCTION

BACKGROUND, MOTIVATIONS, AND OBJECTIVES

Trade costs can significantly impair international business, particularly in developing countries. They are the additional costs of supplying a product to a final consumer, excluding the marginal cost of production. Trade costs include mainly transportation costs, tariffs, non-tariff measures (NTMs), and trade facilitation. NTMs are policy-related trade costs that arise in addition to tariffs (Cadot & Gourdon, 2016) and they are of particular interest as they can constitute a large share of trade costs, particularly for developing countries (Dianna, 2020; Duval, et al., 2016; Ghodsi, 2019).

As the overall level of tariffs has been substantially reduced around the world through multilateral or regional tariff reductions, streamlining NTMs is now one of the new frontiers of trade policy (Otsuki, et al., 2001; Key, 2009; Ferro et al., 2015; Webb et al., 2020). The WTO tariff analysis online (2021) reported that applied tariffs had been reduced globally over the decades, but NTMs have increased significantly, suggesting that NTM-related costs are a major concern in international trade, particularly for developing countries.[1] Understanding the nature of these trade costs is essential for developing appropriate policies to reduce such costs and to enhance competitiveness.

NTMs can be pervasive and opaque: they are not published in tariff schedules, and they can be implemented in response to domestic challenges. A number of studies

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[1] Furthermore, COVID-19 has significantly increased NTMs especially on medical, and health related products and many countries-imposed export bans on vaccine, masks etc. as discussed in the Global Trade Alert (2021), Accessed on 30 January 2020, https://www.globaltradealert.org

indicate that NTMs are likely to restrict trade significantly. For example, Otsuki et al. (2001), Kee et al. (2009), Ghodsi (2019), and Liu et al. (2019), show that NTMs significantly reduce trade. In the literature, there are two main methods for estimating trade costs - direct and indirect. Chen & Novy (2012) investigate different measurement methods for trade costs. The indirect approach attempts to quantify overall measures of trade without distinguishing between cost sub-components. On the other hand, the direct estimates of trade costs rely on collecting directly observable trade data, along with various gravity variables of costs' sub-components. In addition to econometrics, computable general equilibrium models have been extensively used to explore the potential impact of NTMs.

Bangladesh is an important case study of an emerging economy that has increased trade greatly over the past decade. Bangladesh has made significant progress in its export-led growth and has been a frontrunner in South Asia, with a steady average economic growth rate of about 6.5 percent over the last decade. Bangladesh's average trade-GDP ratio is about 35 percent over the decade, which shows that the country is deeply integrated with the global economy (Bangladesh Bank, 2021). The country is set to graduate from the Least Developed Countries (LDC) category by 2026 (UN LDC Portal, 2021) and aims to become an upper-middle-income country by 2031 and a developed nation by 2041 (Bangladesh Economic Review, 2021). Following an export boom over the past decade, Bangladesh's total trade in goods and services increased from US$20 billion in 2000 to US$110 billion in the 2021 fiscal year – a growth of over five times in twenty years (Bangladesh Bank, 2021). Notwithstanding this, the level of Bangladesh's trade is

much lower in value than some other emerging economies such as Vietnam, India, and China, suggesting that an enormous part of Bangladesh's trade potential is largely unrealized. Some of the key constraints that Bangladesh faces in realising its trade potential include high trade costs induced by relatively high tariffs and NTMs, as well as other trade restrictions such as very limited trade facilitation. Out of 56 trade facilitation implementation programs of the World Trade Organization (WTO), only 50 percent are fully implemented currently.[2] Moreover, graduating from LDC status means Bangladesh will lose preferential market access and preferential rules of origin in most developed and developing markets. After graduation, the country will face stricter competition for market access with Vietnam, India, Indonesia, China and several others, particularly as these countries have free trade agreements (FTAs) with many developed countries.[3]

Against this background, the overarching objective of my thesis is to contribute to improved quantification of the economic and trade impacts of trade-related costs, with a particular focus on NTM-related costs for Bangladesh. To achieve this objective, I first develop a 6-digit product-level NTM dataset constructed from the Bangladesh Trade Portal (BTP). I also use United Nations Conference on Trade and Development (UNCTAD) NTMs dataset, the World Bank and UNCOMTRADE trade data as well as Global Trade Analysis Project (GTAP) data and Bangladesh Social Accounting Matrices (SAM). I use both

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[2]Retrieved from Trade Intelligence and Negotiation Adviser (TINA), https://tina.trade
[3] Vietnam is a member of RCEP, CPTPP and has signed many FTAs including with the EU, India has signed 13 FTAs and recently signed FTAs with the UK and Australia, while China has also been progressively signing bilateral and regional FTAs including RCEP.

econometrics and Computable General Equilibrium (CGE) techniques to analyse the impact of NTMs and other trade policy issues.

THESIS OVERVIEW

The main objective of this thesis is to quantify emerging trade issues, including non-tariff measures in Bangladesh. This thesis comprises four main chapters, along with the contribution of Bangladesh's HS -6-digit product level NTM dataset and contributions to developing a dataset for the United Nations Department of Economic and Social Affairs (UN-DESA) on LDC graduation monitoring progress (Appendix III). The four substantive chapters of this thesis are:

1. **Trade Restricting Impact of Non-Tariff Measures in Bangladesh.** In this chapter, I investigate the impact of NTMs. I first use Novy's (2013) inverse gravity to determine bilateral trade costs and then use augmented gravity, applying the PPML estimation method, to investigate the impact of tariffs and NTMs on Bangladesh imports.

2. **Evaluating the Impact of Eliminating Export Subsidies in Bangladesh.** In this second paper (Third chapter) I analyze the impact of eliminating export subsidies on Bangladesh, as these are major NTMs and an important aspect of trade policy for many developing countries. This study indicates there is a substantial opportunity cost of export subsidies, and household income could be enhanced by redirecting the spending to more productive channels.

3. **Costs of LDC Graduation on Market Access: Evidence from Emerging Bangladesh**. In the third paper (Fourth chapter), I estimate the costs of LDC graduation using a computable general equilibrium modelling framework. The macroeconomic analysis indicates that Bangladesh's economy will face a substantially adverse situation after graduation, with a new tariff regime that could lead to a reduction in exports by about 5.9 percent. The analysis indicates that the income of urban households could decrease by three percent, and household consumption may shrink by about four percent.

4. **Growing with Two Giants: A Mixed Blessing for Bangladesh.** In my fourth paper (Fifth chapter) I explore how Bangladesh is dealing with balancing its relationship with its two important neighbors, India and China. Although Bangladesh has huge potential for exports to these markets, it remains largely unrealized due to NTMs and a lack of trade facilitation.

My thesis contributes to a better understanding of emerging trade issues, which could be helpful trade policy insight for Bangladesh and many other LDCs to avoid any potential disruption in market access due to upcoming graduation. Using my new NTM dataset, I demonstrate the high costs of NTMs for Bangladesh, which will be valuable research evidence for streamlining NTM policy. I then move to a very narrow question – what is the effect of a particular type of NTM (exports subsidy) and investigate the opportunity cost of export subsidies which is a critical policy decision for many developing countries. I then estimate the potential long-term impact of LDC graduation

on market access using a computable general equilibrium modeling framework. It is worth mentioning that sixteen LDC countries, including Bangladesh, are at different stages of the graduation process (UN LDC Portal, 2021). In the final substantive chapter, I explore trade and investment relationships between Bangladesh and the giant neighboring economies of China and India.

RESEARCH METHODOLOGY

Gravity Modelling

The gravity model of international trade, first proposed by Tinbergen (1962), has been extensively used for trade policy analysis over the decades. One of the most well-known structural gravity models is that developed by Anderson & van Wincoop (2003) in which a multilateral resistance term for estimating bilateral trade costs was introduced. In their seminal work, Anderson & van Wincoop (2003) show that trade flows between two countries not only depend on bilateral trade measures but also multilateral measures. This structural gravity model has been used extensively in trade policy analysis to estimate bilateral trade costs. For example, Anderson & Yotov (2012) and Head & Mayer (2014) show the empirical success of gravity with aggregated data. On the other hand, Agnosteva & Yotov (2010), Anderson et al. (2015), etc. demonstrate different sectoral level gravity estimates. Pfaffermayr (2019), Yotov et al. (2016), and Santos Silva & Tenreyro (2006) show how maximum likelihood estimation techniques can be used in estimating international trade flows. Nevertheless, Novy (2013) recognizes that a shift in

bilateral trade measures does not only affect international trade but also domestic trade. This means that if a country's tariffs or NTMs increase, some trade can be diverted to international markets and some may be diverted to the national economy. We can calculate the tariff equivalent bilateral trade costs as suggested by Novy (2013).[4] To calculate the determinates of import trade costs, we use the PPML estimation technique, widely used in dealing with heteroskedasticity. Santos Silva & Tenreyro (2011) show the PPML estimator outperforms other linear and nonlinear estimators across a wide range of heteroskedastic and measurement errors in the data.[5]

Computable General Equilibrium (CGE) Modelling Framework

The most comprehensive modelling techniques for estimating the economy-wide impacts of trade policy involve CGE modelling, including the GTAP database and model. In this thesis, I use the MyGTAP model developed by Walmsley & Minor (2013), a customized and extended version of the standard GTAP model (Hertel, 1997). This MyGTAP interface allows us to incorporate country-specific data to investigate the impacts of different domestic policies at the household level, which is important for country-specific analysis. The GTAP model assumes a single regional household. However,

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[4] $\tau_{ij} \equiv \left(\dfrac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\dfrac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1$

[5] $\mathrm{E}(e_{rp}^{k}|Y_r^k, Y_p^k, Y^k, \tau_{\mathrm{rp}}, \Pi_r^k, \rho_p^k) = \mathrm{E}(ln\ e_{rp}^{k}|Y_r^k, Y_p^k, Y^k, \tau_{\mathrm{rp}}, \Pi_r^k, \rho_p^k) = 0$

in the MyGTAP model, we eliminate the single 'regional' household to allow the incorporation of private households and a government agent where expenses are directly related to the income received from endowment factors and taxes (Walmsley & Minor, 2013).[6] It also permits incorporating additional factors of production and multiple private households. The model allows for incorporating income from remittances, foreign aid, foreign capital, and government income. In the MyGTAP framework, the government collects income from taxes and duties revenue and foreign aid and spends this income on public consumption outlay, transfers to households, foreign aid outflow, and subsidies. Similarly, private households receive and accumulate their income from factors of production, transfers from the government and other households and foreign remittances. This accumulated income could be spent on different sectors, including consumptions, transfers, remittances outflow, and some savings. We also develop a baseline database for considering the long-term impact of different policy shocks.

Data for NTM Modelling

For Bangladesh, product- level NTMs data are not available in the Integrated Trade Intelligence Portal (I-TIP) of the WTO, therefore, we have compiled a data base of NTMs at the HS 6-digit product level from the Bangladesh Trade Portal (BTP) of the Ministry of

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[6] Refer, Walmsley & Minor (2013), and Minor & Walmsley (2013), for full documentation of MyGTAP data program and model.

Commerce (MoC).[7] The trade portal is a national information source where all tariffs, NTMs, and other regulatory information related to international trade are published. The BTP publicly publishes product-wise NTMs on its website, extracting mostly from the Import Policy Orders (IPOs) of the MoC and other government regulatory authorities including the National Board of Revenue (NRB) and Bangladesh Bank's circulars. NTMs are identified by product-wise (HS 6-digit) dummy variables for manufacturing and agricultural products. We consider import-related NTMs as classified by UNCTAD (2012), Chapter *A* to Chapter *L*.[8]

I use various other sources of data for my analysis. All bilateral trade data are collected from UNCOMTRADE, denominated in US dollars. Gross Domestic Product (GDP) and total trade data were collected from the World Development Indicators of the World Bank. Bilateral ad-valorem tariff data were collected from World Integrated Trade Solutions of the World Bank. Distance and other gravity variables data were collected from CEPII. Indian NTMs were collected from UNCTAD's I-TIP interface.[9]

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[7] The objective of the trade portal is to provide a convenient, logical, helpful window into international trade information and relevant regulations, particularly for NTMs related information.

[8] UNCTAD NTM Classification: Retrieved from https://unctad.org/system/files/official-document/ditctab20122_en.pdf.

[9] https://trains.unctad.org/Default.aspx

Data Extension to MyGTAP

I incorporate the Bangladesh social accounting matrix (SAM) data with the GTAP Version 10 dataset (Aguiar et al., 2019) applying the MyGTAP model. The latest Bangladesh social accounting matrix is available for 2012 and has been updated for 2014. I aggregate the regions and sectors in the GTAP dataset as required for the analysis related to Bangladesh's main trading partners and relevant sectors. A complete mapping is required between the sectors of the Bangladesh SAM with GTAP sectors, and with the aggregated regions. I then use the household consumption and ownership weights acquired from the SAM (2014) and incorporate them into the MyGTAP model. The ten newly aggregated sectors are mapped to the corresponding sectors in the Bangladesh SAM to define each household's consumption share of the 10 GTAP sectors. I also incorporate income and consumption data for ten different households based on the income level of Bangladesh's rural and urban regional households. These earnings are allocated to each of the ten households according to factor ownership shares. Household incomes were then adjusted for net foreign income, remittances, and capital depreciation, as suggested by Minor & Walmsley (2013).

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CHAPTER II: TRADE RESTRICTING IMPACTS OF NON-TARIFF MEASURES IN BANGLADESH

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Trade-restricting impacts of non-tariff measures in Bangladesh

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ABSTRACT

This paper estimates the bilateral trade costs between Bangladesh and its leading trading partners before investigating the factors that influence Bangladesh's import costs, including the contribution of NTMs. To measure implied bilateral trade costs, we first deploy an inverse gravity equation. We then estimate the determinants of import trade costs at the HS 6-digit product level, applying PPML estimation techniques to a gravity model, using a unique new NTM database developed for the current study. Our results show that imports to Bangladesh are related in an expected way to common trade cost proxies and that NTMs negatively impact imports.

KEYWORDS
Non-tariff measures; trade costs; gravity model; PPML; Bangladesh

JEL CLASSIFICATION
F13; F14; F17; F47

1. Introduction

Trade costs can significantly impair international business, particularly in the developing world. They are the additional costs of suppling a product to a final consumer, excluding the marginal cost of production. Trade costs include mainly transportation costs, tariffs and non-tariff measures (NTMs). NTMs are policy-related trade costs that arise in addition to tariffs (Cadot, Malouche, and Saez 2012; Fugazza 2013; Beghin, Disdier, and Marette 2015) and they are of particular interest as they can constitute a large share of trade costs, particularly for developing countries (Raihan, Khan, and Quoreshi 2014; Dianna 2020; Hu and He 2020). Most developing countries have limited resources and capacity to deal with NTMs that may present requirements such as traceability and lab testing capacity. Bangladesh is an important case study of an emerging economy that has increased trade greatly over the past decade, but trade flows still remain well below potential.

NTMs can be pervasive and opaque: they are not published in tariff schedules, and they can be in implemented in response to domestic challenges.[1] Indeed, Herghelegiu (2018) shows that NTMs are driven not only by economic motivations but also political reasons. NTMs can be discriminatory (Ferrantino 2006; Ing and Cadot 2017). Even if uniformly applied to all imported goods, many NTMs discriminately affect exporters and importers due to the potentially complex nature of NTMs and the

differential capacity of countries to deal with NTMs applied by each trading partner (Bratt 2017). Transparency in NTMs is critical so that traders can assess clearly what their opportunities and challenges are.[2] An unforeseen blockage to trade can lead to costly delays and even the loss of a transaction. However, perhaps the bigger danger is that because of the uncertainty involved, businesses may skip some opportunities.[3] These indirect impacts of NTMs may be much larger than the direct effects (UNCTAD 2018).

As the overall level of tariffs has been substantially reduced around the world through multilateral or regional tariff reductions, streamlining NTMs is now one of the new frontiers of trade policy (Webb et al. 2020; Herghelegiu 2018; Duval, Aman Saggu, and Utoktham 2016; Devadason and Chenayah 2014; Farnaz, Nathalie, and Thierry 2018; Vinícius and Cláudio 2020). Understanding the nature of these trade costs is essential for developing appropriate policies to reduce such costs and to enhance competitiveness.[4]

A number of studies indicate that NTMs are likely to restrict trade significantly. For example, Otsuki, Wilson, and Sewadeh (2001) compute the impact of a European aflatoxin standard on food exports from Africa, suggesting that implementation of this new standard would negatively influence of African exports to Europe. Kee, Nicita, and Olarreaga (2009) find a negative impact of NTMs, estimating restrictiveness indexes from dummy variables. George (2009) finds that companies are less likely to export to those countries with restrictive trade and poor customs administration. Ghodsi (2020) investigates the influence of Chinese technical barriers to trade and finds a negative effect on manufacturing imports. Liu et al. (2019) examine the impact of NTMs on African agriculture exports and find a significant reduction in agricultural goods exports due to different additional compliance requirements. Dianna (2020) explores the barriers of agricultural exports of Guyana and finds transactions related delay costs are the main barriers to exports. De and Rahman (2017) estimate the impact of Indian NTMs and find a similar negative effect on its imports. However, Bratt (2017) suggests that a substantial number of NTMs facilitate rather than impede trade. NTMs are complex in nature, with empirical studies indicating some mixed or even ambiguous findings. However, the WTO tariff analysis online (World Trade Organization 2019) reported that applied tariffs had been reduced globally, but NTMs have increased significantly (Global Trade Alert 2020), suggesting that NTM-related costs are the major concern in international trade, particularly for developing countries.

In the literature, there are two main methods to estimating trade costs - direct and indirect. Chen and Novy (2012) investigate different measurement methods of trade costs. The indirect approach attempts to quantify overall measures to trade without distinguishing between cost sub-components. On the other hand, the direct estimates of trade costs rely on collecting directly observable trade data along with various gravity variables of costs' sub-components.

Given this background, the main research question of the current study is to estimate Bangladesh's trade costs and explore how tariffs and NTMs are affecting Bangladesh's imports. We develop a unique HS 6-digit product level NTMs database

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for this study, extracted from the Bangladesh Trade Portal (BTP) under the Ministry of Commerce of the Bangladesh government.

We first use Novy's (2013) inverse gravity to determine bilateral trade costs and then use augmented gravity, applying the PPML estimation method, to investigate the impact of tariffs and NTMs on Bangladesh imports. We also use the two-stage least square (2SLS) to deal with the endogeneity problem, using Indian NTMs as an instrumental variable. To the best of our knowledge, no research has so far been undertaken on estimating trade costs and the effect of NTMs on the Bangladesh economy. The inverse gravity method and database that used to accomplish the study are discussed in Section 2 of this paper. Section 3 calculates the trade costs for Bangladesh. In the fourth section, we apply a gravity framework using PPML estimation techniques to explore the variables, including NTMs, that influence Bangladesh's imports. The final section offers our conclusions.

1.1. Barriers to trade in Bangladesh

Bangladesh is an emerging economy that has been a frontrunner in South Asia, with a steady average economic growth rate of about 6.5 percent over the decade (World Bank 2020). In 2019, Bangladesh had a real GDP growth rate of 8.2 percent, compared to the South Asian average of 5.5 percent. Following an export boom over the past decade, Bangladesh's total trade in goods and services increased from US$31 billion in 2007 to US$111 billion in 2019 (Figure 1).

The current trade openness ratio of about 37 percent in 2019 reflects how much the country is integrated with the global economy. However, the level of Bangladesh's trade is much lower than some other emerging economies such as Vietnam, India and China, suggesting that an enormous part of Bangladesh's trade potential is largely unrealized (Rahman and Ara 2010; Kathuria and Malouche 2016).

A key contributor to constraints on Bangladesh's trade could be excessive trade costs, including relatively high tariffs and NTMs, as well as other trade restrictions such as very limited trade facilitation. The average trade-weighted tariff applied by
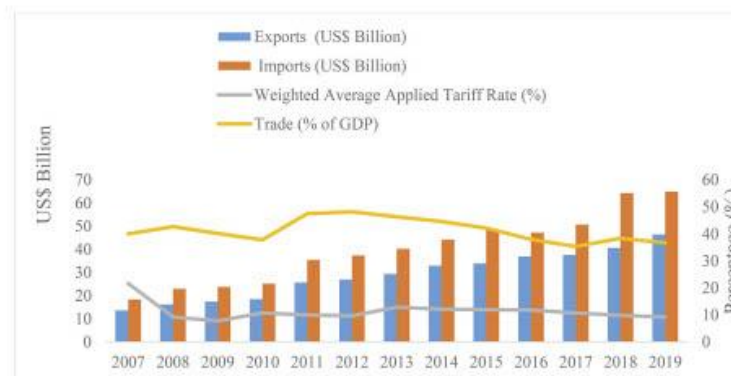
Figure 1. Trends in trade and tariffs for Bangladesh, 2007–2019. *Source*: World Development Indicators (2020) and Bangladesh Bank (2020).

Bangladesh has decreased moderately from 21 percent in 2006 to 10 percent in 2019. However, Bangladesh imposes a range of different NTMs, with the primary source of NTMs data being the Import Policy Order (IPO) of the Bangladesh government. The Ministry of Commerce (MoC), consulting with other ministries and departments, compiles details of all NTMs to publish in the IPO every three years. The most recent Import Policy Order is IPO 2015-2018 (MoC 2018). There are also a small number of NTMs published under the Statutory Regulatory Order (SRO), if required either by MoC or by the National Board of Revenue (NBR). Table A1 shows the main NTMs that Bangladesh has been imposing, as shown in the IPO 2015-2018.

2. Methodology for estimating the trade costs

The gravity model of international trade, first proposed by Tinbergen (1962),[5] has been extensively used for trade policy analysis over the decades. One of the most well-known structural gravity models is that developed by Anderson and van Wincoop (2003), in which a multilateral resistance term for estimating bilateral trade costs was introduced. In their seminal work, Anderson and van Wincoop (2003) show that trade flows between two countries not only depend on bilateral trade measures but also multilateral measures. This structural gravity model has been used extensively in trade policy analysis to estimate bilateral trade cost. For example, Anderson and Yotov (2012) and Head and Mayer (2014) show the empirical success of gravity with aggregate data. Larch, and Yotov (2015) demonstrate different sectoral level gravity estimates. Pfaffermayr (2019), Yotov et al. (2016), and Santos Silva and Tenreyro (2011a) show how maximum likelihood estimation techniques can be used in estimating international trade flows. Nevertheless, Novy (2013) recognizes that a shift in bilateral trade measures does not only affect international trade but also domestic trade. This means that if a country's tariffs or NTMs increase, some trade can be diverted to international markets and some may be diverted to the national economy.

The gravity model developed by Anderson and van Wincoop (2003, 2004) is based on a constant elasticity of the substitution that takes account of bilateral and multilateral trade measures:

$$x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{\prod_i P_j} \right)^{1-\sigma} \tag{1}$$

where x_{ij} indicates exports from i to j, y_i, and y_j is the GDP of country i and j respectively, y^W is world GDP, and σ is the elasticity of substitution. $\prod_i$ is the outward multilateral resistance variable, whereas P_j is the inward multilateral resistance variable, and t_{ij} is trade costs. Anderson and van Wincoop (2003) assume that bilateral trade costs are symmetric, that is outward and inward multilateral resistance is the same. But Novy (2013) argues that there are several shortcomings of Anderson and van Wincoop (2003) assumptions. Novy (2013) contends that the trade cost function might be misspecified as some crucial variables of trade cost determinants may be omitted. Trade costs are also time-varying; therefore, the time-invariant trade

cost proxies have limitations in capturing trade cost changes over time. Novy (2013) also argues that any variation in bilateral trade measures affects not only international trade but also domestic trade. Using the gravity Equation (1) for a country's intranational trade can be written with intranational or domestic trade (x_{ii}) and the product of the outward and inward multilateral resistance as:

$$\prod_i P_i = \left(\frac{x_{ii}/y_i}{y_i/y^W}\right)^{1/(\sigma-1)} t_{ii} \tag{2}$$

Novy (2013) shows that it is easier to get the bidirectional gravity equation as well as easy to calculate the change in multilateral resistance over time as it does not depend on time-invariant trade cost proxies, such as distance, for given domestic trade costs, t_{ii}.

$$x_{ij} x_{ji} = \left(\frac{y_i y_j}{y^W}\right)^2 \left(\frac{t_{ij} t_{ji}}{\prod_i P_i \prod_j P_j}\right)^{1-\sigma} \tag{3}$$

Substituting the solution from the Equation (2) and rearranging yields:

$$\frac{t_{ij} t_{ji}}{t_{ii} t_{jj}} = \left(\frac{x_{ii} x_{jj}}{x_{ij} x_{ji}}\right)^{\frac{1}{\sigma-1}} \tag{4}$$

Then we can calculate the tariff equivalent as suggested by Novy (2013) and the bilateral trade cost, τ_{ij}.

$$\tau_{ij} \equiv \left(\frac{t_{ij} t_{ji}}{t_{ii} t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii} x_{jj}}{x_{ij} x_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \tag{5}$$

To calculate the trade costs, we need different parameters, especially the elasticity of substitution. Anderson and van Wincoop (2004) suggested the value of elasticity of substitution (σ) is more likely between 5 and 10. Novy (2013), Arvis et al. (2012) and Wen, Zheng, and Liu (2013) used σ as 8 while computing trade costs. In order to investigate the elasticity of substitution influence on trade costs, in the current study, we set the value of elasticity of the substitution as 5 (low), 8 (middle) and 10 (high) respectively for analysis.

2.1. Data

All bilateral trade data are collected from UNCOMTRADE (2019), denominated in US dollars. Gross Domestic Product (GDP) and total trade data were collected from the World Development Indicators of the World Bank (WDI, 2019b). Bilateral ad-valorem tariff data were collected from World Integrated Trade Solutions of the World Bank (WITS, 2019a). Distance and other gravity variables data were collected from CEPII (CEPII 2019). Indian NTMs were collected from UNCTAD's I-TIP interface.[6] As intranational trade data are unavailable we can calculate the intranational

trade data (x_{ii}) as suggested by Novy (2013) and Wei (1996) where intranational trade is the total income (output) minus total exports, $x_{ii} = y_i - x_i$. However, Novy (2013) suggested that GDP data are not a suitable proxy for income y_i for two reasons: GDP is based on value added and also it includes non-tradable service data. Novy (2013) uses OECD's STAN industrial analysis output data, but these data cover only a few years for 23 developed countries. However, since gross output data are not available for most countries, intranational trade is calculated instead as GDP minus exports. This approach is investigated by Jacks et al. (2009), who finds that the percentage change of trade costs calculated using GDP is similar to those computed with gross output.

To convert real GDP to output data, we use the fraction of produced goods that are tradable. Evenett and Keller (2002) suggest that the share of output that is tradable is in the range of 0.3 to 0.8, when others generally set it as 0.8 (Jacks, Meissner, and Novy 2007, 2011). Bangladesh's average trade-GDP ratio over the last decade was 41 percent (World Bank 2020). Considering Bangladesh is highly integrated in the global economy, the share of tradable goods could be higher, so the share's value is set as 0.8.

For Bangladesh, product level NTMs data are not available in the I-TIP, therefore, we compile a data base of NTMs at the HS 6 digit product level from the Bangladesh Trade Portal (BTP) of the Ministry of Commerce (MoC).[7] The trade portal is a national information source where all tariffs, NTMs, and other regulatory information related to international trade are published. The BTP publicly publishes product-wise NTMs on their website, extracting mostly from Import Policy Orders (IPOs) of MoC and other government regulatory authorities including the National Board of Revenue (NRB) and Bangladesh Bank's circulars. NTMs are identified by product-wise (HS 6 digit) dummy variables for manufacturing and agricultural products. Many agricultural products face more than one NTM, but we assume that if any product faces at least one NTMs, the dummy variable is one; otherwise, zero. We consider import-related NTMs as classified by UNCTAD (2012), Chapter *A* to Chapter *L*.[8] We use only one reporter country, Bangladesh, as we are exploring product level cross-sectional data. Bangladesh's top-product trade, import tariffs, and NTMs are summarized in Table A2.

3. Trade costs measures for Bangladesh

We use Novy's (2013) inverse gravity model (Equation (5)) to calculate the bilateral trade costs presented in Appendix A3. These are used to compute trade cost indices, with the USA being the base country and 2007 the base year with a value of 100.[9] These bilateral trade costs indices are presented in Appendix A4 and it shows the trend of bilateral trade costs over the year with Bangladesh trade partners.

Table A4 also shows the estimated results of the percentage change in Bangladesh's relative bilateral trade costs measure between 2007 and 2018 with its eight biggest trading partners. We use an elasticity of substitution (σ) value of eight, noting that Anderson and van Wincoop (2004) and Novy (2013) also used the value of elasticity of substitution (σ) of eight. Under these assumptions, we find the bilateral trade costs of Bangladesh have reduced moderately with most of its major

trading partners.[10] However, Bangladesh's bilateral trade costs with the US and Pakistan did not decrease as much as might have been expected.[11]

In sensitivity analysis, we also estimate the trade cost using the elasticity of substitution five and ten to check robustness of the estimates. The sensitivity analysis results show that estimated trade costs vary slightly under different values of elasticity of substitution, but the trends remain the same over the period considered. The analysis shows that trading with India, China, and the EU incur the lowest costs for Bangladesh. Bangladesh has a long traditional trading relationship with China as Asia Pacific Trade Agreement (APTA) partner and India under the South Asian Free Trade Agreement (SAFTA) as well as APTA.

Preferential market access and preferential rules of origin could be a possible reason for reduced bilateral trade costs between Bangladesh and its major trading partners.[12] Bangladesh has enjoyed preferential market access to the EU as well as most developed markets under either GSP or Duty-Free Quota-Free (DFQF) market access of WTO (UN LDC Portal 2021). However, the EU adopted a new GSP law in 2013, implemented from 1 January 2014 that further lowered trade costs.[13] The new GSP reform was mainly to simplify the rules of origin for least developed countries (LDCs). To export to the EU market as an LDC, Bangladesh must meet a 30 percent domestic content requirement, which was previously 45 percent, along with a single transformation for clothing exports that previously was double transformation (e.g. from yarn to fabric to clothing), introduced in 2014.

Furthermore, the Export Promotion Bureau (EPB) of Bangladesh government introduced GSP automation for the EU market, where exporters can submit a certificate of origin (CoO) online from 2015.[14] These initiatives may have an impact on reducing exports costs, which leads to reduced total trade costs with the EU, especially after 2014 as shown in Table A4.

Bangladesh's top three trading partners in 2019 were the EU, China, and India. Trade with the EU was US$35 billion, which is one third of the country's total trade, while trade with China and India was US$19 billion (18 percent) and US$10 billion (10 percent) respectively (Bangladesh Bank 2020). Trade costs with the EU, China and India have been reduced significantly over the years as well.

However, Bangladesh's bilateral trade cost has decreased only very slightly with the USA, which could be due to the high tariff imposed by the USA as they suspended its GSP from June 2013. The US has maintained higher tariffs (about 12.8 percent) for textiles and clothing products imported from Bangladesh; these are the main export items for Bangladesh (World Trade Organization 2021). Bangladesh has enjoyed duty-free access to the USA market for 97 percent of tariff lines under WTO's duty free quota free (DFQF) scheme[15] but since this excludes garments and textile products, it may not be very useful for Bangladesh to access the US market.

4. Estimating the determinates of Bangladesh's imports: do NTMs matter?

Overall, when considering key trading partners, the bilateral trade costs analysis suggests that Bangladesh trade costs have reduced moderately over the decade, which might be due to reduced tariffs, but this requires further investigation to understand

the factors influencing Bangladesh's imports. In the following section, we undertake detailed analysis of these determinants.

Quantifying the effects of NTMs is a daunting task, including the need to deal sometimes with zero trade flows, measurement errors, and endogeneity. The lack of consistent and reliable data series for NTMs also hinders estimating the effects of NTMs (UNCTAD 2018). The two types of methods normally used to quantity the NTM are price-based or quantity-based methods. A price-based approach can compare prices in the importing country with prices of comparable products in free markets, i.e. without distortions (Francois et al. 2013; Egger et al. 2015; Li and Beghin 2014; Ghodsi and Robert 2016; Cadot and Gourdon 2018). However, Ferrantino (2006), Dean et al. (2009) and Berden and Francois (2015) caution against using the price-based method for trade policy analysis since it requires large amounts of product-level price data to estimate NTMs for specific products. Quantity-based approaches use gravity models to estimate by how much the presence of an NTM influences trade flows compared to potential trade (Otsuki, Wilson, and Sewadeh 2001; Kee, Nicita, and Olarreaga 2009; Ferro, Otsuki, and Wilson 2015; Fernandes 2017; Ghodsi 2020; Webb, Gibson, and Strutt 2019). We follow a quantity-based approach in the current analysis.

4.1. Estimation procedure

To calculate the determinates of import trade costs, we use the PPML estimation technique, widely used in dealing with heteroskedasticity. Santos Silva and Tenreyro (2006) show the PPML estimator outperforms other linear and nonlinear estimators across a wide range of heteroskedastic and measurement errors in the data.[16] However, Santos Silva and Tenreyro (2011b) identify potential convergence shortcomings of the Poisson command in Stata when estimating the gravity equations recommended by Santos Silva and Tenreyro (2006). To solve these problems, Santos Silva and Tenreyro (2011b) suggest constructing a subset of explanatory variables, dropping one variable, checking if there are any collinearities with dependent variables, and identifying if any of them can be included in the model. Yotov et al. (2016) also suggest a reduced form of regression, dropping variables one by one and test-checking the model's fitness.

Following this approach to deal with the convergence issue, we drop the reporter GDP from the model, finding collinearity with the dependent variable. We then check NTM, tariff, and distance variables one by one, and run the likelihood ratio (LR) test, finding these variables are significant. The deviance goodness of fit (17.6) and Pearson goodness of fit (14.6) are also very high, indicating a good fitting model.

4.2. Discussion of results

Table 1 depicts the descriptive statistics of the key variables included in the gravity model. In our sample, Bangladesh is the only importing country, whereas exporting countries are all those who traded with Bangladesh in 2018. The sample size is 25,578 products at the HS 6-digit level. NTMs are identified by separate product-wise (HS 6

Table 1. Descriptive data statistics.

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Import	25,578	1,305,276	1.93E + 07	1	1.42E + 09
Ln Import	25,578	8.939	3.882	0	21.07
Ln Tariff (1 + Tariff)	25,578	1.213	0.1361	1	1.37
NTM	25,578	0.125	0.330	0	1
Ln distance	25,578	8.390	0.635	6.04	9.80
Ln GDP partner	25,578	27.231	2.081	18.52	30.02
Adjacency	25,578	0.071	0.257	0	1
Common language	25,578	0.068	0.252	0	1
Common colony	25,578	0.289	0.453	0	1

Source: Authors' calculations, Note: ln = Natural log.

digit) dummy variables for manufacturing and agricultural products. In addition to the entire sample analysis, we also analyze the dataset at the agricultural and non-agricultural product level. The correction matrix is shown in Table A5. We run a Breusch-Pagan/Cook-Weisberg test for heteroscedasticity and find a large chi-square that indicates that heteroskedasticity. Similar results are found from White's test for homoscedasticity.

Table 2 presents the OLS regression findings for all products at the HS6-digit level, as well as agricultural products (HS1-24) and non-agricultural products. The OLS estimates show a higher value on the coefficients on GDP, distance, tariffs, and NTMs. Table 3 depicts PPML estimates which gives more robust results as they allow control of heteroskedasticity. We observe a different pattern of coefficients while using PPML estimations compared to OLS. In particular, the value of coefficients on the partner's GDP, distance, and tariffs drops when using the PPML estimator which is consistent with Santos Silva and Tenreyro (2006).

Concerning adjacency, we note that Bangladesh's main borders are with India and Myanmar and that imports from neighbouring countries are much lower compared to other trading partners (Basu and Debabrata 2007; Kabir and Razzaque 2020; Bangladesh Bank 2020).[17] India has prohibited trade of ceramics and electronics goods through land customs stations. Recently, India has imposed anti-dumping duties on Bangladesh's jute products (Director General of Trade Remedies 2019).[18] Business with Myanmar land border has been suspended for some time due to the Rohingya crisis.

Table 3 shows that the coefficients of tariffs, NTMs, distance, and partner GDP have the anticipated sign under the gravity framework and are statistically significant at the 1 percent level. The coefficient of partners' GDP is positive and highly significant, which implies that Bangladesh tends to import more from larger economies. Distance also negatively affects imports and is significant at the 1 percent level. Tariffs are still a major import barrier to Bangladesh, as shown by the relatively large coefficient for tariffs. The weighted average applied import tariff for the top 100 HS-6 products is about 18.8 percent (BTP 2020). Therefore, it is likely that there is potential to increase imports by reducing import tariffs.

NTMs coefficients are negative and highly significant at the 5 percent level, with the effect of NTMs on agricultural imports being much higher than for the non-agricultural sector. The most common NTMs are sanitary and phytosanitary measures (SPS) and technical barriers to trade (TBT), which are mostly imposed on agricultural

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Table 2. OLS estimation, dependent variable log imports.

	All products	Agriculture (HS1-24)	Non-agriculture
Ln Tariff	−3.785	−4.293	−3.887
	(7.95)**	(7.04)**	(6.97)**
NTM	−1.855	−2.396	−1.373
	(6.79)**	(2.50)*	(6.55)**
ln Distance	−1.751	−0.012	−1.867
	(36.14)**	(0.07)	(37.15)**
Ln GDP	0.44	0.042	0.463
	(29.25)**	(0.73)	(29.61)**
Tariff*NTM	−3.542	−4.071	−3.503
	(8.85)**	(2.84)**	(8.61)**
Adjacency	−1.219	0.491	−1.456
	(3.29)**	(0.61)	(3.45)**
Common language	0.226	0.554	0.38
	(0.59)	(0.65)	(0.88)
Common colony	0.074	0.244	0.053
	(0.9)	(0.99)	(0.61)
Constant	19.771	15.893	20.223
	(28.29)**	(7.01)**	(27.36)**
Adjusted R2	0.16	0.15	0.18
N	25,578	1,745	23,833

Source: Authors' estimation. *Notes*: Robust t-statistics in parentheses.
*$p < 0.05$.
**$p < 0.01$.
All variables except dummies taken in the log. GDP and trade were taken in the model at current US$value. Tariffs were taken 1 + tariff rate.

Table 3. PPML estimation, dependent variable imports.

	All products	Agriculture (HS1-24)	Non-agriculture
Ln Tariff	−1.183	−2.696	−1.449
	(3.33)**	(4.19)**	(2.23)*
NTM	−1.754	−2.372	−0.766
	(2.98) *	(2.73) *	(2.86) *
ln Distance	−0.391	−0.936	−0.919
	(2.75) *	(2.97)*	(4.46)**
Ln GDP	0.274	0.059	0.29
	(4.21)**	(0.82)	(6.18)**
Tariff*NTM	−2.333	−3.254	−1.37
	(2.48)*	(2.21)*	(2.29) *
Adjacency	−1.268	−1.438	−1.535
	(1.73)	(0.84)	(2.15)*
Common Language	0.838	3.956	0.421
	(1.14)	(3.90)**	(0.56)
Common Colony	0.515	−0.958	0.73
	(1.23)	−0.77	(1.85)
Constant	13.856	15.008	15.48
	(4.70)**	(1.4)	(7.11)**
Pseudo R2	0.1554	0.1943	0.188
Log pseudolikelihood	−1.16E + 11	−2.14E + 10	−8.61E + 10
N	25,578	1,745	23,833

Source: Authors' estimation. *Notes*: Robust - z-statistics in the parentheses for PPML.
*$p < 0.05$.
**$p < 0.01$.
All variables except dummies taken in the log. GDP and trade were taken in the models at current US$value. Tariffs were specified as 1 + Tariff rate.

products. This finding is consistent with expectations since most agricultural products face at least several different types of NTMs. The effect of NTMs on imports in the gravity analysis is the overall effect of all NTMs. Nevertheless, some NTMs may have

positive effects, for example if the imposition of these NTMs improve consumer trust or decrease transaction costs and promote trade (Ghodsi, M. 2019; Bratt 2017; Bao and Qiu 2010). It is also important to note that, when there is more than one NTM in place for one particular product, particularly for agricultural goods, the overall impact of NTMs is related to the relative strength of the different NTMs. This implies that the coefficients of the regression analysis are the overall effect of all NTMs.

We also run generalized moments of method (GMM) for the robustness check, but the PPML estimator demonstrates a better fit. The estimated coefficients using GMM are presented in Table A6. A joint hypothesis test for the total trade barriers that includes the interaction of tariffs and NTMs was performed to explore the cumulative effect. The estimated F-statistics from the restricted model than unrestricted model are much higher than the F-critical value, indicating that the collective impact is statistically significant. The effect of the interaction of tariffs and NTMs is also significant, indicating that the combined impact of tariffs and NTMs is much higher and is the leading barriers of Bangladesh imports.

4.3. Dealing with endogeneity

It is assumed that there is a potential endogeneity bias in estimating the effect of NTMs on trade volumes due to the causal effect of NTMs. The reverse causality is also a major concern, as governments may want to regulate some sectors where trade flows are higher, including through the imposition of NTMs (UNCTAD 2018). Prohibitive NTMs could make trade impossible. We assume in this study that the NTM is an endogenous variable.[19] Therefore, an instrumental variable may be required to ensure estimates are not downward biased. To deal with any potential endogeneity issue, we run a two-stage instrumental-variable regression for the model specification. In particular, we use Indian NTMs as the instrumental variables to instrument Bangladesh NTMs.

India is an important trading partner of Bangladesh and a member of SAFTA, APTA, BIMSTEC and BBIN, the sub-regional preferential free trade area with Bangladesh. The product level Indian NTMs that we use are collected from UNCTAD I-TIP, then matched with Bangladesh product level NTMs.

We first run the endogeneity test to check whether or not the NTMs are endogenous variables using Durbin and Wu-Hausman test. We reject the null hypothesis that NTMs are exogenous as the p-value of Durbin and Wu-Hausman test is zero. This result indicates that we need to correct and treat the NTMs as an endogenous variable. Then we check the correlation between Bangladesh NTMs and Indian NTMs, are our instrumental variable, using first-stage regression analysis.

Table 4 shows the 2SLS results that suggest rejecting the null hypothesis of weak instrument, indicating that the instrument seems appropriate. The instrument is statistically significant at the 5 percent level as the F-statistics of 26.44, 30.18, and 25.67 reported in columns two, four, and six for the first-stage regression, which is much higher than F-critical value. The results show that the instrument is strong and has a positive correlation with Bangladesh's NTMs. The second stage estimation coefficients are reported in columns 3, 5, and 7. We find that, after accounting for the

Table 4. The two stage least square (2SLS) estimation results.

	All products		Agriculture (HS1-24)		Non-agriculture	
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage
Indian NTM	−1.236		−2.39		−1.373	
	(3.13)**		(2.50)*		(4.59)**	
Ln Tariff	−1.301	−2.083	−1.293	−1.78	−1.09	−1.449
	(4.91)**	(7.33)**	(5.39)**	(5.28)**	(7.97)**	(2.23)*
BD NTM		−1.12		−2.135		−0.981
		(2.23) *		(3.82) *		(3.89) *
ln Distance	−1.08	−0.391	−0.012	0.936	−0.867	−0.919
	(8.18)**	(2.75) *	−0.07	(2.97)*	(7.15)**	(4.46)**
Ln GDP	0.38	0.204	0.042	0.059	0.463	0.57
	(6.25)**	(4.21)**	0.73	0.82	(9.61)**	(6.18)**
Tariff*NTM	−2.372	−2.58	−1.371	−2.754	−1.503	−1.37
	(5.23)**	(3.48)*	(2.84)**	(3.21)*	(2.91)*	(3.29)*
Adjacency	−0.88	−1.268	0.491	−1.438	−1.456	−1.535
	(4.26)**	−1.73	−0.61	−0.84	(2.45)*	(2.15)*
Common Colony	0.126	0.838	0.554	0.956	0.38	0.421
	−0.59	−1.14	−0.65	(1.90)*	−0.88	−0.56
Common Colony	0.074	0.515	0.244	−0.958	0.053	0.73
	−1.2	−1.23	−0.99	−0.77	−0.61	−1.85
Constant	5.99	12.856	15.893	15.008	20.223	15.48
	(12.89)**	(7.70)**	(7.01)**	−1.4	(27.36)**	(7.11)**
R2	0.12	0.1554	0.17	0.19	0.18	0.2
N	25,578	25,578	1,745	1,745	23,833	23,833
Weak identification test (F-stat)	26.44		30.18		25.67	
Over identification test	Sargan(score) chi2(1) = 0.029 (p = 0.75)					

Source: Authors' estimation. Notes: The instrument for Bangladesh NTM is Indian NTM. Robust t-statistics in parentheses.
*p < 0.05.
**p < 0.01.

endogenous relationship, the relationship between NTMs and Bangladesh's imports remain robust. For instance, the estimated NTMs coefficients are −1.12, −2.134, and −0.981, which are significant at the 5 percent level. The estimated coefficient of Bangladesh's NTM (1.12 for all products) passes the overidentification test (Sargan p-value is 0.75), indicating that the instrumental variable is exogenous and the model is correctly specified. The overall results suggest that the relationship between NTMs and Bangladesh's imports is not driven by the endogeneity problem and that our prior conclusions remain robust.

5. Conclusions

Market access depends on tariffs and meeting a set of regulations for health and safety, not only for humans but also animals, plants, and environmental protection. While quantifying the effects of these NTMs remains a daunting task, there has been a considerable improvement in the availability of data on NTMs and analytical methods used in recent years. The analysis of NTMs remains a complex issue, requiring a good understanding of the peculiarity of NTM data (Nicita and De Melo 2018).

We develop a unique HS 6-digit product-level NTMs dataset for this study from Bangladesh Trade Portal (BTP), which has not previously been used for analysis such

as this. The Ministry of Commerce (MoC) of the Bangladesh government, consulting with other ministries and departments, prepares the Import Policy Order (IPO) every three years, compiling all the NTMs to publish in the IPO. The MoC also extracts every product level NTMs from the IPO and posts on the BTP. The majority of NTMs are technical standards and prohibition to imports.

This paper estimates the bilateral trade costs between Bangladesh and its major trading partners from 2007 to 2018, before exploring which factors, including NTMs, influence Bangladesh's imports. To measure implied bilateral trade costs, we first deploy Novy's (2013) micro-founded inverse gravity equation. Our findings suggest that Bangladesh's bilateral trade costs may have reduced moderately with major trading partners over the decade, with the exception of the United States and Pakistan.

Applying PPML estimation techniques, we then estimate three different regressions for 2018, including all products at the HS 6-digit product level, agricultural products (HS1-24 digit), and non-agricultural products. The gravity estimates reveal that estimated import trade costs measures are reasonably related to common trade cost proxies, including tariffs, NTMs, and geographical variables. The results show that tariffs, NTMs, distance, and partner country GDP have the anticipated sign and are statistically significant at the 1 percent level. Our findings indicate that tariffs remain a significant trading barrier to Bangladesh's imports. NTMs also have a significant negative impact on Bangladesh imports. We find that the effect of NTMs on agricultural imports is much higher than that for the non-agricultural sector. This is consistent with a number of other studies and highlights that most agrarian products face a number of different types of NTMs that tend to impact trade flows adversely. We use a two-stage instrumental variable regression model to test that the endogeneity problem does not drive the relationship between NTMs and Bangladesh's imports. The effect of the interaction of tariffs and NTMs is also significant, indicating that the average combined impact of tariffs and NTMs is much higher than the individual impacts and is the leading barriers to Bangladesh imports.

Bangladesh is an example of an emerging nation with trade flows that remain considerably below potential. The findings of our study suggest that reducing the costs imposed by NTMs, as well as tariffs, is needed to realize the trade potential of Bangladesh. Our results highlight the importance of streamlining NTMs in Bangladesh, particularly for the agricultural sector. Trade negotiations at the multilateral, regional and bilateral level should be pursued by Bangladesh, with a focus on achieving reductions in the costs imposed by NTMs and improved trade facilitation, in addition to more traditional areas of tariff reductions and relaxation of quota constraints. Gaining improved market access in developed and developing markets, along with enhancing export competitiveness through improved productivity and quality, are key to sustainable trade growth for Bangladesh.

Notes

1. For example, the Global Trade Alert (2020) reported 800 discriminatory NTMs in the first seven months of 2020, which is 12 percent higher than the whole year in 2019. The Covid-19 pandemic is likely to be a key reason, with NTMs on medical goods and food items that are very sensitive to domestic politics in most countries (https://www.globaltradealert.org, accessed on 13 August 2020).

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2. The Trade Facilitation agreement (TFA) of the World Trade Organization (WTO) is a significant step towards transparency and accountability in international trade policy.
3. Products may fall under a negative list that prohibits exports or imports. It is challenging to calculate the counterfactual trade impact of these banned goods.
4. South Asian ease of doing business score is 58, while the EU score is 75 in 2020. Bangladesh's ease of doing business score is 45, much lower than the South Asian average.
5. $X_{ij,t} = A_t Y_{i,t}^{\alpha_1} Y_{j,t}^{\alpha_2} D_{ij}^{\alpha_3}$, $\alpha_1 > 0$, $\alpha_2 > 0$, $\alpha_3 < 0$, where $X_{ij,t}$ is the value of export, import or trade from country i to j, $Y_{j,t}$ and $Y_{i,t}$ are the GDP's of countries i and j in period t; A_t is a period-specific constant term; and D_{ij} presents bilateral distance between the importing and exporting countries or bilateral trade costs indices.
6. https://trains.unctad.org/Default.aspx
7. The objective of the trade portal is to provide a convenient, logical, helpful window into international trade information and relevant regulations, particularly for NTMs related information.
8. UNCTAD NTM Classification: https://unctad.org/system/files/official-document/ditctab20122_en.pdf
9. As the USA is one of Bangladesh's leading trading partners, and Bangladesh's trade costs with the USA have been relatively stable, the USA seems the most appropriate country to use as the base so that we can clearly show relative changes.
10. However, a limitation of Novy's (2013) approach is that bilateral trade costs are assumed symmetric. Therefore, some caution with this finding is appropriate.
11. Although Bangladesh and Pakistan both are members of the SAFTA, trade between these two countries is less than US$1 billion, and Bangladesh exported only US$72 million to Pakistan in 2019.
12. Bangladesh has been enjoying presential rules of origin (RoO) under SAFTA and APTA.
13. Regulation (EU) No. 978/2012 (2013), Official Journal of the European Union, European Parliament, EU, Brussels, Retrieved from http://europa.eu/lisbon_treaty/full_text/
14. GSP Tracker (epb-gsp.gov.bd)
15. All developed countries provide DFQF market access to LDCs for at least 97 percent of tariff lines as decided in the 6th WTO ministerial meeting in Hong Kong.
16. $E(e_{rp}^k | Y_r^k, Y_p^k, Y^k, \tau_{rp}, \Pi_r^k, \rho_p^k) = E(lne_{rp}^k | Y_r^k, Y_p^k, Y^k, \tau_{rp}, \Pi_r^k, \rho_p^k) = 0$
17. Trade between Bangladesh and Myanmar was about US$600 million in 2019 (Bangladesh Bank 2020). Bangladesh and India are cooperating in many forms, including in the SAFTA, APTA, Bay of Bengal Initiative for Technical and Economic Cooperation (BIMSTEC), and Bangladesh, Bhutan, India, and Nepal (BBIN) initiative. However, Bangladesh imported 27 percent of total imports from China and only 15 percent from India in 2019. Bangladesh faces numerous NTMs, especially antidumping and regulatory measures to access to the Indian market (Global Trade Alert 2020; Kabir and Razzaque 2020).
18. Director General of Trade Remedies (DGTR), Department of Commence, New Delhi, http://www.dgtr.gov.in/sites/default/%1Fles/Jute_FF_NCV_20.10.16.pdf.
19. Either omitted variables bias or measurement error or reserve causality issues are very common for NTMs.

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Appendices

Table A1. Main NTMs in Bangladesh as of December 2018.

Technical standard measures	Other nontariff measures
Standard certificate required to import petroleum	Approval required to import ethanol
Standards certificate required for after shave lotion	Certificate required for gas cylinder or gas container
Standards certificate required for biscuits	Clearance certificate required to import cartridges/ ammunitions of revolver and pistol
Standards certificate required for tea	Clearance certificate required to import opium
Standards certificate required for cement	Import of chassis with two stroke engines of three wheeler vehicles is banned
Standards certificate required for ceramics	Composition required to import salt
Standard certificate required to import tumbler & switches	Explosive license required to import furnace oil
Standards certificate required for coconut oil	Hatchery or breeding farm required to import one day chicks
Standards certificate required for dextrose monohydrate	Health certificate required for fish and fish products
Standards certificate required for edible sun flower oil	Heath certificate required to import pyrex and glassware products
Standards certificate required for fruit cordial	Import permit required to import potato seeds
Standards certificate required for fruit or vegetable juice	Import permit required to import rice seeds
Standards certificate required for hair oil	Import quota on cinematograph films
Standards certificate required for infant formula	Imports under aid required competitive quote
Standards certificate required for instant noodles	Mandatory fumigation test required to import cotton from the US
Standards certificate required for jams (fruits preserves) & jelly	No Objection certificate (NOC) required under some circumstances
Standards certificate required for LED acid starter batteries	Certificate required to import scrap vessels
Standards certificate required for lipstick	NoC Certificate required to import Radio Navigational, Remote Control Apparatus
Standards certificate required for liquid glucose	Packaging requirement for all kinds of milk food products
Standards certificate required for lozenges	Permission required to import deltramethrine of synthetic pyrithroid
Standards certificate required for marmalade	Permit required for nuclear reactors & its parts
Standards certificate required for milk powder	Permit required for private sector import of LPG
Standards certificate required for mosquito coil	Permit required for radio-active material
Standards certificate required for newsprint	Permit required to import eggs of poultry
Standards certificate required for pencils	Permit required to import Fishing nets
Standards certificate required for polyester blend shirting	Standard required cereal for infants and kids
Standards certificate required for portable fire extinguisher	PSI certificate required to import coal/hard coke
Standards certificate required for safety razor blades	PSI certificate required to M.S. billets
Standards certificate required for sauce (fruit & vegetable)	Quarantine certificate required to import potato seeds
Standards certificate required for shampoo	Quarantine certificate required to import rice seeds
Standards certificate required for sugar	Radiation certificate required for food items
Standards certificate required for tomato ketchup	Registration certificate is required to import used motor vehicles parts
Standards certificate required for writing and printing papers	Registration required to import weight measures items/machine
Standards certificate required toilet soap	Required approval for import of explosives
Standards certificate required tooth paste	Required certificate for importing poultry and birds
Storage facilities required to import edible oil	Required certificate to export fish and fish products including frozen fish
Substance tolerance limits for milk powder, milk food and milk products	Required to submit import price information
Standard certificate required to import ballast for fluorescent lamps	Requirement for importer to register with authorized banks
Standard Certificate required to import batteries	Requirement for Labelling of all kinds of milk food products

(continued)

Table A1. Continued.

Technical standard measures	Other nontariff measures
Standard certificate required to import carbonated beverages	Requirement for labelling of pesticides & insecticides
Standard certificate required to import chips/crackers	Restriction on insurance from selected company
Standard certificate required to import fans	Restriction to import except by the Defence Services
Standard certificate required to import honey	Restriction to import old motor car
standard certificate required to import skin cream	Restriction to import old vessels
Standard Certificate required to import soft drinks	Restriction to import warships
Standard certificate required to import soya bean oil	Finance measures (LC related)
Standard certificate required to import steel sheet & coil	
Standard certificate required to import toothpaste	
Standard certificate required to import tubular florescent lamps	

Source: Authors' compilation from BTP (2019) and IPO 2015-18. *Note:* There are 40 additional products which are prohibited to import. There are also approximately 85 chemicals items which require technical standard to import (IPO 2015-18). These can be provided by the authors on request.

Table A2. Bangladesh's top imports at HS-6 level, trade values, tariffs and NTMs in 2018.

Partner	HS code	Product name	US$ million	Weighted average applied tariff (%)	NTM imposed on all countries
Indonesia	151190	Palm oil, other than crude	1423.56	31.2	Yes
Singapore	271011	Light petroleum oils & preparations	1210.97	25.0	No
Kuwait	271011	Light petroleum oils & preparations	1192.24	25.0	No
Singapore	271019	Petroleum oils & oils	1129.35	25.0	No
Brazil	170111	Cane sugar, raw, in solid	750.77	25.0	Yes
India	520100	Cotton, not carded/combed	672.03	37.5	Yes
Argentina	150710	Soya bean oil, crude,	590.66	15.0	Yes
India	100630	Rice/milled or wholly milled	379.34	5.0	Yes
China	720711	Steel semi-finished products of iron	376.38	15.0	No
Malaysia	271011	Light petroleum oils	342.26	25.0	No
US	120100	Soya beans,	315.51	37.5	No
Malaysia	151190	Palm oil, other than crude	298.26	31.2	Yes
Canada	100110	Durum wheat	267.18	5.0	Yes
India	520521	Cotton yarn, single (excl. sewing thread)	255.48	5.0	No
China	520811	Woven fabrics of cotton, unbleached,	246.93	37.5	Yes
Saudi Arabia	270900	Petroleum oils & oils etc	215.15	25.0	No
Indonesia	270119	Coal other than anthracite & bituminous,	207.95	5.0	Yes
Brazil	150710	Soya bean oil, crude,	194.80	15.0	Yes
China	252310	Cement clinkers	194.04	15.0	Yes
China	271011	Light petroleum oils & preparations	193.91	25.0	No
Japan	870322	Vehicles (cylinder capacity >1000cc but not >1500cc	193.88	32.8	Yes
Pakistan	520942	Woven fabrics containing 85%/more of cotton,	186.48	37.5	Yes
Saudi Arabia	390210	Polypropylene,	185.05	15.0	No
Qatar	310210	Urea	184.87	0.0	Yes
Japan	890800	Vessels for breaking up	174.99	15.0	Yes
China	621710	Made up clothing accessories	170.47	37.5	No
India	520942	Woven fabrics of cotton,	165.83	37.5	Yes
China	851712	Telephones for cellular networks	165.75	15.0	No
Russia	100110	Durum wheat	155.38	5.0	Yes
Ukraine	100110	Durum wheat	155.29	5.0	Yes
China	520942	Woven fabrics of cotton, 85% or more of cotton,	151.01	37.5	Yes
India	100110	Durum wheat	142.68	5.0	No
China	310530	Diammonium hydrogenorthophosphate	139.97	0.0	No
United Arab Emirates	270900	Petroleum oils & oils obt. from bituminous	138.59	25.0	No
China	520842	Woven fabrics, weighing >100 g/m2	135.13	37.5	Yes
China	520839	Woven fabrics (excl. of 5208.31–5208.33),	132.97	37.5	Yes
China	851762	Machines for the reception,	132.14	15.0	No
Tunisia	310310	Superphosphates	130.01	2.4	Yes
China	551219	Woven fabrics of synthetic	125.48	37.5	Yes
Malaysia	520100	Cotton, not carded/combed	121.34	37.5	No
China	844720	Flat knitting machines; stitch-	118.65	0.0	No
China	520831	Woven fabrics of cotton, 85%/more of cotton	114.58	37.5	Yes
Germany	850213	Electric generating sets	114.42	5.0	No
Rep. of Korea	890800	Vessels & other floating	111.58	15.0	No
Saudi Arabia	310210	Urea,	108.60	0.0	Yes
Belarus	310420	Potassium chloride	107.63	0.0	Yes
Morocco	310310	Superphosphates	106.13	2.4	Yes
India	271011	Light petroleum oils	101.64	25.0	No

Source: Authors' calculations based on data from the BTP (2019).

Table A3. Trade costs between Bangladesh and major trading partners: 2007–2018 ($\sigma = 8$).

	China	US	EU	Canada	Korea	Japan	India	Pakistan
2007	0.66	0.62	0.57	0.68	0.65	0.66	0.62	0.62
2008	0.65	0.62	0.57	0.64	0.65	0.66	0.61	0.62
2009	0.62	0.63	0.56	0.63	0.64	0.64	0.59	0.62
2010	0.62	0.62	0.56	0.63	0.64	0.65	0.58	0.61
2011	0.54	0.61	0.55	0.62	0.63	0.64	0.56	0.62
2012	0.59	0.60	0.55	0.60	0.62	0.64	0.55	0.61
2013	0.61	0.61	0.55	0.60	0.60	0.64	0.56	0.60
2014	0.62	0.62	0.56	0.59	0.60	0.63	0.58	0.61
2015	0.60	0.61	0.54	0.59	0.59	0.63	0.57	0.60
2016	0.60	0.59	0.53	0.59	0.60	0.63	0.55	0.59
2017	0.58	0.62	0.54	0.59	0.58	0.62	0.55	0.61
2018	0.57	0.61	0.54	0.59	0.58	0.62	0.55	0.62

Source: Authors' calculations.

Table A4. Trade cost indices of Bangladesh with her major trading partners: ($\sigma = 8$, Bangladesh-USA 2007 = 100).

	China	USA	EU	Canada	Korea	Japan	India	Pakistan
2007	106.45	100.00	91.94	109.68	104.84	106.45	100.00	100.00
2008	104.84	100.00	91.94	103.23	104.84	106.45	98.39	100.00
2009	100.00	101.61	90.32	101.61	103.23	103.23	95.16	100.00
2010	100.00	100.00	90.32	101.61	103.23	104.84	93.55	98.39
2011	87.10	98.39	88.71	100.00	101.61	103.23	90.32	100.00
2012	95.16	96.77	88.71	96.77	100.00	103.23	88.71	98.39
2013	98.39	98.39	88.71	96.77	96.77	103.23	90.32	96.77
2014	100.00	100.00	90.32	95.16	96.77	101.61	93.55	98.39
2015	96.77	98.39	87.10	95.16	95.16	101.61	91.94	96.77
2016	96.77	95.16	85.48	95.16	96.77	101.61	88.71	95.16
2017	93.55	100.00	87.10	95.16	93.55	100.00	88.71	98.39
2018	91.94	98.39	87.10	95.16	93.55	100.00	88.71	100.00
% Change: 2007–2018	−13.64	−1.61	−5.26	−13.24	−10.77	−6.06	−11.29	0.00

Source: Authors' Calculation.

Table A5. Correlation metrics.

	lnImport	lnTariff	NTM	lnDist	lnGDPP	Adja	Com Lan	Com Col
lnImport	1							
lnTariff	−0.1974	1						
NTM	−0.1669	0.1785	1					
lnDistance	−0.2357	−0.055	−0.0259	1				
lnGDPP	0.214	−0.0705	−0.0514	0.0659	1			
Adja	0.0975	0.0131	0.0174	−0.4826	0.0988	1		
Com Lan	0.1003	0.0105	0.0179	−0.4647	0.122	0.6801	1	
Com Col	0.0254	0.059	0.0283	−0.5807	−0.4717	0.4338	0.4252	1

Source: Authors' calculations.

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Table A6. GMM estimation (dependent variable log imports).

	All products	Agriculture (HS1-24)	Non-agriculture
b1	−1.785	−2.293	−1.887
	(7.95)**	(7.06)**	(6.98)**
b2	−1.455	−2.396	−1.373
	(6.79)**	(2.51)*	(6.55)**
b3	−1.751	−0.012	−1.867
	(6.15)**	(0.07)	(7.15)**
b4	0.44	0.042	0.463
	(29.26)**	(0.74)	(29.62)**
b5	4.542	8.071	4.503
	(8.85)**	(2.85)**	(8.61)**
b6	−1.219	0.491	−1.456
	(3.29)**	(0.61)	(3.45)**
b7	0.226	0.554	0.38
	(0.59)	(0.65)	(0.88)
b8	0.074	0.244	0.053
	(0.9)	(1)	(0.61)
b9	19.771	15.893	20.223
	(28.29)**	(7.03)**	(27.36)**
N	25578	1,745	23,833

Source: Authors' calculations.

CHAPTER III: EVALUATING THE IMPACT OF ELIMINATING EXPORT

SUBSIDIES IN BANGLADESH

Abstract

Export subsidy reform is a crucial policy debate for many developing countries. This study analyses the impact of eliminating export subsidies for Bangladesh using a computable general equilibrium framework. Our simulations indicate that the partial removal of export subsidies has a positive effect on GDP. If we reduce export subsidies by 50 percent and transfer this funding from the government to the targeted seven low-income household groups, real GDP may increase by about 0.81 percent. Government transfers to households leads to an increase in real income for all seven targeted households, especially for rural households where incomes rise on an average by 2.5 percent. This study indicates there are significant opportunity costs associated with export subsidies, and household income could be enhanced by redirecting the spending to more productive channels.

Key Words: *Export Subsidies; Income Distribution; Ready Made Garments; Bangladesh; Least Developed Country (LDC); Computable General Equilibrium (CGE) modelling.*

1. Introduction

Export subsidies are a key policy intervention tool used in many developing countries that offer incentives for exporters in international markets. Export promotion strategies are trade policy tools that have a long tradition of providing export subsidies to increase exports. Export subsidies may increase domestic production and exports, but they are often criticized for inefficiencies and high costs to consumers in the subsidizing economy. Moreover, export subsidies could influence international market prices that could harm other exporters by reducing their market shares. The economic impact of export subsidies is inconclusive in the literature. It may boost domestic production, competitiveness, and trade for some sectors, but it could hurt the overall economy.

Bangladesh is one of the leading emerging economies with a steady average economic growth rate of about 6.5 percent over the last decade, including managing to maintain a growth rate of 3.5 percent during the pandemic (Bangladesh Bank, 2020). It has become a global role model for its socio-economic development miracle from a "basket case" as dubbed by Henry Kissinger in 1971. With this tremendous progress over the decades, Bangladesh is planning to graduate from least developed countries (LDCs) status to developing country (DC) status by 2026,[1] whereby Bangladesh will lose all preferential market access under the World Trade Organization (WTO) framework after graduation.

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[1] General Assembly resolution A/RES/76/8 adopted on 24 November 2021, decided that Bangladesh will graduate five years after the adoption of the resolution, i.e., on 24 November 2026. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf.

In addition, Bangladesh must eliminate its domestic trade-restrictive policies, especially export subsidies.

What is the impact of removing export subsidies on trade, income, and employment? This has been an important policy debate over the years. Elimination of export subsidies may have a differential impact across the different sectors and income groups. Laborde et al. (2013) evaluate the impact of export taxes at the HS 6-digit level on the world economy using a general equilibrium model setting and conclude that removing export taxes would increase global welfare by 0.23 percent. Panagariya (2000) appraises different country-specific export subsidies and concludes that Indian export subsidies have a marginal impact on its exports. He also argues that Brazil and Mexico's export subsidies eventually had a negative impact on export diversification. Elbehri & Leetmaa (2001) find that the elimination of export subsidies may improve welfare for net food-exporting countries but reduce the welfare for net food importers, due to deteriorating terms of trade. Coady et al. (2015) show that most subsidies are not well targeted, largely benefiting higher income groups and as a consequence subsidy may contribute to lower productivity, leading to economic weakness in the long run. Rhee & Kang (2019) identify that export subsidies may harm LDCs when there is a significant technological gap between two countries. Girma & Stepanok (2020) show that subsidizing firms increases domestic competition that makes it difficult for non-subsidized firms to export.

On the other hand, Bollman & Ferguson (2018) explore the impact of eliminating export subsidies on the different Canadian States and find that removing agricultural subsidies

hurts rural employment, with huge adverse spill-over effects in the surrounding communities. Helmers & Trofimenko (2013) assess the impact of export subsidies in Colombia and find that the export subsidy positively affects export volumes of the subsidized sectors. Narayanan & Rungta (2014) investigate the economic impacts of the elimination of Indian apparel subsidies and demonstrate that India may experience a welfare loss of about US$ 71.5 million, while other Asian countries may gain about US$ 218 million. Gharibnavaz & Waschik (2015) find that food and energy subsidy reforms accompanied by lump-sum payments to households could result in aggregate welfare gains of over 45 percent. Olivier et al. (2015) evaluate the short-term and long-term impact of the export promotion program in Tunisia, suggesting that in the short run subsidies have a significant impact leading to higher exports, greater product and market diversification but no impact in the long run. Fabrice et al. (2020) estimate the impact of Nepal's cash export subsidies under the Cash Incentive Scheme for Exports (CISE) program and show that export subsidies have limited impact on total exports but find a positive impact in improving the performance of apparel exporters who are more successful in accessing the government subsidy scheme. Ong et al. (2019) find that a one percent decrease in farm subsidies would reduce U.S. farm exports by 0.40 percent per annum.

This brief literature review indicates that the impact of export subsidies is ambiguous in the literature: removing export subsidies may adversely affect exports and employment,

but the overall welfare impact for a country can be positive due to increased overall efficiency.

Bangladesh has been using different instruments to support its export sector. Total exports were about US$ 47 billion in 2019, of which 87 percent of exports are accounted for by apparel products, with Bangladesh being the second-largest readymade garments exporting country in the world. The three main support measures are duty drawback, a bonded warehouse, and a cash subsidy which comprised about 3.7 percent of GDP in 2018 (Bangladesh Economic Review, 2019). As Bangladesh's main export sector is ready-made garments (RMG), most of this export subsidy goes to the apparel sector.

Moreover, as Bangladesh is set to graduate from the LDC to a DC status by 2026, export subsidies, especially for industrial products, have to be eliminated after graduation.[2] Other WTO members could – if subsidies are not eliminated, take action against Bangladesh under Articles 4 of Subsidies and Countervailing Measures (SCM) of WTO and ask for the withdrawal of the subsidy.[3]

Against this background, our study's primary research question revolves around what is the likely impact of eliminating export subsidies, especially on the macroeconomy and household income distribution in Bangladesh. To answer this question, we deploy the MyGTAP model framework developed by Walmsley & Minor (2013), an extension of the

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[2] The World Trade Organization (WTO) prohibits most direct export subsidies, except for least developed countries (LDCs).

[3] The WTO rules on subsidies in industrial goods are presented in Articles VI and XVI of GATT 1994 and in the Agreement on Subsidies and Countervailing Measures (SCM).

standard static GTAP model (Hertel, 1997). This MyGTAP framework allows us to incorporate country specific information to investigate the impacts of trade policies on different household groups (Minor & Walmsley, 2013). We include the income share for ten rural and urban regional households, then explore the potential economic impact of removing export subsidies on the national economy, households' incomes and consumption. This is the first attempt to empirically estimate the impact of removal of export subsidies in Bangladesh, as far as we know. Export subsidies are important policy measures that directly impact trade and may have huge spillover effects on employment, income distribution, and poverty in different households. The findings of this case study of an important emerging economy, could provide valuable policy insights for other developing economies as well.

A brief structure of Bangladesh export subsidies is discussed in the following section. Section three explains the MyGTAP methodology and how we incorporate the Bangladesh social accounting matrix (SAM) into the GTAP framework. We then present the findings from simulations in the fourth section before turning to some conclusions.

2. Export Subsidies of Bangladesh

Over the past decade, Bangladesh's export boom, particularly in the apparel sector, has helped Bangladesh to achieve significant economic growth. Bangladesh is the second-largest apparel exporting country in the world. In 2019, Bangladesh had a real GDP growth rate of 8.2 percent, compared to the South Asian average of 5.5 percent (World Bank,

2020). However, in 2020 the growth rate fell drastically to 3.5 percent due to the unprecedented Covid -19 pandemic. Bangladesh's total trade has increased from US$ 4 billion in 1980 to US$111 billion in 2019, then fell to 89 billion in 2020 due to the pandemic. The current trade openness ratio is about 32 percent, which reflects how integrated the country is with the global economy (Figure 1). The weighted average tariff rates applied by Bangladesh have decreased moderately over the decade from 22 percent in 2000 to 9 percent in 2019 (Figure 1).

Figure 1: Trends in Trade and Tariffs for Bangladesh
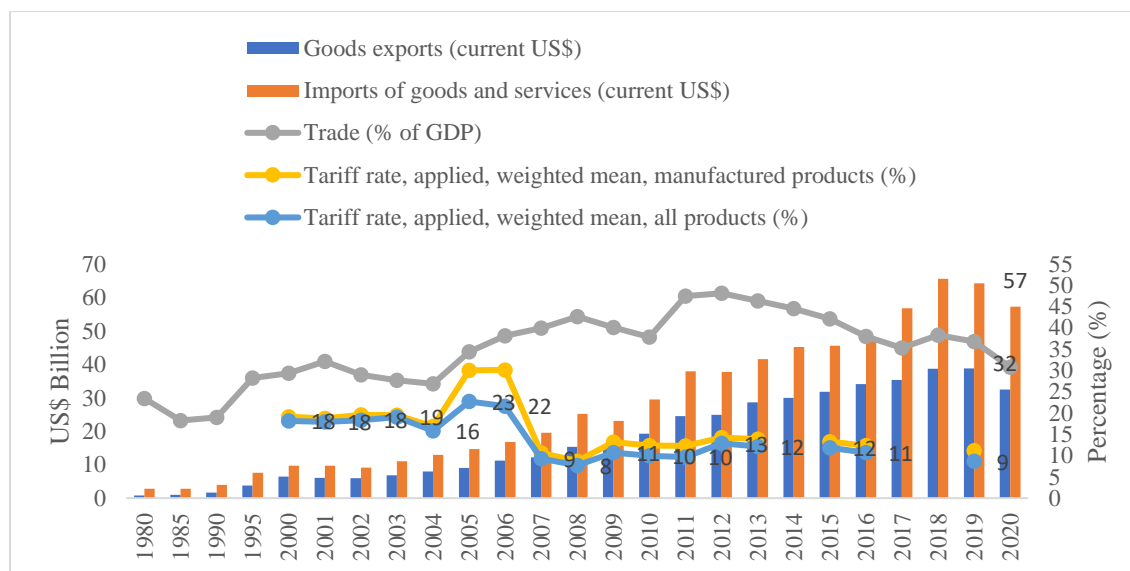
Source: World Bank Indicators (2021), Accessed on 16 August 2021.

Bangladesh has been using different supporting instruments to boost its exports. The main mechanisms are the bonded warehouse facilities, duty drawbacks, direct export cash incentives, various tax concessions, tax holidays schemes, and export credits. Figure

(2) shows different export incentives ranging from 5 percent to 20 percent on export values in various sectors over the last decades, with little change over time. The Bangladesh Bank announced cash incentives for the 2020 fiscal year for the export of products under 36 categories, including a two percent additional special incentive for ready-made garment products (Bangladesh Bank, 2020).

Figure 2: Sectoral Cash Incentives on Exports Value in Bangladesh (% of exports)
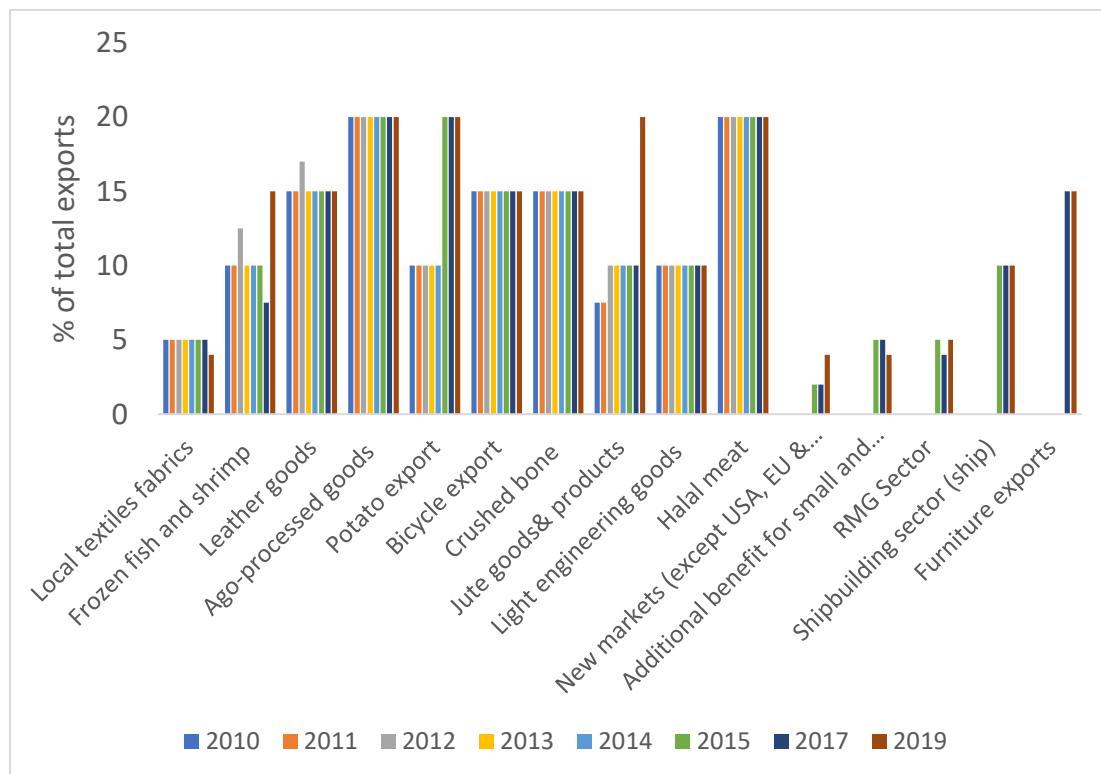
Source: Authors' compilation from Bangladesh Bank Various SRO (2015, 2016, 2017, 2018,2019, 2020), and Bangladesh Trade Portal (2020), Ministry of Commerce (MoC), Peoples' Republic of Bangladesh.

Figure 3: Bangladesh Export Subsidies Relative to GDP and the Development Budget (in Billion BDT)
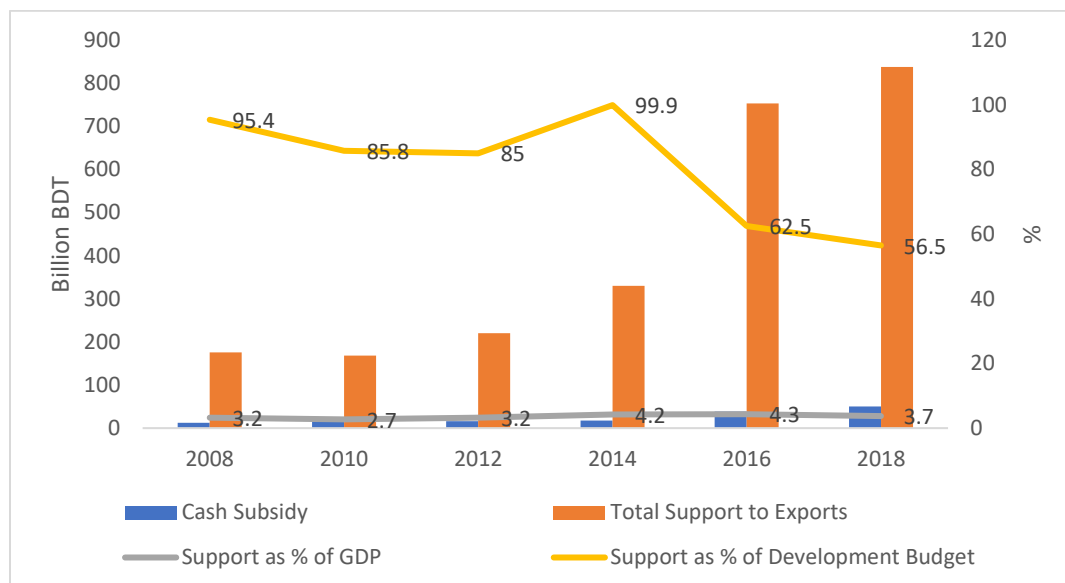
Source: Authors compilation from National Board of Revenue (NBR, 2019) and Bangladesh Economic Review Archive, (2015, 2016, 2017 & 2018), Ministry of Finance, People's Republic of Bangladesh. Note: BW-Bonded warehouse, DD- Duty drawback

Recently, the government of Bangladesh has declared an additional US$ 780 million in cash subsidies to boost the export in response to the Covid-19 pandemic.[4] The three main support measures to exports, i.e., duty drawback,[5] bonded warehouse facilities,[6] and cash

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[4] The government of Bangladesh has declared 17 stimulus packages equivalent to US$11.7 billion, which is about 3.4 percent of GDP, to combat the Covid-19 pandemic and rescue the economy. Of these packages, an additional US$ 560 million (BDT 50 billion) is allocated to export subsidies (Ministry of Finance, Government of Bangladesh, as of December 30, 2020).

[5] Under the provisions of section 13 of The Value Added Tax Act, 1991 and under section 37 of The Customs Act, 1969 of Bangladesh government all import duties and taxes paid on raw materials and inputs used for the manufacture of exported goods or services shall be refunded.

[6] Bangladesh's customs bonded warehouse regime permits licensed manufacturers to import duty-free parts and materials required for their export production purposes. The bonded warehouse facilities are mostly used by RMG industries.

subsidy, cost about 3.7 percent of GDP in 2019, and accounted for 22.5 percent of the government revenue budget, along with 56.5 percent of the development budget (Figure 3).

It is worth noting that most of the beneficiaries of such export incentives are the business elite and lobby groups which significantly influence the government.[7] There are also colossal leakages and misuse of export subsidies and incentives.[8] These large expenditures could be used for more productive sector or development programs.

3. Modelling Framework

The GTAP computable general equilibrium (CGE) model is the most comprehensive model and dataset for estimating nation-wide impacts of trade policy. The detailed structure of the GTAP database, assumptions, model, equations, closures, elasticity, and parameters, are presented in Hertel, (1997).[9] Gilbert, et al., (2018) provide a detailed systematic literature review of CGE and discuss the strengths and limitations of CGE models in the context of international trade models. The GTAP framework structure includes regional

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[7] The Transparency International Bangladesh (TIB) study shows that around 10 percent of the parliamentarians are involved in RMG businesses (TIB, 2013).

[8] For example, BDT 9.9 billion scams by Bismillah Group (BG): This BG company has managed to receive cash incentives against fake export documents and overpriced non-existing export items, https://www.dhakatribune.com/uncategorized/2013/11/03/tk9-9bn-scam-by-bismillah-group.

[9] Hertel, (1997) provides a detailed introduction to the GTAP database.

households, governments, different sectors and their nests, along with global sectors across countries including how they are linked to each other.

In this paper, we use the MyGTAP model developed by Walmsley & Minor (2013), a customized version of the standard GTAP model (Hertel, 1997). This MyGTAP model allows us to incorporate country-specific data and is able to investigate the impacts of different domestic policies on the household level, which is essential for country-specific analysis. In the standard GTAP model, a regional household is assumed. However, in the MyGTAP model, we eliminate the single 'regional' household, incorporating multiple private households and government agents where spending is directly related to the income received from endowment factors and taxes (Walmsley & Minor, 2013).[10] The model allows for incorporating income from remittances, foreign aid, foreign capital, and government income. In the MyGTAP framework, the government collects income from taxes, duty revenue and foreign aid. This income is then spent on public consumption outlays, transfers to households, foreign aid outflow, and subsidies. Similarly, private households receive and accumulate their income from factors of productions, transfers from the government, other households, and foreign remittances. This accumulated income could be spent on different sectors, including consumption, transfers, remittances outflow and savings. Siddiq et al. (2014) examined the effect of elimination

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[10] Refer to Walmsley & Minor (2013) and Minor & Walmsley (2013), for full documentation of MyGTAP data program and model, https://impactecon.com/resources/

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of the petroleum subsidy on income distribution using the MyGTAP framework in Nigeria and found that a reduction in the subsidy generally increases Nigerian GDP but hurts low-income households. Khan, et al. (2021) explored trade liberalization and income inequality in Pakistan using the MyGTAP model and concluded that trade liberalisation has a differential impact on income inequality in the country.

3.1 Data Extension and Aggregation to MyGTAP

The main features of the MyGTAP framework allow us to incorporate country-specific data on household and factors endowment. We incorporate the Bangladesh Social Accounting Matric (SAM) data prepared from households' income and expenditure survey (HIES) with the GTAP Version 10 dataset (Aguiar et al., 2019) applying the MyGTAP program (Minor & Walmsley, 2013). The latest available Bangladesh SAM is for 2012 and updated for 2014.[11]

We aggregate the 141 regions in the GTAP 10 dataset into 15 regions (Appendix Table A1a) and the 65 sectors into ten aggregate sectors. Our regional aggregation emphasizes countries that are the leading trading partners of Bangladesh, including the United States, the European Union, China, and India. We also aggregate the 65 GTAP sectors into ten sectors considering the Bangladesh SAM. The detailed sectoral and regional aggregations are presented in the Appendix Table A1a and A1b.

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[11] The updated SAM was provided by Dr. Selim Raihan from the South Asian Network for Economic Modelling (SANEM), a leading think-tank in Bangladesh.

A complete mapping is required between the sectors of the Bangladesh SAM with the corresponding GTAP sectors, and with the aggregated regions. We then use the ten different rural and urban households' income, consumption and ownership weights acquired from the SAM (2014) to incorporate in the MyGTAP model.

These earnings were then allocated to each of the ten households according to factor ownership shares. Household incomes were then adjusted for net foreign income, remittances, and capital depreciation, as suggested by Minor & Walmsley (2013). We use this dataset to investigate the effects of removing export subsidies on both household and macro levels. A summary description of the Bangladesh social accounting matrix and database used in this study is described in Figure 4.

Figure 4: Structure of the Bangladesh Economy in the Updated SAM 2014 (%)
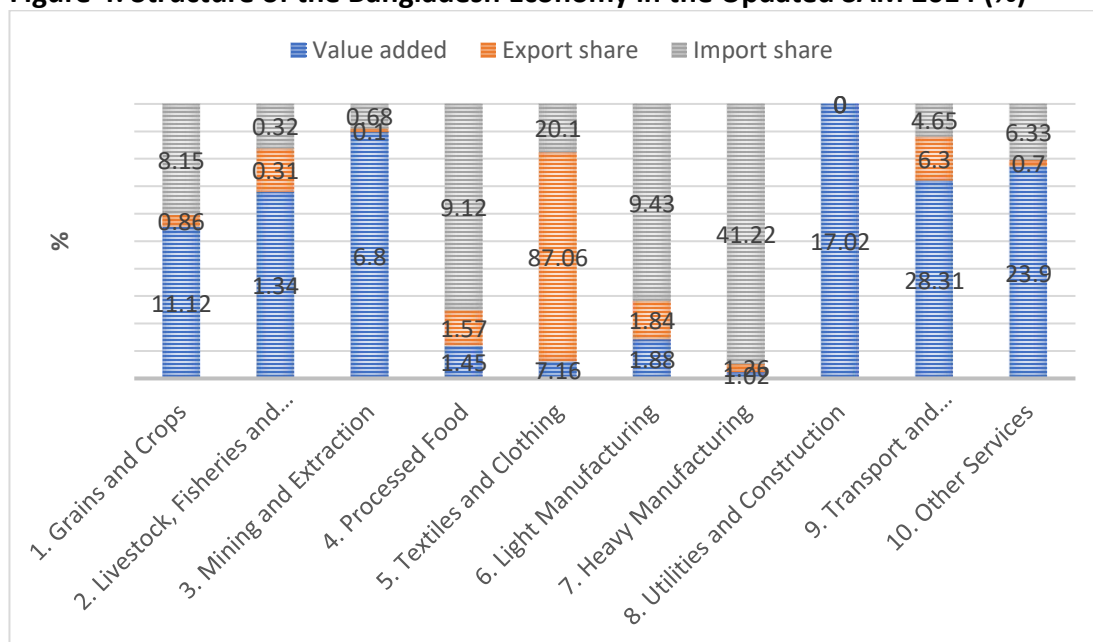

Source: GTAP 10 & SAM (2014)

Figure 4 shows the structure and share of different economic sectors in Bangladesh in 2014,

as shown in the SAM. Grains and crops are the leading category in the agriculture sector, which contributes 11.3 percent of value added. On the other hand, in the industry sector, textile and clothing is the leading category that contributes a 7.6 percent share in the economy. The apparel sector is also highly export oriented. About 87 percent of Bangladesh exports come from textiles and clothing sectors, while imports by this sector are about 20 percent, as shown in the SAM. Bangladesh is heavily dependent on importing in the heavy manufacturing sectors, which is about 41 percent of total imports, especially intermediate capital goods.

Figure 5. Share of Household Income from Factor of Production (%)
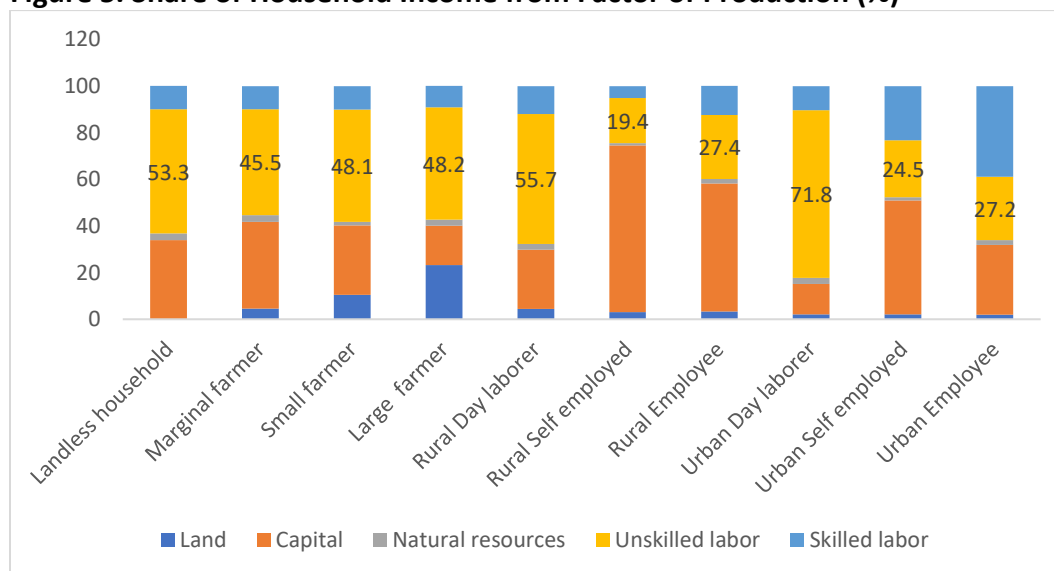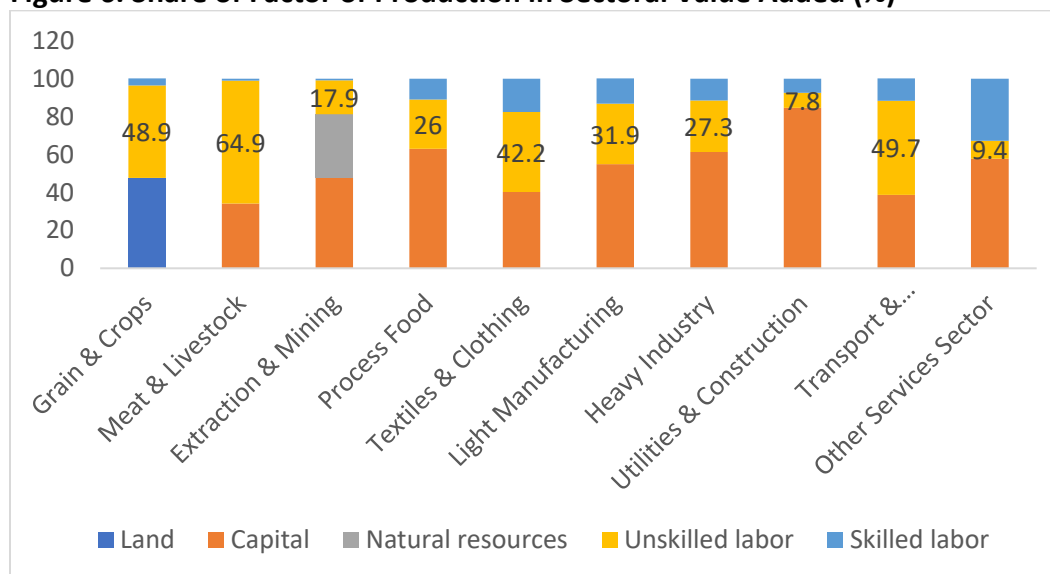

Source: Bangladesh 2014 SAM

Figure 5 shows factor ownership by rural and urban households while Figure 6 demonstrates how these factors of production are employed in different sectors and where the income comes from these ten households. Unskilled labour is largely employed in the agricultural sector, as shown in Figure 6. The Figures depict that urban day

labourers get most of their income from unskilled employment, and about 42 percent of value added is unskilled labour in the textile and apparel sector.

Figure 6. Share of Factor of Production in Sectoral Value Added (%)

Source: Bangladesh 2014 SAM

3.2 Updating Bangladesh Export Subsidies Rate Using Altertax:

The government of Bangladesh (Ministry of Finance) declares subsidies every year in June, and the Central Bank of Bangladesh (Bangladesh Bank) implements the decision made by the government. However, Bangladesh's sectoral export subsidy rate in the GTAP version 10 database does not reflect actual subsidies applied. The GTAP database consists of many observed macroeconomic and trade data from the best available international sources including WTO's export subsidies dataset. It seems that Bangladesh's export subsidies datasets do not appear to be accurate in the WTO. Therefore, it is essential to first update these subsidies in the pre-simulation database. We employ the Altertax method (Malcolm, 1998) to

correct the subsidy rate incorporating in the GTAP 10 database for simulations. The purpose

of this procedure is to maintain the internal consistency of the database with the least possible

effects on the value flows in the dataset (Burfisher, 2017 Siddig et al., 2014). Bangladesh's

government has been providing export subsidy of an average of about 10 percent over the last

decade. Therefore, we update the export subsidy to this rate to reflect in Bangladesh's

situations more correctly. We then use this updated database for subsequent policy

simulations.

3.4 Simulations Scenarios

We simulate the following three different scenarios to evaluate the potential impact of

export subsidies for Bangladesh:

- Complete elimination of the export subsidies under scenario one. This simulation

  reflects that Bangladesh will graduate from an LDC to a developing country by 2026

  and all export subsidies must be eliminated under the WTO framework.[12]

- Under Scenario two, we introduce a partial removal that is a 50 percent reduction

  of export subsidies to all sectors and at the same time include the transfer of funds

  to seven poor rural households categories using savings accumulated from the

  subsidy removal. This allows us to assess the production, exports and its implication

  on different households' incomes.

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[12] WTO (2016) Ministerial Decision of 19 December 2015: WT/MIN(15)/45—WT/L/980, https://www.wto.org/english/thewto_e/minist_e/mc10_e/l980_e.htm#fnt-5

- In scenario three, we introduce the elimination of export subsidies only in the apparel sector to analyse the impact. Reducing export subsidies, especially textiles and clothing, may hurt production and employment as Bangladesh is the second-largest apparel exporter in the world and this sector encompasses about 87 percent of Bangladesh's total exports.

4. Analysis of the Simulations Results

4.1 GDP

The impact of removing export subsidies can be investigated at both the macroeconomic and household level. This section presents the results showing the simulated impacts on GDP, industry output, trade, and household income and consumption. The overall macroeconomic impact of removing export subsidies is presented in Figure 7. The results show that full elimination of export subsidies has a slight positive impact on GDP due to the improvement of overall economic efficiency. Subsidy elimination increased export prices, but import prices didn't change, which led to a decline in export. But at the same time, there are some positive impacts due to increased allocative efficiency. It's worth mentioning that import tariffs of Bangladesh are relatively high; therefore, eliminating export subsidies does not improve allocative efficiency significantly. Overall, export subsidy elimination has no negative effect on GDP. However, if we eliminate export subsidies on the readymade garments sector under scenario three, the real GDP may increase by 0.04 percent which is the same compared to the full elimination of export

subsidies by all sectors. The contribution of ready-made garments sectors to GDP is about 7 percent, which indicates that an elimination of export subsidies in the apparel sector does not have any negative impact on the GDP.

Figure 7: Macroeconomic Impact of Exports Subsidy Elimination (real % change)
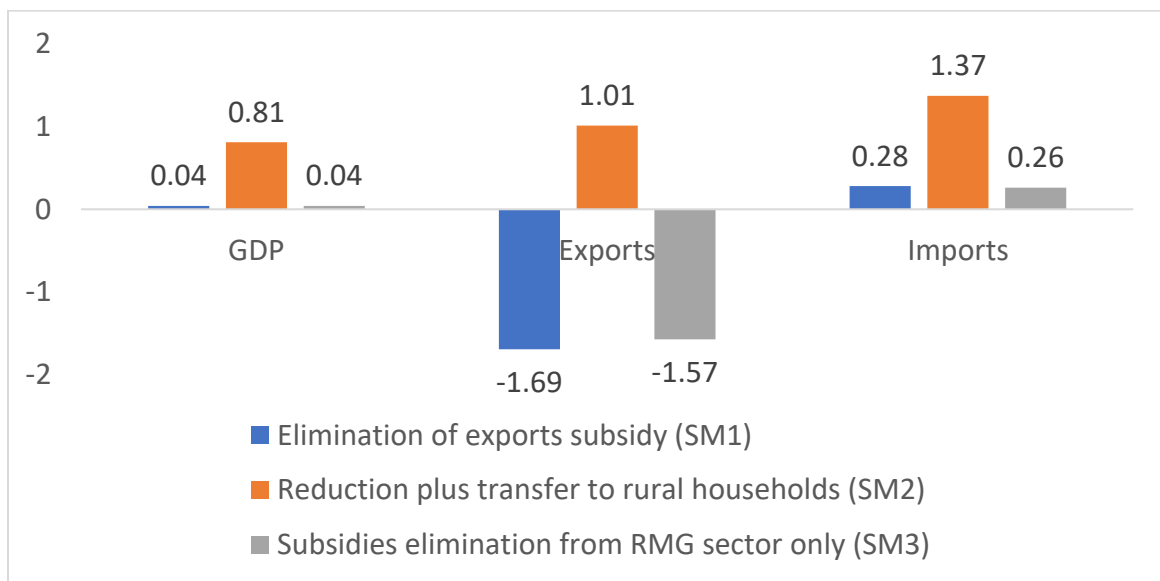
Source: Authors' simulations

In contrast, if we reduce the export subsidy by 50 percent and transfer this funding from the government to target seven poor rural household groups, real GDP may increase by more than 0.81 percent.[13] A key factor of such a significant increase in GDP is the rapid increase in output of the agriculture and manufacturing sectors. As shown in Figure 10,

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[13] We simulate the removal of export subsidies from the base data. We set the export subsidies to zero and define government transfers to households of that same dollar amount. We split up this value and give it equally to all seven rural low-income household.

overall production is likely to increase in all sectors except apparel outputs. A substantial increase in sectoral outputs influences household income and consumption due to transfer of funds to rural households. As real GDP is determined by the sum of household consumption, investment, government expenditure and net exports, the significant increase in household consumption results in a significant increase in real GDP.

4.2 Trade

It is evident from the simulations that the elimination of export subsidies will drop exports under scenarios one and three. Total exports could be reduced by about 1.69 percent, and 1.57 percent under scenario one and three respectively. However, under scenario two, both exports and imports show positive results increase relative to the reduction under scenario one and three. Total imports may increase by 1.37 percent due to an increase in the aggregated income at the household level, although import prices show no change, domestic prices show a slight increase. An increase in real imports is also driven by the rise in importing petroleum and in other manufacturing sectors. Transferring to poor households does not hurt exports as these still increase by about one percent. Note that despite a drop in net exports, real GDP increases because of the other components like consumption and investment of GDP. The analysis also indicates that the overall change in the balance of trade in Bangladesh is positive and no significant impact is detected in terms of trade.

4.3 Sectoral trade

Textiles and clothing are the main export items of Bangladesh, constituting about 87 percent of Bangladesh's total exports in 2019. Therefore, the exports of the RMG sector could be affected adversely if the Bangladesh government eliminates export subsidies under all three scenarios (Figure 8). Exports of the ready-made garments sector could be reduced by 4.7 percent if we eliminate export subsidies only under scenario three. However, under scenario two the readymade garments export fall could be 2.4 percent. At the same time, imports might decrease as exports decrease, especially intermediate inputs of the RMG sector, which constitute about 20 percent of Bangladesh's total imports (Figure 4). However, removing export subsidies may positively impact exporting of all other sectors except RMG, which could be important for the export diversification strategy in Bangladesh. The removal of export subsidies also reduces imports in the light manufacturing sector. It is apparent that if we transfer the savings fund that accumulated from the removal of subsidies to the rural household, that would add to investment and increase GDP. However, this transfer to rural households leads to increased rural consumption, which helps to increase imports, especially intermediates goods.

Figure 8: Impact on Sectoral Exports (real % change)
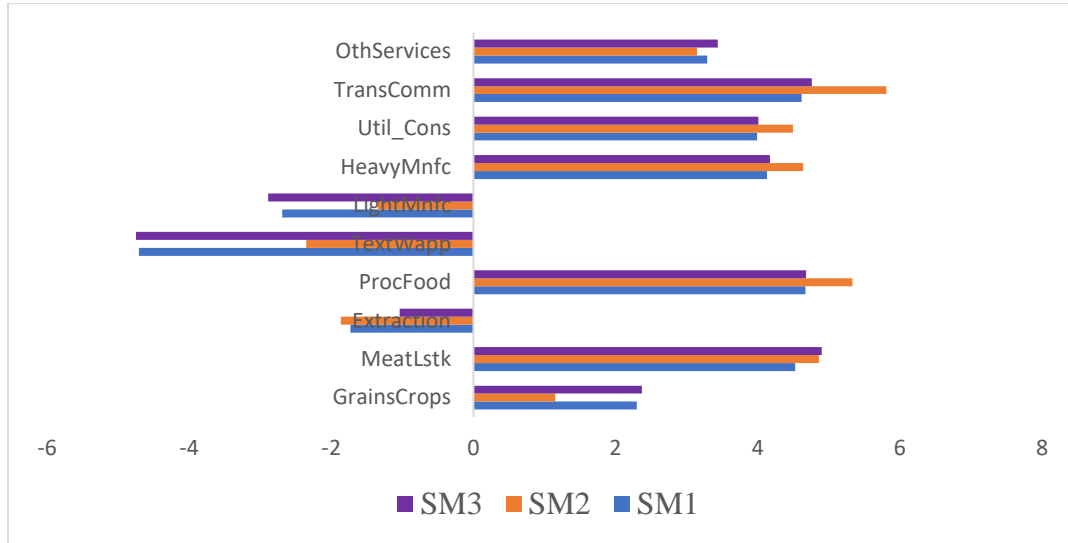
Source: *Authors' simulations*

4.4 Sectoral output

The RMG industry has been enjoying various stimulus supports, including cash incentives, duty drawbacks, and bonded warehouse facilities over the decades. If we eliminate the export subsidies under all three different scenarios, apparel production would be affected negatively as presented in Figure 9. Under scenario three, if we eliminate export subsidies for the apparel sector, the total production of textiles and clothing would be reduced by about three percent while scenario one has similar negative impact but under scenario two, output could fall by 1.5 percent. However, the light and heavy manufacturing sector experiencing strong growth and agricultural output also increasing significantly. The analysis indicates that the removal of export subsidy may have a negative impact on the apparel sector but a positive effect on the output of other sectors.

Figure 9: Impact on Sectoral Output (real % change)
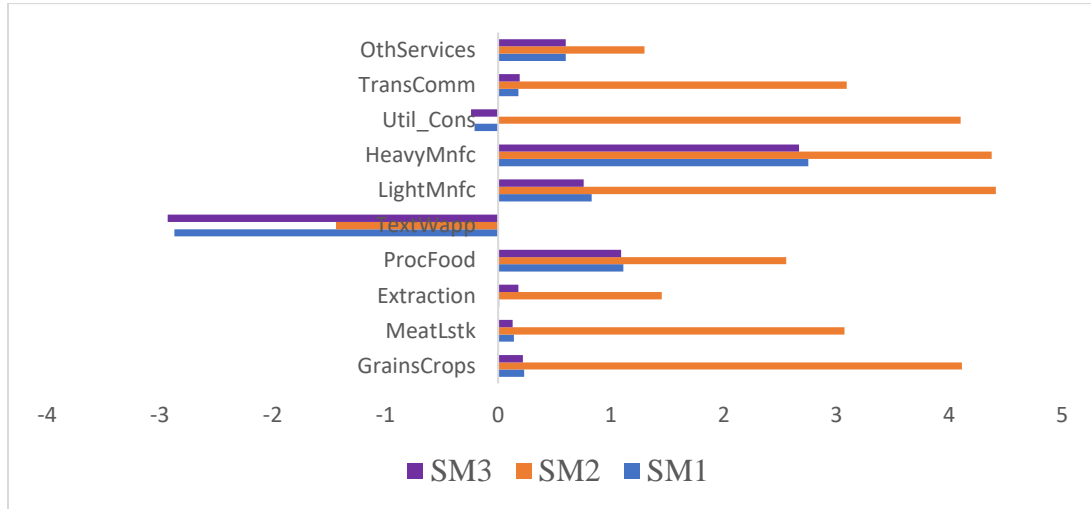
Source: Authors' simulations

4.5 Impact on households

Distributional analysis of households is an important supplement to the macro-economic analysis, particularly for a developing country such as Bangladesh. The estimated change in Bangladesh's household incomes, are shown in Figure 10. The simulation results reveal that the real household income declines only for the urban households but increases for small rural households under Scenario one. In Scenario two, which includes a government transfer to poor households, the household income increases across all rural households' groups. Changes in the sources of household income show that households benefit from a government transfer with an increase on average of 2.5 percent for rural households, but a slight decrease in the urban household income.

Figure 10: Impact on Household Incomes (real % change)
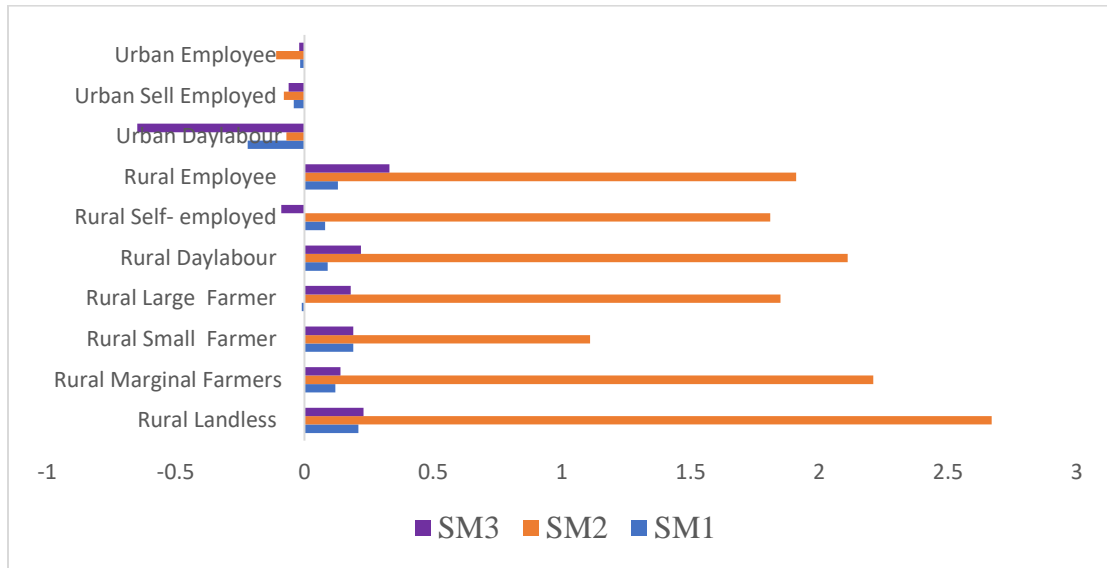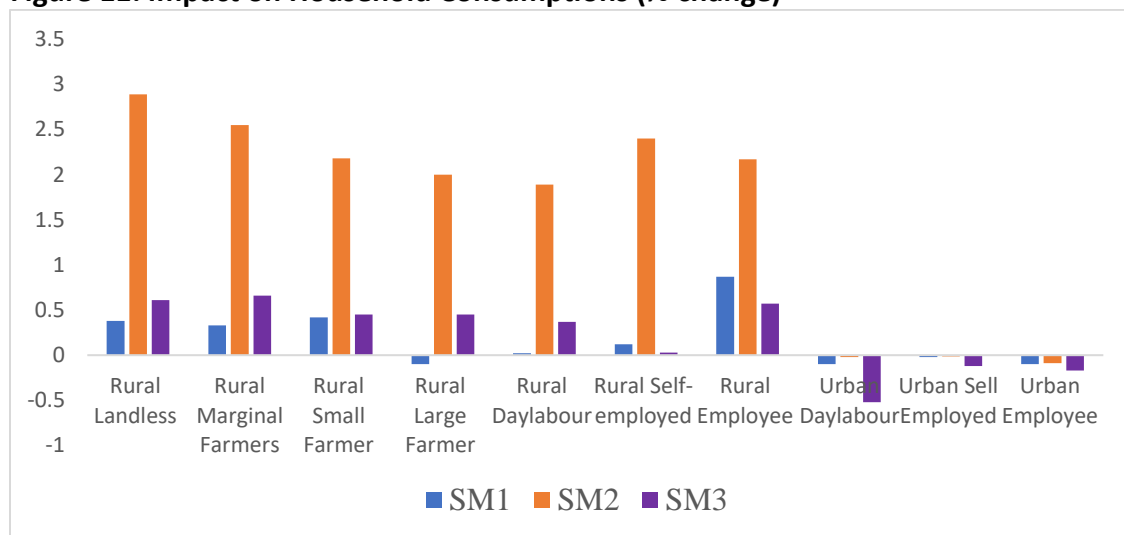

Source: Authors' simulations

Table 3 shows the contribution of the apparel sector to GDP is about 7.16 percent. About 42 percent of value added in the garment industry is urban unskilled households who are directly affected due to the lower output that leads to lower exports in the apparel sector. According to Haque and Bari (2021), about 4.2 million workers are employed in the apparel sector in Bangladesh which is about 26 percent of urban employee (Appendix Table A2). Therefore, incomes of urban households could decline due to a fall in RMG productions and exports which will directly affect urban unskilled household income.

The overall composition of rural households' expenditure is mainly on food which is about 80 percent of poor households' spending on their total consumption. This implies that a rise in domestic demand causes a rise in endowment factor prices and contributes to an overall increase in price level. Due to the elimination of export subsidies initially, domestic

prices may increase due to higher production costs, which leads to a lower export. Thus, a lower export leads to higher supply in the domestic market, which leads to a lower domestic price. Therefore, eliminating export subsidy affect the domestic price fall helps to increase some households' income. Nevertheless, it is noticed that the domestic price increases by 0.80 percent due to money transfers from the government to poor households.

Figure 11: Impact on Household Consumptions (% change)

Source: Authors' simulations

Figure 11 demonstrates the changes in consumption for different household groups. We find that the average consumption level may increase on an average by about 3.5 percent, mostly in the rural area under Scenario two. The urban households are expected to experience a decrease in consumption under scenarios one and three. The main reason for this is that urban households depend on the apparel and light manufacturing sectors whereas rural households mostly depend on their agricultural production. This study

indicates that there is a substantial opportunity cost of export subsidies and welfare could be enhanced by redirecting the spending to more productive channels.

5. Concluding Remarks

Export subsidy elimination is a critical policy decision for many developing countries. Bangladesh has been providing export subsidy support to increase its exports, amounting to about US$10 billion (BDT 838 billion) in 2018, at a cost of 3.7 percent of its GDP (Figure 3). Bangladesh's main export sector is ready-made garments, which were about 87 percent of Bangladesh's total exports in 2019 (Bangladesh Bank, 2020); therefore, most of this export subsidy goes to the RMG sector. Moreover, as Bangladesh is set to graduate from the status of a least developed country to a developing country by 2026, export subsidies, especially for industrial products, must be eliminated after graduation. Given this background, this study's main objective is to estimate the economic impact of removing export subsidies on Bangladesh's economy.

This paper uses the MyGTAP program and model developed by Walmsley & Minor, (2013), to investigate the impacts of different domestic policies at the household level. We combine the Bangladesh social accounting matrix data with the GTAP version 10 database using the MyGTAP model. We incorporate both rural and urban regional household incomes, consumptions, and ownership weights in the MyGTAP model collected from the Bangladesh social accounting matrix.

We then simulate the three different scenarios to evaluate the potential economic impact of the removal of export subsidies of Bangladesh that is a complete elimination of the export subsidies under Scenario one. Under Scenario two, we introduced a partial removal that is a 50 percent reduction of export subsidies to all sectors and, at the same time transfer direct funds to poor households' that savings from the subsidy to assess the income implication of different families. Also, we explore the impact of the elimination of export subsidies on the textiles and clothing sector only.

The simulations show that the elimination of export subsidies has positive impact on GDP due to the improvement of overall economic efficiency. But both exports and imports will drop if we eliminate the export subsidies. While if we reduce the export subsidy by 50 percent and transfer the accumulated savings from the government to the targeted seven household groups, real GDP may increase by about 0.81 percent. However, the removal of export subsidy will affect the RMG sector substantially.

The removal of export subsidies may drop the real household income for urban households but increase income to rural households. Government transfer to poor households leads to increased income to all different rural household groups. The real income may increase due to a rise in the return of wages and profits from factor of production. Changes in household income sources show households benefit from a government transfer increasing by 2.5 percent for rural households. This analysis indicates that there is a substantial opportunity cost of export subsidies, and welfare could be increased by redirecting the spending to more productive channels. Supporting

export industries is compelling Bangladesh to spend a large amount, which could be used for various development programs that may bring more significant benefits for the country.

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Appendices:

Appendix Table A1a: Sectoral Aggregation

Sector	Sector Description
Grains & Crops	Paddy rice, wheat, cereal grains, vegetables, fruit, nuts oil seeds, Sugar cane, sugar beet, plant-based fiber crops
Livestock, Fisheries & Meat Products	Cattle, sheep, goats, horses, animal products, meat, raw milk wool, silk-worm cocoons
Mining &Extraction	Forestry, fishing, coal, oil, gas, minerals
Processed Food Items	Vegetable oils and fats, dairy products, processed rice, sugar, food products, beverages, and tobacco products
Textiles & Clothing	Textiles & clothing sector
Light Manufacturing	Leather products, wood products, paper products, publishing, motor vehicles and parts, transport equipment, manufacturers, metal products
Heavy Manufacturing	Electronics items, machinery and equipment, petroleum, coal, products, chemical, rubber, plastic products, mineral products, ferrous metals, metals, and chemical products
Utilities & Construction service.	Electricity, gas manufacture and distribution, water and construction service
Transport & Communication Services	Trade, transport, land transport, sea transport, air transport communication, accommodation and food service, Warehousing and support activities
All other Services	Financial Services, Insurance, Business Services, Recreation, and other services, Pub Admin, defense, health, education, dwellings, real estate activities

Source: *GTAP version 10*

Appendix Table A1b. Regional Aggregation

Aggregated Region	Comprising GTAP countries/regions
Oceania	Australia, New Zealand
Bangladesh	Bangladesh
India	India
China	China
USA	USA
Japan	Japan
East Asia	Japan, Hong Kong, Korea, Mongolia, Taiwan, Rest of East Asia
Southeast Asia	Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia
South Asia	Nepal, Pakistan, Sri Lanka, Rest of South Asia
North America	Canada, Mexico, Rest of North America
Latin America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala
EU28	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Norway, United Kingdom, Switzerland
MENA and the Middle East	Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa
Sub-Sahara	Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Rest of Western Africa, Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa
Rest of world	Rest of EFTA, Albania, Bulgaria, Belarus, Croatia, Romania, Russian Federation, Ukraine, Rest of Eastern Europe, Rest of Europe, Kazakhstan, Kyrgyzstan, Rest of Former Soviet Union

Source: *GTAP version 10*

Appendix Table A2: Bangladesh household population and income share

	Households	Total Population (mill)	Share of Population (2016)	Income (BDT million) SAM 2014	Income share
1	Rural Landless farmers	12.22	0.08	625805	0.07
2	Rural Marginal Farmers	13.02	0.08	555853	0.06
3	Rural Small Farmers	21.03	0.13	1107736	0.12
4	Rural Large Farmers	15.23	0.10	710514	0.08
5	Rural Day labour	9.01	0.06	654011	0.07
6	Rural Self- employed	17.62	0.11	1699450	0.18
7	Rural Employee	18.42	0.11	858937	0.09
8	Urban Day labour	14.42	0.09	526567	0.06
9	Urban Sell Employed	24.03	0.15	1438602	0.16
10	Urban Employee	15.22	0.09	1088096	0.12
	Total	160.22	1.00	9265570	1.00

Source: *Authors compilation from BBS (2017), from Household Income and Expenditure Survey 2016, BBS(2018, 20119) and SAM 2014*

CHAPTER IV: COSTS OF LDC GRADUATION ON MARKET ACCESS:

EVIDENCE FROM EMERGING BANGLADESH

Costs of LDC graduation on market access: evidence from emerging Bangladesh

Mohammad Masudur Rahman & Anna Strutt

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Costs of LDC graduation on market access: evidence from emerging Bangladesh

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ABSTRACT

We empirically estimate the costs of LDC graduation on market access for Bangladesh using a computable general equilibrium modelling framework. If developed countries impose standard generalized system of preferences (GSP) tariffs while importing from Bangladesh and at the same time Bangladesh eliminates its export subsidies, our modelling suggests that real gross domestic product (GDP) may drop by about 0.38 per cent and exports could fall by about six percent for Bangladesh. The ready-made garment sector could be affected severely, with results suggesting exports could decline by about 14 per cent. Our analysis indicates that the income of urban households could decrease by three per cent, and household consumption may shrink by about four per cent. To minimize these potentially adverse impacts, Bangladesh should aim to ensure market access continues through signing preferential trade agreements. In addition, streamlined subsidy policies, enhanced domestic productivity, export diversification, and increased foreign investment, are likely to be important areas of focus for a smooth LDC graduation.

1. Introduction

LDC graduation is a watershed moment for any emerging economy. The LDCs are very specific low-income developing countries that are more vulnerable compared to other developing countries. The United Nations Committee for Development Policy (UNCDP) classified the LDCs in the 1960s in UN resolution 2768 (XXVI).[1] The WTO and the World Bank follow this classification for their different preferential tariffs and loan arrangements. The UNCDP reviews and monitors the status of LDCs and makes recommendations on graduating from the category.

[1] https://www.un.org/development/desa/dpad/least-developed-country-category.html.

There are currently 46 LDCs on the United Nations' (UN) list,[2] 35 of which have become members of the World Trade Organization (WTO).[3] These 46 LDCs consist of 986 million people but account for only 1.3% of global GDP and 0.9% of global trade (World Bank, 2020). Interestingly, a number of these countries will be graduating in a few years, marking a significant development achievement. For example, Bhutan is set to graduate in 2024 while Bangladesh, Lao PDR and Myanmar will do so in 2026.

Bangladesh has been recommended for graduation after meeting all three thresholds for LDC graduation, namely gross national income (GNI) per capita, human asset index (HAI), and economic vulnerability index (EVI), as reviewed by the Committee for Development Policy (CDP) of UN Economic and Social Council in 2021.[4] Bangladesh has been a frontrunner among LDCs in South Asia, with an average economic growth rate approximating 6.5% over the last decade, including a growth rate of 6.9% in 2021, during the Covid-19 pandemic (Bangladesh Economic Review, 2022). Bangladesh has become a global role model for its socio-economic development miracle from a "basket case" as dubbed by Henry Kissinger in 1971.

Bangladesh has made significant progress on the GNI per capita, HAI,[5] and EVI.[6] The GNI per capita has increased five-fold over two decades (Figure 1). With respect to GNI per capita, the graduation threshold is US$1222, and Bangladesh's is at US$1827 in 2021. The country has also surpassed Pakistan and India in GNI per capita.[7] However, compared to the developing country average (US$6666), it is still much lower.[8]

Bangladesh has also made remarkable progress in its socio-economic development. The adult literacy rate has increased sharply over the decades and the mortality rate has also dropped significantly. As reviewed by the CDP, the HAI index for Bangladesh accounted for 75.3 in 2021, where the threshold level for graduation is 66. However, Bangladesh remains behind the developing countries' average HAI index of 78.3.

The EVI shows how vulnerable a country is in terms of economic and environmental shocks. Although the GNI per capita and HAI have substantially increased over the decades, the EVI has not decreased considerably, due to ongoing environmental vulnerability. The EVI index was 34 in 2000 and 27 in 2021 while the threshold is 32 or below.[9] As Bangladesh continues to face different types of environmental shocks – both natural and human-related disasters – there is a huge scope for reducing environmental vulnerability.

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[2] As of 11 February 2021, United Nations Committee for Development Policy (UNCPD), https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf.

[3] Understanding the WTO – Least Developed Countries, https://www.wto.org/english/thewto_e/whatis_e/tif_e/org7_e.htm.

[4] UN (2021) Graduation from the LDC category, https://www.un.org/development/desa/dpad/least-developed-country-category/ldc-graduation.html.

[5] The HAI comprises six social indicators which are (1) Under-five mortality rate, (2) Gross secondary school enrolment ratio, (3) Prevalence of stunting, (4) Adult literacy rate, (5) Maternal mortality rate and (6) Gender parity index for gross secondary school enrolment.

[6] The EVI comprises eight indicators which are (1) Share of agriculture, forestry and fishing in GDP, (2) Merchandise export concentration, (3) Instability of exports of goods and services, (4) Instability of agricultural production, (5) Share of population in low elevated coastal zones, (6) Remoteness and landlockedness, (7) Share of population living in drylands, (8) Victims of disasters. The lower index, the lower the risk.

[7] The UNCDP prepared the data for 2021 for a triennial review averaging the value of GNI per capita over the last three years. United Nations; https://www.un.org/development/desa/dpad/least-developed-country-category-bangladesh.html.

[8] Ibid.

[9] Ibid.

Figure 1. Trend of HAI, EVI and GNI per capita.
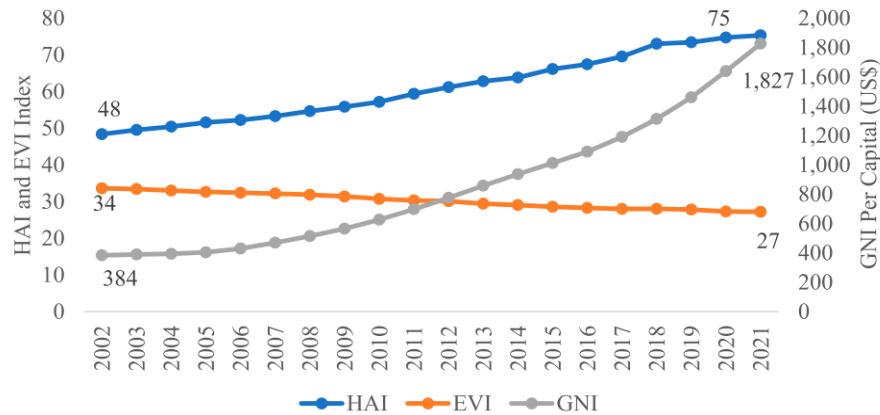
Against this background, Bangladesh is set to graduate from the LDC category by 2026. On one hand, graduation from the LDC category may give Bangladesh more self-dignity and some economic benefits, including an improved credit rating and a more attractive environment for foreign investment. However, on the other hand, Bangladesh will lose preferential market access to many countries. It must also eliminate domestic trade-restrictive policies, especially export subsidies and the country may no longer enjoy some concessional official development assistance or loans (WTO & EIE, 2020).

The WTO (2020) analyses the varying impacts resulting from LDC graduation, including summarizing smooth graduation options. Specific to Bangladesh, the United Nations Department of Economic and Social Affairs (2019) qualitatively analyses the possible effects of LDC graduation which relate to trade and development cooperation. The Economist (2018) observes that although Bangladesh will miss out on concessional financing and preferential market access to export markets upon graduation, the graduation will help to attract foreign investments as it stands as a testament to Bangladesh's good growth performance over the years. However, graduation may come at a social cost, as evidenced by Islam et al. (2020), who empirically examine the social aspects of LDC graduation in Bangladesh, particularly its impact on insulin prices. They explore how intellectual property (IP) provisions in the WTO will impact Bangladesh's insulin prices and their subsequent impacts on welfare and poverty upon graduation. The results show that the social cost of LDC graduation leads to a significant jump in insulin prices that could cause a huge decline in households' welfare.

Southichack (2017) explores the costs and benefits of LDC graduation for Lao PDR and concludes that graduating with a solid economic foundation is vital for Lao PDR's success and sustainability. Acharya and Rasphone (2017) echo the same sentiment in their paper. Ancharaz (2019) discusses the flexibility offered through a smooth transition, along with fall-back options available to Small Island Developing Countries (SIDS) LDC graduates. He argues that there is sufficient time for these SIDS to chalk out plans

and develop institutional capacities for a successful graduation. All these show both positive and negative impacts that come with graduation, which could vary from country to country.

When Bangladesh graduates from LDC status to a developing country, Bangladesh will in principle lose most of its preferential market access after graduation. The country will not only lose preferential market access but also lose preferential rules of origin reserved for LDCs. However, Bangladesh would remain eligible for the standard Generalized System of Preference (GSP) which are preferential tariffs that are lower than Most Favoured Nation (MFN) tariffs in the EU and some other developed markets.

The EU is the biggest trading block which provides three types of GSP for developing countries: standard GSP, GSP plus (+), and Everything but Arms (EBA) arrangement.[10] Under the EBA, the EU grants duty-free market access for all imported products except arms from LDCs like Bangladesh, which will be eliminated after graduation and standard GSP will be in place instead. Moreover, as an LDC, Bangladesh has also been enjoying duty-free market access in most developed markets under the Duty-Free Quota-Free (DFQF) arrangement of the WTO. Recently China has offered duty-free market access for 98% of tariff lines under the Asia Pacific Trade Agreement (APTA) and DFQF. Bangladesh has also been enjoying different preferential markets in India and other South Asian markets under the South Asian Free Trade Agreement (SAFTA). Therefore, Bangladesh has been enjoying preferential market access in most key global markets under GSP, DFQF, or regional free trade agreements.

Bangladesh has significantly benefited from the EU's preferential treatment over the decades, even in the post-MFA era (Ahmed, 2009; Alam et al., 2017). Bangladesh's exports to the EU were US$1.5 billion in 2001, which increased to US$26 billion in 2019 (Europa, 2020). The utilization rate of the GSP in the EU market is about 96% which indicates that Bangladesh has been very successful in exporting its products to the EU market (Appendix Figure A1). However, this also implies that Bangladesh is highly dependent on the EU's GSP, and any preference erosion may have a significant negative impact on Bangladesh's exports to the EU. The EU has also benefited from lower prices when importing from Bangladesh, which increased economic welfare in the EU (World Bank, 2020).

Additionally, many other regulatory issues must be compatible with the global trading system. Export subsidies, especially for industrial products, have to be eliminated after graduation, at least in principle.[11] Other WTO members could – if subsidies are not eliminated – take action against Bangladesh under Article 4 of Subsidies and Countervailing Measures (SCM) of the WTO and ask for the withdrawal of the subsidy.[12]

Bangladesh has been using different instruments to support its export sector. The main tools are bonded warehouse facilities, duty drawbacks, direct export cash incentives, various tax concessions, tax holidays scheme, and export credits. Three main support measures were duty drawbacks, a bonded warehouse, and cash subsidies which comprised about

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[10] Under the standard GSP and GSP *plus(+)* arrangement, the EU grants tariff reductions for products covered by about 66% of tariff lines originating from developing countries, depending on countries' socioeconomic performance (Europa, 2020).

[11] The WTO prohibits most direct export subsidies, except for LDCs. However, it is evident that many countries provide different subsidies and may not inform the WTO regularly.

[12] The WTO rules on subsidies and countervailing measures in non-agricultural (industrial) goods are contained in article VI and XVI of GATT 1994 and in the "Agreement on Subsidies and Countervailing Measures (SCM)" which prohibits most direct export subsidies, except for LDCs.

3.7% of GDP in 2018. Bangladesh's main export item is ready-made garments (RMG),[13] which comprised about 87% of Bangladesh's total exports in 2019 (Bangladesh Bank, 2020). Therefore, most of these export subsidies of about US$11 billion go to the apparel sector.

Against this backdrop, the main objective of this study is to quantify some key aspects of the economic impact of Bangladesh's graduation from LDC status. This represents an important case study of an emerging economy that may have valuable policy insights for other LDCs.[14] We deploy the MyGTAP framework developed by Walmsley and Minor (2013), an extension of the standard GTAP model (Hertel, 1997). This framework allows us to incorporate country specific information to investigate the impacts of trade policies on different household groups (Walmsley & Minor, 2013). We include 10 rural and urban regional households, which enables us to explore the potential economic impact of LDC graduation on the national economy as well as households' incomes and consumption.

Bangladesh's preferential market access and export subsidies are discussed in the following section. Section three explains the MyGTAP model methodology and how we incorporate Bangladesh's social accounting matrix (SAM) into the GTAP framework. We then present findings from simulations in the fourth section, including analysis of the long-term policy impact and testing the robustness of results before making some concluding comments.

2. Bangladesh trade regime and preferential market access

2.1. Bangladesh trade regime

In 2019, Bangladesh had a real GDP growth rate of 8.2%, compared to the South Asian average of 5.5% (WDI, 2020). Bangladesh's total trade has increased from US$27 billion in 2006 to US$111 billion in 2019, with a trade openness ratio of about 38% in 2019, which reflects how integrated the country is with the global economy (Appendix Figure A2). Bangladesh exported US$47.4 billion to the world in 2019, with top destinations including the EU, the US, Japan, Canada, and India. Bangladesh's weighted average applied tariff rates decreased moderately over the decade from 21% in 2006 to 10% in 2019 (World Bank, 2020).

Bangladesh's main export items are knitwear (HS61), woven garments (HS62) and home textiles (HS63), which together accounted for 86% of total exports in 2020, as shown in Appendix Figure A3. Bangladesh also exports some jute and jute products, footwear, agricultural products and frozen food products. Bangladesh's leading export destination is the EU which accounted for about 56% of its total exports in 2020, followed by the USA (17%) and Japan (4%). Bangladesh's export to its neighbours, especially China and India, is less than one billion dollars (Appendix Figure A4).

Over the past decade, Bangladesh's export boom, particularly in the ready-made garments sector, has helped Bangladesh to achieve significant economic growth. This success in the apparel industry is linked with an abundance of low-skilled labour, positively related

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[13] The apparel industry in Bangladesh is mainly readymade garments (RMG), the finished products. The average MFN import duty is about 10% on RMG products, which most countries will impose on imports from Bangladesh.

[14] Many other LDCs, including Bhutan, Cambodia, Lao PDR, Nepal and Myanmar, will graduate to developing country status within the next few years.

to backward linkages in global value chains (GVCs). According to the United Nations Economic and Social Commission for Asia and the Pacific, Regional Integration and Value Chain Analyzer (UNESCAP RIVA)[15] 2017 database, Bangladesh's forward linkages constituted 13.2% and backward linkages constituted 14.1% of its gross exports to the world. The main sector that leads Bangladesh's GVC participation in both forward and backward linkages is the textiles and clothing sector. About 16.1% of Bangladesh's RMG sector gross exports to the world comprise imported content and 10.9% of Bangladesh's RMG sector gross exports to the world are used in further export production. The textile sector is by far the most important sector for Bangladesh that participates in GVCs.

Frederick and Staritz (2012) provide evidence of successful upgradation of the apparel industry in the post-multi-fibre arrangement (MFA) period. Gereffi and Memedovic (2003) show how the GVC framework has transformed the apparel industry over the past decade. Bangladesh has successfully upgraded its manufacturing plants and management skills (Moazzem & Sehrin, 2016). The World Bank's (2020) report on GVCs shows that Bangladesh has successfully integrated its apparel sector using its large pool of low-skilled, low-cost workers. The report also indicates Bangladesh has successfully utilized its preferential market access in the global apparel industry, which plays a critical role in the Bangladesh economic growth miracle. However, Bangladesh has higher backward GVC participation of imported intermediates and capital goods to its gross exports than its forward GVC participation, reflecting a pattern of exports largely focused on final goods rather than intermediates (UNCTAD, 2020). As the country prepares to graduate from being an LDC, upgrades from the firm level up are needed in terms of efficient processes and functions, more sophisticated products, and overall value chain linkages.[16]

2.2. Preferential market access

Table 1 summarizes the ways in which Bangladesh will lose preferential market access and other preferential treatment with graduation. Table 2 shows the current level of preferential market access that Bangladesh and many other LDCs have been enjoying over the decades. The EU, Canada, Japan, Australia and some other countries mostly offer duty-free market access when importing from LDCs.

Tariffs on the apparel sector are much higher in the EU, USA, China, Japan, and Canada compared to the average applied tariff on industrial products.[17] Table 2 shows the average standard GSP tariff of the apparel sector for selected markets. The MFN-applied tariffs and standard GSP on the apparel sector are comparably higher in most countries (WTO, 2020) compared to manufacturing products. The MFN tariffs on the apparel sector are much higher in the EU than the average applied tariffs on industrial products. The EU has tariff protection of about 4% for fabrics, 8% for semi-finished garments and 12% MFN rate for clothing (Europa, 2020). As 87% of Bangladesh's exports are garments, most of these would face standard GSP tariffs of 9.6% in the EU (WTO, 2020). This indicates that Bangladesh may face high tariffs exporting to most of the developed markets after graduation. However, the USA had suspended GSP importing from Bangladesh in 2013 and offered a 97%

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[15] https://riva.negotiatetrade.org.
[16] The Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies, OECD Summary Paper, 2015.
[17] The simple average applied EU import tariff was 4.35% on industrial goods in 2019.

Table 1. Impact of LDC graduation on preferential treatment for Bangladesh.

Main issues	Potential loss
Loss of preferential market access under WTO's DFQF	Bangladesh will lose access to LDC-specific DFQF schemes
Loss of EBA preference	EU and other developed country market access under EBA scheme (another type of GSP of EU) for LDCs
Loss of LDC-specific rules of origin	Bangladesh will lose LDC-specific preferential rules of origin
Subsidy elimination	Bangladesh must eliminate export subsidies and comply with the Agreement on Agriculture (AoA) and the Agreement on Subsidies and Countervailing Measures (SCM)
Trade-Related Intellectual Property Rights (TRIPS) bindings	Bangladesh may face some negative shocks but needs to align with TRIPS, especially for the pharmaceutical sector. This may have a huge impact on drug prices
No more concession loans and development assistance	Bangladesh may not be able to access concession rate loans and some development assistance, support, climate finance, training, etc. from the UN
High UN contributions	Bangladesh will have to pay higher contributions to the UN

Source: Authors' compilations from UN LDC portal (2021).

tariff line under DFQF but did not provide any duty-free market access for the apparel goods imported from Bangladesh.

Table 2 also shows a major erosion of preference of the post-graduation rules of origin scenario for the major markets. In the EU market, 50% of domestic contents will be required compared to the current 30%, and double transformation will be required for clothing exports (e.g. from yarn to fabric to clothing) compared to the current single transformation (e.g. from fabric to clothing). Similar rules of origin requirements will apply for most developed markets, which will negatively impact Bangladesh's exports.

2.3. Export subsidies scenarios

Bangladesh has been using different supporting instruments to boost its export over the years. The main mechanisms are the bonded warehouse facilities,[18] duty drawbacks,[19] direct export cash incentives, various tax concessions, tax holidays scheme, and export credits. Table 3 shows the different export incentives ranging from 5% to 20% of exports in various sectors over the decades.

The three main support measures for exports, i.e. duty drawbacks, bonded warehouse facilities, and cash subsidies, accounted for about 3.7% of GDP in 2018, 22.5% of the revenue budget and 56.5% of the development budget (Table 4). Recently, the government of Bangladesh has declared an additional US$560 million cash subsidy to rescue exports from the COVID-19 pandemic.[20]

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[18] Bangladesh's customs bonded warehouse regime allows the importation of duty-free parts and materials required for export production purposes by licensed manufacturers. The bonded warehouse facilities are mostly used by RMG industries.

[19] Under the provisions of Section 13 of The Value Added Tax Act, 1991 and under Section 37 of The Customs Act, 1969 of the Bangladesh government, all import duties and taxes paid on raw materials and inputs used for the manufacture of exported goods or services shall be refunded.

[20] The government of Bangladesh has declared 16 stimulus packages equivalent to US$11.7 billion, which is about 3.4% of the GDP in 2020, to combat the Covid-19 pandemic and rescue the economy. Of these packages, an additional US$560 million (BDT 50 billion) are allocated to export subsidies (2020), Socio-Economic Development in Bangladesh & Stimulus Packages to Combat COVID-19, Retrieved from https://mof.gov.bd/site/publications/bdf6a97c-7327-4868-b985-7833fdb83574/Socio-Economic-Development-in-Bangladesh-&-Stimulus-Packages-to-Combat-COVID-19.

Table 2. Selected market access of Bangladesh for the RMG sector.

Country	Scheme	Coverage	Standard GSP applied tariff rate	Rules of Origin (RoO) for post-LDCs
EU	GSP under EBA initiative	99.8% (excluding arms and ammunition)	9.6% where MFN-applied rate is 12%	(a) 50% domestic content will be required compared to the current 30%. (b) Double transformation will be required for clothing exports
USA	DFQF under WTO. GSP suspended in 2013	97.5% except the apparel sector	9.1% where MFN-applied rate is 9.8%	35% domestic content requirement and no impact will be on LDC graduation as the GSP has been suspended since 2013
China	DQFQ and APTA	97%	0 (APTA) where MFN-applied rate is 9.69%	APTA RoO: (a) 45% value addition will be required (currently 35%). (b) 60% regional cumulation will be allowed (currently 50%)
Canada	GPT–LDC	98.6% (excluding dairy, eggs, poultry)	9.4%	Under general preferential tariff (GPT) 40% of import content will be allowed compared to the current 60% as an LDC
Japan	GSP and DFQF market access	97.9% (excluding rice, sugar, fishery, leather)	6.5% where MFN-applied rate is 7.1%	Single transformation will be allowed but must follow standard GSP RoO
Korea	APTA	89.9% under LDC but 0 under APTA	0 (APTA) where MFN-applied rate is 10.1%	Under APTA 45% domestic value addition will be required compared to the current 35%. Regional cumulation will allow with value addition requirement of 60% (currently 50%)
India	SAFTA	All except 25 products under SAFTA LDC	5% (SAFTA non-LDC) where MFN-applied rate is 23.6%	No change of tariff heading allowed and must follow product-specific non-LDC rules of origin

Source: Authors' compilation from UN LDC Portal (2021), WTO Tariff Profile (2020), SAFTA (2020), UNESCAP and APTA (2020), China Blue Book (2020). https://www.un.org/ldcportal/preferential-market-access-for-goods.

Table 3. Selected sectoral cash incentives on Bangladesh's exports.

Sectors/products	Rate of cash incentives in each fiscal year (%)							
	2010	2011	2012	2013	2014	2015	2016	2018
Local textiles fabrics	5	5	5	5	5	5	5	4
Frozen fish and shrimp	10	10	12.5	10	10	10	7.5	15
Leather goods	15	15	17	15	15	15	15	15
Ago-processed goods	20	20	20	20	20	20	20	20
Potato export	10	10	10	10	10	20	20	20
Bicycle export	15	15	15	15	15	15	15	–
Crushed bone	15	15	15	15	15	15	15	15
Jute goods and products	7.5	7.5	10	10	10	10	10	20
Light engineering goods	10	10	10	10	10	10	10	10
Halal meat	20	20	20	20	20	20	20	20
New markets (except USA, EU and Canada) for textile sector						2	2	4
Additional benefit for small textile industry						5	5	4
RMG sector						5	4	5
Shipbuilding sector						10	10	10
Furniture exports							15	15

Source: Authors' compilation from Bangladesh Bank Various SRO (2015, 2016, 2017, 2018, 2020), and Bangladesh Trade Portal (BTP), Ministry of Commerce (MoC), Peoples' Republic of Bangladesh.

Table 4. Bangladesh exports subsidies relative to GDP and the development budget (in billion BDT).

Supports	2008	2010	2012	2014	2016	2018
Tax expenditure for BW	162.3	152.2	202.7	310.5	702.5	766.7
Tax return for DD	0.601	0.884	1.69	1.39	12.5	20.6
Cash subsidy	12.7	15	15.8	17.91	38	50.5
Total support to exports	175.6	168.1	220.2	329.8	753	837.8
GDP at current prices	5458	6147	6943	7874	17329	22505
Support as % of GDP	3.2	2.7	3.2	4.2	4.3	3.7
Revenue budget	605	691	794	951	2231	3714
Support % of revenue budget	29	24.3	27.7	34.7	33.8	22.6
Development budget	184	196	259	330	1204	1483
Support as % of development budget	95.4	85.8	85	99.9	62.5	56.5

Note: BW – Bonded warehouse, DD – Duty drawback.
Source: Authors' compilation from National Board of Revenue (NBR, 2019) and Bangladesh Economic Review Archive (2015–2018), Ministry of Finance Peoples' Republic of Bangladesh.

3. Modelling framework

To comprehensively model the economy-wide impacts of Bangladesh's graduation, we employ computable general equilibrium (CGE) modelling, using the 10a version of the Global Trade Analysis Project (GTAP) database and model. The detailed structure of the GTAP model assumptions, equations, standard closure, elasticities, and parameters, are presented in Hertel (1997), with details of the current database provided in Aguiar et al. (2019). The GTAP framework includes detailed interactions between different sectors within and across countries, as well as regional households and governments.

In this paper, we use the MyGTAP augmentation of the GTAP model, developed by Walmsley and Minor (2013). MyGTAP is a customized and extended version of the GTAP model that enables us to incorporate country-specific data to investigate the impacts of different domestic policies on the household level, with a focus on generating insights for country-specific analysis. While the standard GTAP model assumes a single regional household, in the MyGTAP model, we eliminate the single 'regional' household for

each country, instead incorporating private households and a government (Walmsley & Minor, 2013).[21] The model we employ also permits incorporating factors of production and multiple private households as well as incorporating income from remittances, foreign aid, foreign capital, and government income. In the MyGTAP framework, the government collects income from taxes, duties revenue and foreign aid, spending this income on public consumption, transfers to households, foreign aid outflow, and subsidies. Similarly, private households receive and accumulate their income from factors of productions, transfers from the government and other households and foreign remittances. This accumulated income could be spent on consumption from different sectors, transfers, remittances outflow, and some savings.

3.1. Data extension and aggregation to MyGTAP

The main features of the MyGTAP framework allow us to incorporate country-specific data on households and endowment factors. We incorporate the Bangladesh social accounting matrix data prepared from households' income and expenditure survey (HIES) with the GTAP Version 10 dataset (Aguiar et al., 2019) into the MyGTAP model (Minor & Walmsley, 2013). The latest Bangladesh social accounting matrix for 2012 and has been updated to 2014.[22]

We aggregate the 141 regions and countries in the GTAP 10 dataset into 15 regions and countries (Appendix Table A1a) and the 65 sectors into 10 aggregate sectors (Appendix Table A1b). Our regional aggregation emphasizes countries that are the leading trading partners of Bangladesh, including the United States and European Union, China and India. We aggregate the 65 GTAP sectors into 10 sectors, taking the available Bangladesh SAM into account since mapping is required between the sectors of the Bangladesh SAM and GTAP sectors, and with the aggregated regions. We then use the household consumption and ownership weights acquired from the SAM (2014) and incorporate them into the MyG-TAP model. The 10 aggregated sectors are mapped to the corresponding sectors in the Bangladesh SAM to determine each household's share of consumption. We incorporate income and consumption data for 10 different households based on the income level of Bangladesh's rural and urban regional households.

Factor ownership shares are used to allocate earnings to each of the 10 households, with household incomes then adjusted for net foreign income, remittances, and capital depreciation, as suggested by Minor and Walmsley (2013). This dataset provides a starting point from which we investigate the effects of removing export subsidies both on households and at the overall country level. A summary description of the Bangladesh social accounting matrix and database used in this study is provided in Table 5.

Table 5 shows the structure and share of different economic sectors in Bangladesh, as shown in the 2014 SAM. Grains and crops are the leading categories in the agriculture sector, contributing 11.1% of value added in the economy. The textile and clothing sector is the leading industrial category that contributes a 7.2% share in the economy. This sector is

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[21] Refer to Walmsley and Minor (2013) and Minor and Walmsley (2013), for full documentation of the MyGTAP data program and model, https://impactecon.com/resources/working-papers/.

[22] The updated SAM was provided by Dr Selim Raihan from South Asian Network for Economic Modelling (SANEM), a think-tank in Bangladesh.

Table 5. Structure of the Bangladesh economy in the updated SAM 2014 (%).

Aggregated sectors	Value added	Exports' share of output	Share of total exports	Imports relative to output	Share of total imports
1. Grains and crops	11.1	0.4	0.9	8.5	8.2
2. Livestock, fisheries and meat products	1.3	0.1	0.3	2.4	0.3
3. Mining and extraction	6.8	0.2	0.1	1.9	0.7
4. Processed food	1.4	1.5	1.6	17	9.1
5. Textiles and clothing	7.2	51.6	87.1	17.6	20.1
6. Light manufacturing	1.9	2.4	1.8	23.3	9.4
7. Heavy manufacturing	1.0	1.2	1.3	59.1	41.2
8. Utilities and construction	17.02	–	–	–	–
9. Transport and communication services	28.31	2.87	6.3	4.99	4.65
10. Other services	23.9	0.25	0.7	4.88	6.33
Total	100		100		100

Source: SAM (2014).

Table 6. Share of household income from different factors of production (%).

	Land	Capital	Natural resources	Unskilled labour	Skilled labour
Landless household	0	34	2.8	53.3	10
Marginal farmer	4.6	37.1	2.9	45.5	9.9
Small farmer	10.5	29.7	1.6	48.1	10.1
Large farmer	23.2	16.9	2.6	48.2	9.2
Rural day labourer	4.5	25.3	2.5	55.7	12
Rural self employed	3	71.6	0.9	19.4	5.1
Rural employee	3.4	54.8	2	27.4	12.5
Urban day labourer	2.1	13	2.7	71.8	10.3
Urban self employed	2.1	48.9	1.3	24.5	23.1
Urban employee	2	29.9	2	27.2	38.9

Source: Bangladesh 2014 SAM.

highly export-oriented, with about 87.1% of total exports coming from textiles and clothing, while comprising under 20.1% of imports (Table 5). Bangladesh is heavily dependent on importing in the heavy manufacturing sectors, which is about 41.2% of total imports, especially intermediate capital goods.

Table 6 shows factor ownership by rural and urban households while Table 7 demonstrates how these factors of production are employed in different sectors. Table 6 illustrates where the income comes from for these 10 households. Unskilled labour is particularly important in the agricultural sectors, as indicated in Table 7. The tables depict that urban day labourers get most of their income from unskilled employment, and 42% of value added in the textile and apparel sector is contributed by unskilled labour.

3.2. Updating Bangladesh export subsidies rate

The government of Bangladesh (Ministry of Finance) declares subsidies every year in June, and the Central Bank (Bangladesh Bank) implements the decision made by the government. However, the GTAP version 10 database uses the WTO's export subsidies dataset, which does not appear to accurately reflect Bangladesh subsidies. Therefore, we update these subsidies in the pre-simulation database, employing the *Altertax* method (Malcolm, 1998). This procedure aims to maintain the consistency of the value flows in the database as much as possible while integrating the updated subsidy rates (Burfisher, 2017;

Table 7. Share of factor of production in sectoral value added (%).

	Land	Capital	Natural resources	Unskilled labour	Skilled labour
Grain and crops	47.6	0	0	48.9	3.6
Meat and livestock	0	34.1	0	64.9	1
Extraction and mining	0	47.6	33.6	17.9	0.9
Process food	0	63.1	0	26	10.9
Textiles and clothing	0	40.2	0	42.2	17.6
Light manufacturing	0	54.9	0	31.9	13.3
Heavy industry	0	61.3	0	27.3	11.4
Utilities and construction	0	84.7	0	7.8	7.5
Transport and communication	0	38.7	0	49.7	11.7
Other services sector	0	57.8	0	9.4	32.8

Source: Bangladesh 2014 SAM.

Figure 2. Impact of LDC graduation on real GDP (% change).
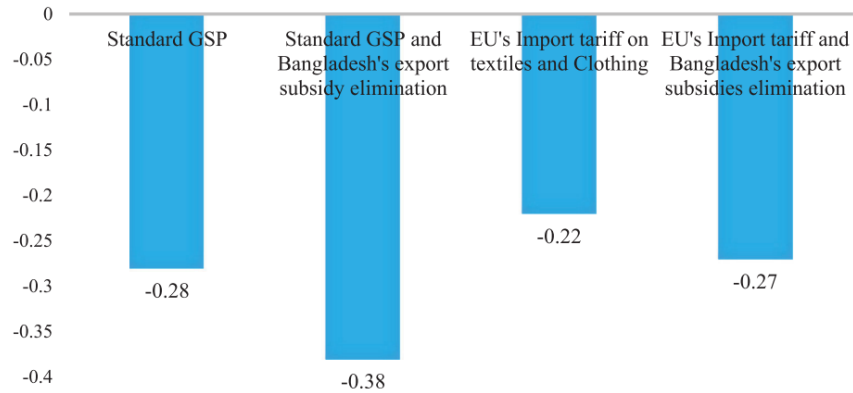
Source: Authors' simulation.

Siddig et al., 2014). Bangladesh's government has been providing an average of about a 10% export subsidy over the last decade therefore this is integrated into the updated data from which we run our policy simulations.

3.3. Simulation scenarios

Given that Bangladesh is set to graduate from being an LDC by 2026, Bangladesh must prepare for the post-graduation environment in which it will not be able to access preferential market access under the WTO's DFQF framework and preferential GSP, including EBA arrangement in the EU market. We simulate the following four scenarios to generate insights into the potential impact of graduation on Bangladesh:

- Under scenario one, we explore the potential impact if the EU, UK, Japan, Canada, and Australia impose standard GSP tariffs on imports from Bangladesh. As Bangladesh has been enjoying preferential tariffs under SAFTA, we also apply SAFTA non-LDC

tariffs. We do not consider Korean and Chinese MFN tariffs as they give about 97% tariff lines duty-free under APTA and DFQF. We also do not consider changes in USA tariffs in this simulation as the USA has suspended GSP imports from Bangladesh since 2013.

- Under scenario two, in addition to the tariff changes from the first scenario, we introduce the elimination of export subsidies to selected sectors including textiles and clothing, light manufacturing and agricultural sectors exporting from Bangladesh.
- Under scenario three, we investigate the impacts of only the EU imposing standard GSP tariffs on imports from Bangladesh as the EU is the largest export destination of Bangladesh. The EU standard GSP on ready-made garments is 9.6% (Europa, 2020).
- Under scenario four, in addition to the tariff changes from scenario 3, we also introduce an elimination of export subsidies to all these selected sectors exporting from Bangladesh.

4. Analysis of the simulations results

4.1. Macroeconomic impact

The impact of introducing new tariffs and eliminating export subsidies can be investigated at both the macroeconomic and household levels of analysis. This section presents the simulation results that show the potential impacts on macroeconomic indicators, industry outputs, trade, and households' income and consumption. The overall macroeconomic impacts of the new standard GSP tariffs and elimination of export subsidies modelled are presented in Figure 2. It is evident from the simulations that the increased tariffs and elimination of export subsidies will reduce exports and imports substantially under all four scenarios. The simulation results show that if the EU, Japan, Canada, Australia introduce standard GSP tariffs (Table 2), GDP reduces by 0.28%. If the complete elimination of export subsidies also takes place for Bangladesh it may further negatively impact real GDP (0.38%), exports, imports and household income.

The analysis shows that shrinking exports from Bangladesh could lead to a negative balance of trade impact that could affect GDP. Total exports reduce by about 5.9% under scenario two. This analysis indicates that Bangladesh will face a challenging situation after graduation with this new environment.

In contrast, if the EU only introduces its standard GSP tariff importing from Bangladesh and at the same time if Bangladesh eliminates its export subsidies, real GDP may decrease by about 0.27%. Bangladesh exports fall by 5.2% in this scenario (Figure 3). The analysis indicates that the overall change in the balance of trade is negative and there is a significant negative impact on terms of trade.

4.2. Sectoral output

The RMG industry has been enjoying not only duty-free market access, but also various stimulus supports, including cash incentives, duty drawbacks, and bonded warehouse facilities over the decades. If we eliminate the export subsidies and increase tariffs on exports to GSP tariffs when exporting to developed markets this will impact RMG production, as presented in Figure 4.

**Figure 3.** Impact of LDC graduation on real exports (% change).
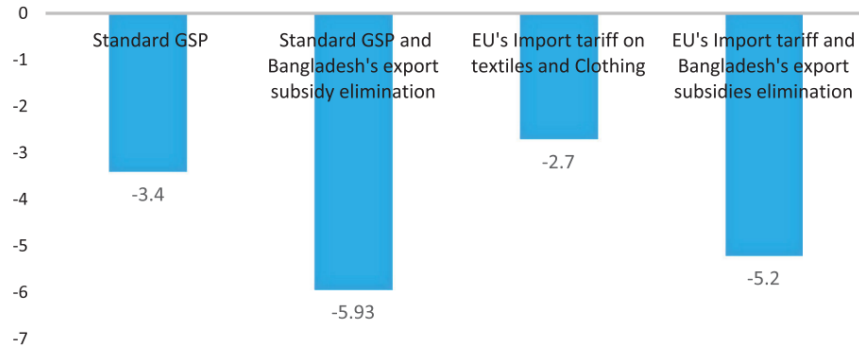
Source: Authors' simulation.

Figure 4. Impact on sectoral output (% change).
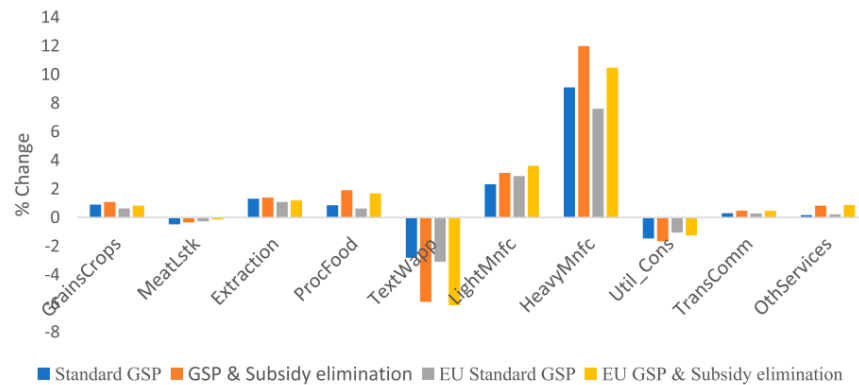
Source: Authors' simulation.

Under scenario two if we eliminate export subsidies and impose a 9.6% tariff, the total production of textiles and clothing would be reduced by about 6.1%. But the tariff changes and subsidy eliminations may have a positive impact on the output of other sectors. The industrial sector will face lower tariffs (about 4.3%) than the RMG sector (9.6%) in the EU market, which may increase the output and exports of the non-RMG sector. The other explanation is resource mobilization, with resources moving away from the RMG sector to other industries, leading to higher production of non-RMG sectors. The light and heavy manufacturing sector would experience positive growth. Agricultural output may increase significantly as well, although, the contribution to exports by all these sectors is not very significant compared to the RMG sector. The analysis indicates that the removal of export subsidy may hurt the highly export-intensive apparel sector but will have a positive effect on the output of other sectors (Figure 5).

Figure 5. Impact on the RMG exports (% change).
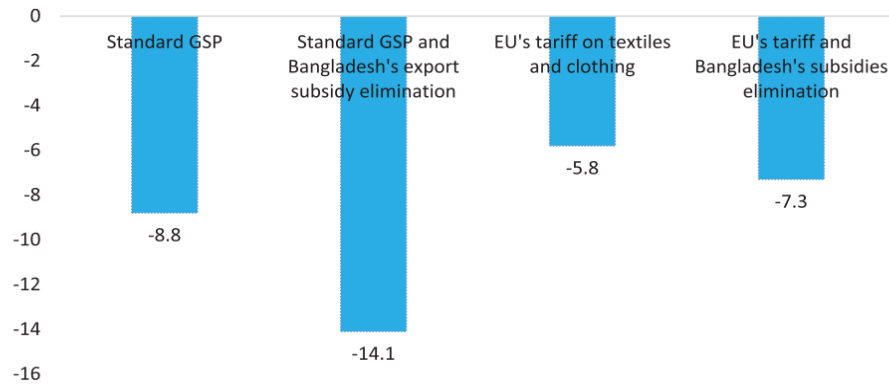
Source: Authors' simulation.

4.3. Impact on RMG sector

Textiles and clothing are the main export items of Bangladesh, constituting about 87% of Bangladesh's total exports in 2019. Therefore, the RMG sector's exports could be affected adversely post-LDC graduation under all four scenarios. Exports of the ready-made garments sector could fall by 14% under scenario two. However, due to overall increased efficiency through eliminating export subsidies, some of the resources may move out from RMG sector to other sector which may increase exports of light engineering, processed foods, and the agricultural sector.

At the same time, imports might decrease substantially in all sectors under all four scenarios, especially intermediates inputs of the RMG sector, which constitutes about 20% of Bangladesh's total imports. Elimination of export subsidies also reduces imports in the light manufacturing industry.

4.4. Impact on households

Given the MyGTAP modelling extension for Bangladesh developed in this paper, we are able to supplement the macroeconomic results with a distributional analysis of household income. The estimated change in household income is shown in Figure 6. The simulation results reveal that real household income declines substantially for urban households under all four scenarios. The real income could be decreased due to reduced income in the RMG sector, in particular, urban households are more linked with export-oriented industries than rural households.

Our results suggest that the income of urban households could decline on average by 3% under scenario two due to a significant fall in RMG exports which will directly affect urban unskilled household income. Due to the elimination of export subsidies domestic prices may increase which leads to lower exports. However, rural household incomes may not fall significantly as their income is not so directly related to the export-oriented ready-made garment industry.

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Figure 6. Impact on household incomes (% change).
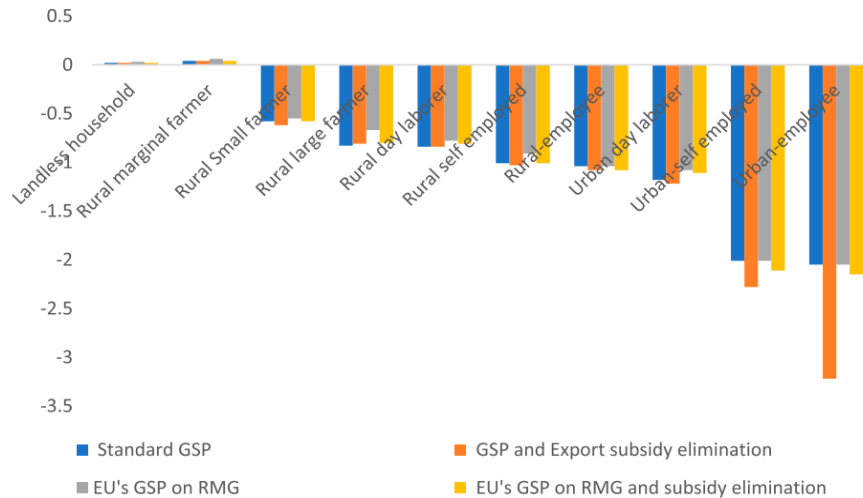
Source: Authors' simulation.

Urban unskilled households contribute about 42% to value added in the garment industry and are directly affected due to the lower exports that lead to lower output in the apparel sector. According to Haque and Bari (2021), about 4.2 million workers are employed in the apparel sector in Bangladesh. Table 5 shows the contribution of the apparel sector to GDP is about 7.16%. This indicates that urban unskilled labour, which is about 4.2 million people, is particularly affected by the LDC graduation. The Bangladesh Garment Manufacturers and Exporters Association (BGMEA) indicates that women comprise 80% of workers employed in member factories (World Bank, 2012). Rural households, whose main source of income is from agriculture and farming, are likely to be less affected than urban households as they are not so reliant on the RMG sector for their incomes.

Changes in household consumption under each scenario are presented in Figure 7 and show that consumption may fall by about 4% in the urban area, but the reduction in rural consumption is much smaller. While consumption may decrease substantially among the urban employees who are directly employed in the garments industry, rural workers are more insulated from the impacts of the policy changes modelled.

5. Robustness and sensitivity analysis

5.1. Baseline database for long-term impact simulations

As Bangladesh is set to graduate from the LDC category by 2026, followed by another three years of the transition grace period, we also simulate the impacts of the scenarios from a database that is projected to 2031. These simulations provide insight into how overall results may differ if modelled from a baseline that includes a structural change in the

Figure 7. Impact on household consumption (% change).
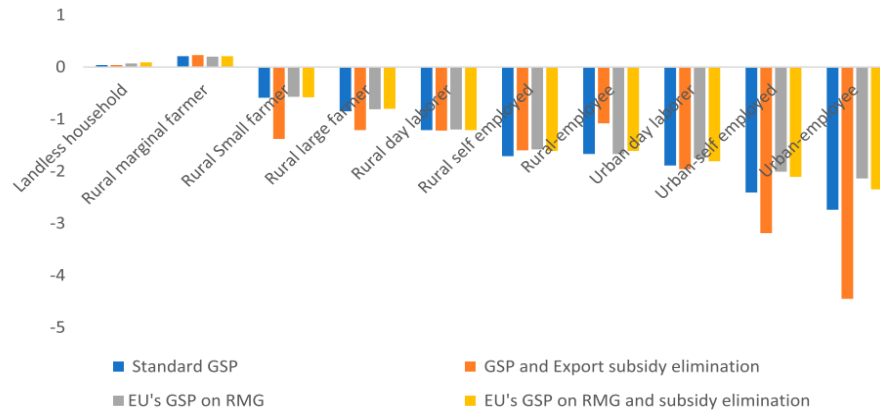
Source: Authors' simulation.

Table 8. Baseline average growth projections (% change) of Bangladesh.

|	Y2012–2016	Y2017–2021	Y2022–2026	Y2027–2031
Population	0.99	0.88	0.67	0.47
GDP growth rate	6.55	7.03	6.10	5.26
Population (aged 15–64)	1.94	1.60	1.04	0.76

Source: Authors' estimations based on SSP2.

Bangladesh and other world economies at the time the graduation will be implemented.[23] First, we develop a baseline projection of the global economy from 2014 to 2030. Starting with the GTAP version 10 dataset, with a base year of 2014, we exogenously apply growth to population, labour force, and GDP per capita growth to simulate changes in Bangladesh and the other global economies modelled over this period (following Anderson & Strutt, 2016). In particular, we use a middle of the road shared socio-economic pathways (SSP2) projection[24] to estimate the growth rate projections shown in Table 8.

The macroeconomic impact of GSP tariff and elimination of export subsidies modelled from the updated 2031 baseline are presented in Figure 8. The simulations indicate a similar pattern of impact to the comparative static simulations. The results evince that Bangladesh economy will face a challenge in export markets after graduation. The simulation results show that if the EU, Japan, Canada, Australia introduce standard GSP tariffs when importing from Bangladesh, real GDP could fall by 0.24% and total exports may decline by about 6.5%, while exports of the ready-made garments sector could fall by 10.8% in 2031. However, the negative impact of LDC graduation could be lower in the long run due to the increased resilience of the economy over the years.

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[23] While useful for sensitivity analysis, given our focus in this study on household impacts which rely on data from the 2014 SAM for which projections into the future are not available, it would not be appropriate to draw detailed household insights from this updated dataset.

[24] https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10.

Figure 8. Macroeconomic impacts of LDC graduation in 2031 (% change).
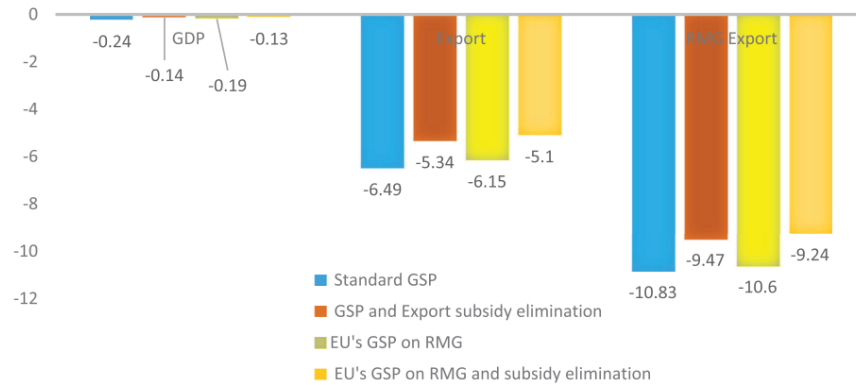
Source: Authors' simulations.

5.2. Sensitivity of results to trade elasticities

As a check on the robustness of results, we undertake a sensitivity analysis of some key parameters. Given our focus on the impact of increased tariffs and reduced export subsidies, we test the impact of assuming different trade elasticities in the modelling. In particular, we double the size of the substitution elasticity between Bangladesh and its trading partners for imported goods. The macroeconomic impact is shown in Appendix Figure A5. The quantitative results of the sensitivity analysis are similar to the main study. Real GDP falls and overall exports drop, particularly RMG exports. Consistent with other literature, we find that pattern of results is similar, but the magnitude of the results does change somewhat with changes in the values of parameters (Timilsina et al., 2018).

5.3. Limitations of the analysis

The economic impacts estimated by CGE models depend on many assumptions including with respect to parameters, data, model specifications and closures. For example, our model assumes perfect competition in all sectors. In the model closure we use, capital and labour are assumed to be fully mobile between sectors, whereas land is treated as moving sluggishly between sectors and government spending is assumed as a constant share of government income. Gilbert et al. (2018) provide a useful review of some strengths and limitations of CGE models for international trade policy analysis.

While our modelling captures bilateral trade flows between Bangladesh and other countries, the CGE model and database we use in this study does not focus on global supply chains, production processes that may shift rapidly between different locations or trade in unfinished goods relative to finished goods. Some limitations of global CGE models which do not fully capture global supply chains are discussed by Athukorala et al. (2018).

In the current study, we only consider the market access issue of LDC graduation, where we model standard GSP-related tariffs and export subsidies elimination scenarios. We do

not consider rules of origin, trade-related intellectual property rights, development assistance, or any other issues Bangladesh may face after graduation. In addition, we do not model the potential benefits through an increased investment that may occur on graduation, or the impact of future trade agreements, both of which may help to offset any negative impacts.

6. Conclusion and policy recommendations

Graduation from the LDCs category may give more self-dignity and some economic benefits through improved credit rating and attract more investment, but at the same time countries will lose preferential market access. Given the impending graduation, Bangladesh needs to have a smooth graduation transition strategy in place so that potential disruptions from the graduation are minimized and its long-term goals are realized.

Bangladesh has been enjoying preferential market access as an LDC in recent decades. The EU, UK, Canada, Japan, Australia and others developed countries offer mostly duty-free market access importing from LDCs like Bangladesh. The GSP utilization rate of Bangladesh in the EU market is 96%, indicating that Bangladesh has substantially benefitted from duty-free market access. Although MFN-applied tariffs on many industrial goods are relatively low in developed markets, the standard GSP rates for the textiles and clothing sector are relatively high in most developed countries (WTO, 2020), and these are the rates Bangladesh will face when exporting to these markets after graduation. Export subsidies are another critical policy issue. Bangladesh has been providing export subsidies of about US$10 billion in 2018, which accounted for about 3.7% of its GDP or about 57% of its development budget. Bangladesh's main export item is ready-made garments; therefore, most of this export subsidy goes to the RMG sectors. As Bangladesh is preparing to graduate from LDC to DC status by 2026, export subsidies, including for industrial products, must be eliminated after graduation.

This study analysed the potential impact of LDC graduation using a computable general equilibrium framework incorporating household data from the Bangladesh social accounting matrix. In particular, we used the MyGTAP program and model developed by Walmsley and Minor (2013) to incorporate country-specific data to investigate the impacts of different domestic policies at the household level. We then simulate four different policy scenarios to evaluate the potential impact of LDC graduation on Bangladesh, starting with imposing the standard GSP tariffs that Bangladesh will face general as a developing country. We then added a complete elimination of the export subsidies. Under scenarios three and four, we introduced the EU's tariff imposition, without and with subsidy elimination.

The findings show that if developed countries (except the USA) impose tariffs when importing from Bangladesh and at the same time if Bangladesh eliminates its export subsidies, Bangladesh's GDP may fall by 0.38%, and exports could fall by 6%. The RMG sector could be affected severely, with exports of the RMG sector declining by 14%. The analysis also indicates that the income of urban households could decline on average by 3%. Real household income may decline substantially for urban households, particularly due to reduced income in the RMG sector and urban household consumption may fall by about 4%.

The simulations also indicate that if the European Union (EU) only imposes standard GSP tariffs while importing from Bangladesh and if Bangladesh eliminates its export subsidies, Bangladesh's real GDP real may fall by about 0.24%. Bangladesh's total exports could fall by about 5.2%, while exports of the apparel sector decline by about 7.2%. Urban household incomes may decrease due to a significant reduction in RMG exports and production.

Graduation will bring some challenges, especially after phasing out of the transition period. Bangladesh has set a target to become an upper-middle-income country by 2031 and an aspiration to be a developed nation by 2041 (Perspectives Plan 2021–2041, Bangladesh Planning Commission). To achieve this ambitious goal, Bangladesh needs a graduation transition strategy to ensure that graduation does not cause disruptions in this long development journey. The economy has undergone substantial structural change over the years. The share of agriculture in GDP has declined from 17% in 2010 to 13% in 2020 (WDI, 2020), with the shares of industry and service sectors increasing steadily. While the economy is growing, an important challenge is the lack of export diversification, both in products and markets. In addition, the current COVID-19 pandemic has significantly impaired overseas employment, which may substantially impact the current account balance. The pandemic has also affected people's health, livelihoods, and employment, especially in the vast informal sector. Low productivity, the informal labour market, workplace safety issues, controlling disease outbreaks, and dealing with environmental disasters are critical issues the country needs to tackle to ensure sustained economic growth.

Our study indicates that if Bangladesh is unable to ensure continuity of market access, the costs of LDC graduation for Bangladesh may be high. Bangladesh will face severe competition in export markets with economies such as Vietnam, India, Indonesia and China after graduation. Bangladesh should prepare a comprehensive transition strategy to ensure its export market access in the developed market can cope with the post-graduation environment. Bangladesh should try to ensure continued access to the EU market, a key export market. The GSP plus could be an option to ensure market access in the EU. Different preferential or free trade agreements with East Asian countries will also play a key role in integrating Bangladesh into the East Asian supply chain. The FTA strategy should be integrated into the national policy agenda, especially in the Fifth Five-Year Plan and the long-term Perspective Plan. Moreover, Bangladesh needs to play an active role in the WTO and UN LDC conference to ensure market access continues after graduation.

6.1. Future research

There are a number of areas in which the current research could usefully be developed. For example, similar research could be carried out for other graduating LDCs. A firm-level impact analysis would be very useful for providing detailed insights into employment distribution. Future work could also focus more explicitly on global supply chains, including how they affect the industrial composition of output, the occupational composition of employment, and the regional distribution of income in Bangladesh or other graduating LDCs. In addition, future studies could usefully focus on quantifying some potential benefits of LDC graduation that we do not model here, including an improved environment for foreign investment.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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CHAPTER V: GROWING WITH TWO GIANTS: A MIXED BLESSING FOR

BANGLADESH

SOUTH ASIA SCAN

GROWING WITH TWO GIANTS – A MIXED BLESSING FOR BANGLADESH

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**Growing with Two Giants –
A Mixed Blessing for Bangladesh**

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Executive Summary

Bangladesh has been struggling to balance its relationship with its two important neighbours – India and China. While China now holds the position as Bangladesh's top trading and investment partner, India is its second largest trading partner. Bangladesh largely imports the same products from India and China – predominantly cotton, vehicles and trains, nuclear reactors and heavy machinery. Its main exports to India and China are garment and textile products and some agricultural products, including jute and leather.

Bangladesh has a significant comparative advantage in the apparel, jute and leather sectors. Although Bangladesh has enormous export potential to China and India, this potential remains largely unrealised due to non-tariff measures (NTMs) and the lack of trade facilitation. The Indian anti-dumping duty on jute and jute products imported from Bangladesh is an example of a recent NTM. Computable general equilibrium modelling simulations indicate that if India and China reduce their NTMs by increasing trade facilitation by 50 per cent, Bangladesh's exports could increase by 3.14 per cent within these two markets.

Chinese investments in Bangladesh reached about US$40 billion (S$54.7 billion) in 2019, while Indian investments were about US$5 billion (S$6.8 billion) in the same period. Bangladesh is striving to attract foreign direct investments (FDI), while China and India want to influence their neighbours through their geopolitical strategies. The Sonadia deep-sea port is one of the 'victim' projects which had to be called off due to geopolitical competition in the Bay of Bengal between the two giants. Bangladesh's current strategy is to draw political support from India and financial support from China. However, this balancing act may not be sustainable in the future.

Both China and India have their respective geopolitical interests in South Asia. The China-India strategic rivalry has intensified in recent years, as witnessed by their border conflicts. Australia, India, Japan and the United States (US) formed the Quadrilateral Security Dialogue (also called the Quad) to tackle Chinese influence in the region. Moreover, many of the major Asian countries, including Japan, Korea, Singapore and Taiwan, are looking for alternative investment opportunities, either as part of a 'China exit' or a 'China plus' strategy.

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To avoid conflict and become a passive victim of the geopolitical competition in the region, Bangladesh should reiterate its foreign policy principle of 'Friendship towards all, malice towards none'. Maintaining good working relations with India and China are vital for Bangladesh's sustainable economic growth. At the same time, Bangladesh should also attract FDI from other markets, as Dhaka has both geopolitical and economic advantages in the Asia Pacific region. Bangladesh should cultivate and use this unique position to its advantage through tactful involvement in trade and investment with both India and China.

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Introduction and Rationale for the Study

Bangladesh has emerged as a regional gateway for South Asia and Southeast Asia and plays an important role in global supply chains. It is one of the most rapidly growing economies in Asia, with an average growth rate of about 6.5 per cent over the past few decades.[1] In 2021, Bangladesh's gross domestic products (GDP) per capita was US$2,462 (S$3,420).[2] In the June 2022 budget presentation, the government forecasted a growth rate of 7.5 per cent for FY2022-23, with a GDP per capita of US$2,885 (S$4,018).[3] The International Monetary Fund had earlier predicted that Bangladesh's per capita would overtake India's by 2021. Bangladesh succeeded in surpassing India in GDP per capita last year,[4] which is a remarkable achievement in Bangladesh's development story. In terms of many social indicators, Bangladesh is in a much better position than India, as pointed out by Noble Laureate Professor Amartya Sen in his various writings.[5] It also superseded Pakistan quite some time ago in becoming the second biggest economy in South Asia.[6]

In the last decade, Bangladesh's total trade increased from an estimated US$43 billion (S$58.8 billion) in 2010 to US$110 billion (S$150.4 billion) in 2019.[7] Furthermore, its trade to GDP ratio is 38 per cent, reflecting its increasing integration with the global economy. Citibank, Goldman Sachs, J P Morgan and Merill Lynch have identified Bangladesh as an important country with unrealised investment potential in the region. The United Nations Committee for Development Policy recently recommended Bangladesh's graduation from the least developed countries (LDCs) category into the developing countries grouping as it has met all three thresholds for LDC graduation, namely, gross national income per capita, the human asset index and the economic and environmental vulnerability index.[8] These indicate that Bangladesh's development model is reaping dividends. Globally, it has become a role model of socio-economic development, far from the "basket case" that American statesman Henry Kissinger dubbed it in 1971.

Bangladesh's next-door neighbours are two giants — India and China. Bangladesh shares about a 4,000-kilometre land border with India and is within China's geographical orbit through the Chinese Belt and Road Initiatives (BRI). Beijing and Delhi are emerging superpowers

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on the international stage. The World Economic Forum forecasts that China will overtake the US, in terms of GDP, by 2024 and India will become the third largest economy in the same period.[9] The last few decades have witnessed tremendous economic growth and poverty reduction in both countries. These economic trends have led to a rise in a wealthy middle class with massive spending capacity. However, since 2019, Sino-Indian relations have deteriorated tremendously. Border skirmishes, technology bans and the fallout from the COVID-19 pandemic have worsened the fractious relationship. Both countries have begun courting regional neighbours to balance each other.

Bangladesh has deep historical, cultural and linguistic affiliations with India. After his release from a Pakistan prison, the 'Father of the Nation' – Bangabandhu Sheikh Mujibur Rahman – first landed in Delhi in 1972, enroute to Dhaka from London, where he iterated that India and Bangladesh were "eternal friends and brothers". However, relations between Dhaka and Delhi have not always been steady, owing to domestic politics and changes in government. These played a critical role in changing the bilateral relationship of India and Bangladesh. Nevertheless, in recent years, bilateral relations have improved. India's Prime Minister Narendra Modi visited Bangladesh on 26 and 27 March 2021 to commemorate the 50th year of Bangladesh's independence, where avenues to deepen economic and cultural collaboration were discussed.

1   Economic data, Bangladesh Bank (2020), https://www.bb.org.bd.
2   Gross Domestic Product (GDP) 2020-21 (Final), Bangladesh Bureau of Statistics, Government of the People's Republic of Bangladesh, https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/057b0f3b_a9e8_4fde_b3a6_6daec3853586/2022-02-08-08-05-3347c0f140eaa82212bc87e82f618 1c5.pdf.
3   Budget Documents (2022-23), Finance Division, Ministry of Finance, Government of the People's Republic of Bangladesh, https://mof.gov.bd/site/page/9ea7529b-c8ef-49b5-8b8e-87ef72a2b3ec.
4   India GDP Per Capita, 1958 – 2022, CEICA, https://www.ceicdata.com/en/indicator/india/gdp-per-capita.
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6   World Development Indicators (WDI), https://datatopics.worldbank.org/world-development-indicators
7   World Development Report 2020: Trading for Development in the Age of Global Value Chains Washington, DC: World Bank, World Bank, https://doi.org/10.1596/978-1-4648-1457-0.
8   UN LDC Portal https://www.un.org/ldcportal/tags/graduation.
9   "This is what global economy look like in 2024", World Economic Forum (2020), weforum.org.

The India-Bangladesh bilateral relationship has grown closer in the last decade and has been marked by consistency and increased cooperation. According to the joint statement, there are more than 50 bilateral institutional mechanisms between India and Bangladesh in "security, trade and commerce, power and energy, transport and connectivity, science and technology, defence, rivers and maritime affairs, etc."[10] Both sides are active in various regional and sub-regional groups like the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and the Bangladesh, Bhutan, India and Nepal (BBIN) Initiative.

In addition to BIMSTEC and BBIN, the two countries are part of several other forums, including the South Asian Free Trade Agreement (SAFTA) and the Asia Pacific Trade Agreement (APTA). Better trade and investment opportunities are drivers for improving bilateral relations.[11] However, these benefits are not equally distributed as they are heavily skewed in India's favour.[12]

Relations between Bangladesh and China have generally been less interactive despite the establishment of diplomatic contact in 1975. However, relations between Dhaka and Beijing have slowly gained momentum and culminated during Chinese President Xi Jinping's visit to Bangladesh in 2016. A total of 15 agreements and memoranda of understanding (MoU) as well as 12 loan and mutual agreements were signed during the visit under the BRI.[13] China has now become Bangladesh's largest trading partner and top investor. Beijing's goodwill projects, large-scale investments and non-interference in domestic politics have garnered much support amongst Bangladeshis.

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[10] Joint Statement issued on the occasion of the visit of Prime Minister of India to Bangladesh, 27 March 2021, https://mea.gov.in.

[11] S Kathuria and N Rizwan, "Benefits of cooperating with big neighbors: The case of Bangladesh and India", in S Raihan and P De (Eds.), Trade and Regional Integration in South Asia: A Tribute to Saman Kelegama (Springer, New Delhi, 2020), pp. 109-127, https://doi.org/10.1007/978-981-15-3932-9.

[12] M S Ullah and K Inaba, "Impact of RTA and PTA on Bangladesh's export: Application of a gravity model", Journal of Industry, Competition and Trade, 12(4), 2012: pp. 445-460, https://doi.org/10.1007/10842-011-0116-3; and S Raihan and F Ashraf, Review of Bangladesh's Engagement in Preferential Trading Arrangements, Country Study Series No.1. Enhancing the Contribution of Preferential Trade Agreements to Inclusive and Equitable Trade, Bangkok: ESCAP, 2017.

[13] M K Khan, I A Sandano, C B Pratt, and T Farid, "China's belt and road initiative: A global model for an evolving approach to sustainable regional development", Sustainability, 10(11), 2018: 4234, https://doi.org/10.3390/su10114234.

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Sahoo (2013) contends that India is losing its market share in South Asia to China.[14]

Steady economic growth and remarkable poverty reduction over the last decade in China and India have attracted global economic interest in these markets. Thus, Bangladesh's close geographical position to China and India allows it the opportunity to develop strong bilateral ties and regional cooperation with these two giants. Against this backdrop, this South Asia Scan's primary focus is to deliberate on how Bangladesh should balance between these two giants and capitalise on trade and investment opportunities with them.

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[14] Pravakar Sahoo, "The growing dominance of China in South Asia: An Indian perspective", *The International Trade Journal,* 27(2), 8 March 2013, pp. 111-141, https://doi.org/10.1080/08853908.2013.764241.

Distinctive Facts about the Two Giants

India lags behind China in many major economic and development indicators (see Table 1 for India and China's comparative economic statistics). According to the World Bank, Beijing's economy is roughly five times bigger than India's in terms of GDP and GDP per capita.[15]

Chinese total exports in goods and services were about US$2.64 trillion (S$3.60 trillion) whereas Indian exports were US$524 billion (S$714 billion) in 2019. China has a huge trade surplus as its imports were US$2.48 trillion (S$3.38 trillion) in 2019 whereas India is a trade deficit country, with imports at US$606 billion (S$826 billion) in 2019 (Table 1). Chinese FDI outflow was US$111 billion (S$151 billion) in 2019 while Indian investment outflow was only US$12 billion (S$16 billion) during the same period.

Furthermore, India is still broadly an agriculture-based economy whereas China has progressed to a more industrialised economy. More than one billion Chinese people used the Internet in 2020 and, recently, China introduced the digital yuan in seven cities.[16] On the other hand, India struggles to provide for the basic needs for many Indians, with roughly seven per cent of its population still deprived of electricity.[17] In comparison, all Chinese households enjoy access to basic amenities. The ease of doing business and trade facilitation in China is much better than in India, as illustrated in Table 1.

Although the World Bank envisions a 5.2 per cent global contraction in the near term due to the economic contraction caused by the COVID-19 pandemic, both China and India are forecasted to weather the storm relatively well.[18] In 2020, the Chinese economy registered

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[15] World Development Report 2020: Trading for Development in the Age of Global Value Chains, Washington, DC: World Bank, World Bank (2020), https://doi.org/10.1596/978-1-4648-1457-0.

[16] "China prepares to launch the world's first official e-currency", The Economist, 17 November 2021, https://www.economist.com/the-world-ahead/2020/11/17/china-prepares-to-launch-the-worlds-first-official-e-currency.

[17] World Development Report 2020: Trading for Development in the Age of Global Value Chains, Washington, DC: World Bank, World Bank, https://doi.org/10.1596/978-1-4648-1457-0.

[18] Global Economic Prospects, January 2021, Washington, DC: World Bank, World Bank, https://doi.org/10.1596/978-1-4648-1612-3. Also see World Economic Outlook Update, January 2021: Policy Support and Vaccines Expected to Lift Activity, International Monetary Fund (2021), https://www.imf.org/en/publications/weo.

a growth of 5.2 per cent and is forecasted to grow at 8.2 per cent in 2021.[19] Similarly, the Indian economy has shown signs of recovery and these trends are a positive indicator of New Delhi's quick rebound from the health crisis. Both economies will continue to grow in the next decade. This brief distinctive analysis shows China has made tremendous progress in socio-economic development while India still has an enormous potential for progress and development.

Table 1: Selected Socioeconomic Indicators

Economic/Development Indicators	Bangladesh	China	India
Agriculture, forestry and fishing, value added (% of GDP)	12.7	7.1	16.0
Exports of goods & services (% of GDP)	15.3	18.4	18.4
Ease of doing business score (0 = lowest performance, 100 = best performance)	45.0	77.9	71.0
GDP growth (Annual growth rate %)	8.2	6.1	4.2
GDP (Current US$ billion in 2019)	303	14342	2868
GDP per capita (Current US$)	1855	10261	2099
Gross capital formation (% of GDP)	31.6	43.3	29.7
Export in goods and services in 2019 (US$ billion)	46	2641	528
Import in goods and services in 2019 (US$ billion)	64	2476	606
Foreign direct investment outflow in 2019 (US$ billion)	-	111	12

Source: World Bank, 2020, UNCATD (2020)

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[19] World Economic Outlook Update, January 2021: Policy Support and Vaccines Expected to Lift Activity, International Monetary Fund, https://www.imf.org/en/publications/weo.

13

Bilateral Trade with the Two Giants

Bangladesh's bilateral trade with India was US$3.4 billion (S$4.64 billion) in 2008 and it increased to US$10 billion (S$13.64 billion) in 2019. On the other hand, China's trade with Bangladesh was US$4.6 billion (S$6.27 billion) in 2008 and increased to about US$18.7 billion (S$25.5 billion) in 2019, almost double that compared to India (Figure 1). In 2019, Bangladesh imports from the world amounted to US$56.99 billion (S$77.71 billion), of which 30 per cent were from China and 15 per cent from India.[20]

However, Bangladesh's exports to its neighbours have not been significant over the last decade. Bangladesh exports to India reached US$1 billion (S$1.36 billion) in 2019 and only US$800 million (S$1.09 billion) to China during the same period.

Figure 1: Bangladesh's Trade with China and India
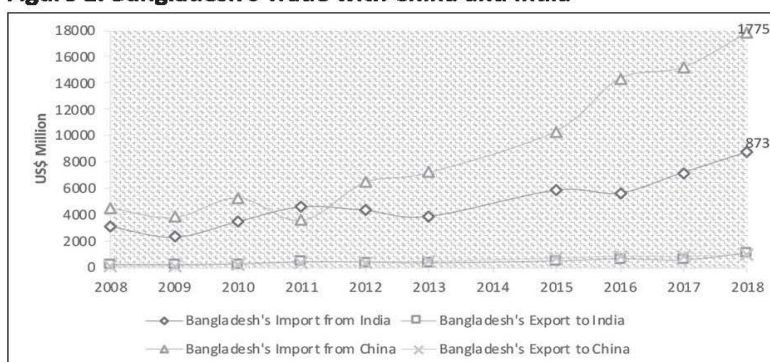
Source: Bangladesh Bank (2020)

Bangladesh's main imports from India are cotton, vehicles and trains, nuclear reactors and heavy machinery. Its main exports to India are garments and textiles products and some agricultural products, including jute and leather. Its import pattern with China is similar to that of India. Bangladesh imports nuclear machinery and chemical

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[20] Trade Intelligence and Negotiation Adviser (TINA) 2021, https://tina.trade/.

items, heavy and light manufacturing products from China, along with cotton, textiles and clothing. In 2019, Bangladesh imported nuclear reactors and machinery worth about US$2.9 billion (S$3.96 billion) from China (Tables 2 and 3).

Table 2: Bangladesh Trade with India in 2019 (US$ Million)

Products	Import	Products	Export
Cotton	1,583	Apparel & clothing accessories, not knitted	369
Vehicles other than railway or tramway rolling stock, & parts & accessories	1,002	Animal or vegetable fats, oils; edible fats, animal or vegetable waxes.	159
Nuclear reactors, boilers, machinery, & mechanical appliances	626	Vegetable textile fibres; paper yarn and woven fabrics	142
Iron and steel	322	Apparel and clothing accessories, knitted or crocheted	130
Residues & waste from the food industries; prepared animal fodder	286	Readymade textile articles; worn clothing and worn textile	41
Electrical machinery and equipment, and parts and accessories of such articles	284	Plastics and articles thereof	33
Organic chemicals	259	Inorganic chemicals, precious metals, radioactive elements	32
Plastics and articles thereof	259	Cotton	28
Tanning or dyeing extracts; dyes, pigments and colouring	242	Iron and steel, metal	28
Edible vegetable and certain roots	233	Beverages, spirits, and vinegar	28
Others items	2,551	Others items	259
Total Imports from India	**7,648**	**Total Exports to India**	**1,248**

Source: World Bank, 2020, UNCATD (2020)

Bangladesh's main exports to China are readymade garments, mainly apparels which require a huge amount of cotton. Bangladesh imported cotton amounting to US$2.2 billion (S$3 billion) from China and US$1.5 billion (S$2.05 billion) worth from India in 2019.

This bilateral trade analysis shows Bangladesh's trade with China and India was almost similar in 2011. However, within a decade, China's trade relationship with Bangladesh doubled, compared to Indian engagement with Bangladesh (Tables 2 and 3).

Table 3: Bangladesh' Bilateral Trade with China in 2019 (US$ Million)

Products	Import	Product: HS 2 Digit	Export
Nuclear reactors, boilers, machinery & mechanical appliances	2,924	Articles of apparel and clothing accessories	283
Cotton	2,199	Articles of apparel and clothing accessories, knitted or crocheted	224
Electrical machinery and equipment and parts; electronics items	1,637	Vegetable textile fibres; paper yarn and woven fabrics	105
Man-made staple fibres	756	Fish & crustaceans, mollusc & other aquatic invertebrates	74
Knitted or crocheted fabrics	744	Raw hides & skins (other than fur skins) and leather	39
Man-made filaments	669	Mineral fuels, mineral oils and products of distillation; bituminous; mineral waxes	16
Iron and steel	613	Footwear, gaiters and the like; parts of such articles	13
Plastics and articles thereof	385	Man-made staple fibres	10
Fertilisers	307	Made up textile articles; worn clothing and worn textile	9
Organic chemicals	255	Optical, photographic, cinematographic, medical or surgical	7
Others items	3,151	Others items	51
Total Imports from India	**13,639**	**Bangladesh Exports**	**831**

Source: Bangladesh Bank (2020) and Export Promotion Bureau (2020)

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Investment Relations with the Two Giants

China has emerged as a global source of investments over the past few decades, thanks to its huge trade surplus and high national savings. China used to be an investment receiving country but has now emerged as a major provider of global investments. In 2019, Chinese global investments were about US$117 billion (S$160 billion) whereas Indian global investments amounted to only US$12 billion (S$16.37 billion) – mostly in its neighbouring countries (Figure 2).

Figure 2: Chinese and Indian Investment Inflow and Outflow
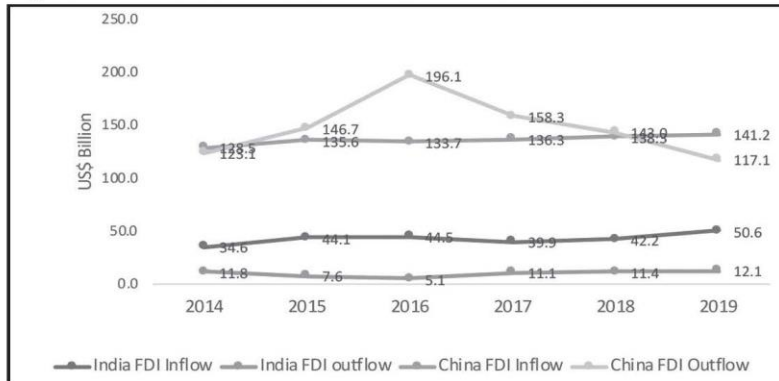
Source: UNCTAD World Investment Report (2020)

India is an investment receiving country – its national savings are much lower than its investments and it runs a high trade deficit. This explains the rise of Chinese investment in the region, especially after Xi visited Bangladesh in 2016 and Bangladesh officially joined the BRI. Figure 3 shows Chinese and Indian investment trends in Bangladesh. Investments from both countries were more or less similar until Chinese investments took off post-2016 after Bangladesh formally joined the Chinese BRI. China has now become the largest investor in Bangladesh.

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Figure 3: Chinese and Indian Net Investment in Bangladesh

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bangladesh Total FDI Inflow	756	609	648	896	1551	2235	2333	2152	3613	3880
Chinese FDI								89	506	1159
Indian FDI	39	29	28	30	47	80	52		125	114

Chinese FDI to Bangladesh   Indian FDI to Bangladesh
Bangladesh Total FDI Inflow (all countries)
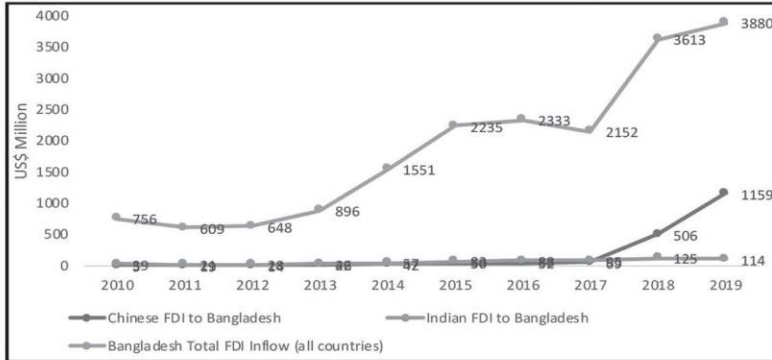
Source: Bangladesh Bank Survey (2020)

Bangladesh has developed 98 special economic zones (SEZs) for its rapid industrialisation. According to the Bangladesh Economic Zone Authority, China is one of the major investors in these zones. According to the Bangladesh Investment Development Authority (BIDA), China registered 78 new projects among 166 total projects in 2020,[21] which accounted for about US$2 billion (S$2.73 billion) — 60 per cent of total investments in Bangladesh (Table 4). Apart from China, Japan is another major investor in Bangladesh. Tokyo has implemented two major projects: an elevated express railway in Dhaka and the Matabari deep seaport.

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[21] Bangladesh Investment Development Authority (BIDA), 2020; http://bida.gov.bd/.

Table 4: Bangladesh Foreign Investment in FY2019-2020

Country	Number of Project	US$ Million	Sectors
China	78	1,934	Power sector, infrastructure, textiles and wearing, footwear
Malaysia	2	1,200	Chemicals, power sector, textiles and wearing
Singapore	7	168	Power sector, textiles and wearing
India	18	23	Power sector, textiles and wearing Pharmaceutical, and hospital and trading
United Arab Emirates	1	109	Gas and petroleum, banking
Korea	6	17	Textiles and wearing, footwear
Japan	17	18	Infrastructure and communication and fertiliser
Taiwan	3	78	Electronics, textiles and wearing, and trading
Mauritius	1	33	Power sector, infrastructure, textiles and wearing, footwear
Netherlands	4	41	Cement and leather products
Others country	29	63	
Total	**166**	**3,685**	

Source: BIDA and Bangladesh Bank

In addition to infrastructure and industrial sector investments, Chinese investments are prominent in Bangladesh's capital market. The Shenzhen Stock Exchange bourse acquired a 25 per cent stake in the Dhaka Stock Exchange in 2018. An Indian stock exchange consortium was a prominent opponent to the Chinese investor.[22] However, it failed in its bid to acquire a stake.

Besides, Bangladesh has been implementing some major projects, most of which are financed by China, Japan, India and Russia. This is aimed at balancing the relationship among these countries and diversifying its financing portfolio.[23]

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[22] Dhaka Stock Exchange, Annual Report 2018; https://dsebd.org.
[23] Bangladesh Investment Development Authority (BIDA), Annual Report, 2019-20.

Chinese and Indian Influence on Major Infrastructure Projects

Bangladesh requires significant investments to keep up with the pace of its ongoing growth and development. Foreign investments will not only bring the required capital to finance its growth but will also provide Dhaka with the technical and managerial know-how, which will have a ripple effect on the growth and development of the country.

Bangladesh has been implementing several mega projects with Chinese and Indian support. China primarily supports the construction of the country's road and transport infrastructure while India focuses on railway and power plant implementation.[24]

The following are several key projects that were recently developed or are in the process of being developed in Bangladesh.

Padma Multipurpose Bridge

This project is worth US$3.65 billion (S$4.98 billion). It is a 6.1-kilometre double-deck bridge funded by the Bangladesh government which will connect the southern part of Bangladesh with Dhaka. China's Major Bridge Engineering Company Ltd was selected to construct the project. On 25 June 2022, Bangladesh's Prime Minister Sheikh Hasina inaugurated the landmark Padma Bridge, the longest bridge in Bangladesh.

Matarbari Deep Sea Port

The Sonadia deep-sea port investment was called off due to geopolitical competition in the Bay of Bengal between India and China in 2016. Bangladesh then planned to develop its first deep-sea port in cooperation with Japan at the Matarbari area of Cox's Bazar district. The Matarbari deep seaport will have a 16-metre water draft and its strategic location would aid in reducing dependency on the Singapore and Colombo ports.

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[24] Bangladesh imports 1,160MW of power from India each year.

This mega project is a result of the Bay of Bengal Industrial Growth Belt declared by Hasina and Japan's late Prime Minister Shinzo Abe when the former visited Japan in 2014. The total cost of this project is US$2 billion (S$2.73 billion), and the Japan International Cooperation Agency (JICA) will provide loans for 80 per cent of the financing. The rest is to be contributed by the Bangladesh government. Japan's Nippon Koei JV, in collaboration with the Roads and Highways Department of Japan, will develop the project by 2025.

Dhaka Elevated Expressway

This is a 46-kilometre-long highway which will cost around US$1.4 billion (S$1.9 billion). China Exim Bank is investing US$461 million (S$628 million) while China ICBC will lend US$400 million (S$545 million) to Bangladesh for this project. The Italian-Thai Development Corporation has signed a US$1.062 billion (S$1.45 billion) contract with the China Railway Construction Corporation to build the Dhaka Elevated Expressway. This is the first big infrastructure project under the public-private partnership initiative based on the build, operate and transfer module in Bangladesh, which is supposed to be completed by December 2022.

Karnaphuli Underwater Tunnel

This project is worth US$2.49 billion (S$3.39 billion) and is mainly funded by the China Exim bank under the BRI. Hasina and Xi laid the foundation for this project in 2016 when Xi visited Dhaka. The China Communication Construction Company and China Road and Bridge Engineering Company are in charge of building the tunnel under a government-to-government agreement.

Dhaka Metro Rail

The Dhaka Metro Mass Rapid Transit (MRT) is the mega metro rail project implemented by Japanese finance and is set to be partially operable by the end of 2022. The estimated cost of this project is US$2.5 billion (S$3.41 billion), in which 75 per cent of the project cost is taken as a soft loan (0.1 per cent interest) from JICA. The Asian

Development Bank recently approved a loan amount of US$33.26 million (S$45.33 million) for the project, and the rest will be managed by the Bangladesh government.

Investment in the Special Economic Zone

The Bangladesh government has established 98 SEZs comprising 70 government and 28 private economic zones for long-term sustainable economic and industrial development. Many different types of incentives are offered to both domestic and foreign investors in the SEZs. Japanese, Korean, Indian and Chinese SEZs have been established to increase product diversification and cluster development for industrialisation. The implementation of these economic zones marks a breakthrough for Bangladesh's aspiration to industrialise. The Chinese Economic and Industrial Zone (CEIZ),[25] Indian Economic Zone (Mongla)[26] and Japanese Economic Zone (Araihazar)[27] are top investors in the SEZs.

This brief mega project analysis indicates that Bangladesh is set to move to a new phase of development. Most of the mega projects will be completed within a few years. When all these projects are in operation, the country will transform into a new regional hub in regional supply chains. Most of the infrastructure projects are being implemented with Chinese finance. However, Bangladesh has been trying to diversify its foreign investment sources to reduce its investment dependence on China and India.

Despite success stories in many development aspects, Bangladesh has not been successful in attracting enough foreign investments. From 2010 to 2019, FDI inflows (net) remained at about US$1 billion (S$1.36 billion) to US$2 billion (S$2.72 billion) annually. The share of FDI, as a percentage of the GDP, has not grown, which is, on average, 0.73 per cent of the GDP over the last 25 years.[28] However, Chinese

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[25] Chinese Economic and Industrial Zone (CEIZ), Bangladesh Economic Zones Authority, www.beza.gov.bd/chinese-economic-industrial-zone.

[26] Indian Economic Zone (Mongla), Bangladesh Economic Zones Authority, https://www.beza.gov.bd/indian-economic-zone-mongla.

[27] Japanese Economic Zone (Araihazar), Bangladesh Economic Zones Authority, https://www.beza.gov.bd/japanese-economic-zone-araihazar.

[28] World Development Indicator (WDI) 2021, World Bank, https://databank.worldbank.org/source/world-development-indicators.

and Indian investments began to gain momentum after 2016 when both countries' top leaders visited Dhaka and become strategic development partners. Bangladesh is trying to attract investments from its neighbouring countries for its economic development without jeopardising its geopolitical prey.

23

Export Intensity with China and India

The Export Intensity Index (EII) determines bilateral trade intensity.[29] It is used to determine whether the bilateral trade between two countries is greater or smaller than expected, compared to its global trade. It is described as the ratio of a country's export share going to a trading partner divided by the share of global trade going to that same partner.[30] If the EII is greater than one, the trade between the two entities is deemed intense, compared to the rest of the world.

Figure 4: Bangladesh Export Intensity Index with China and India
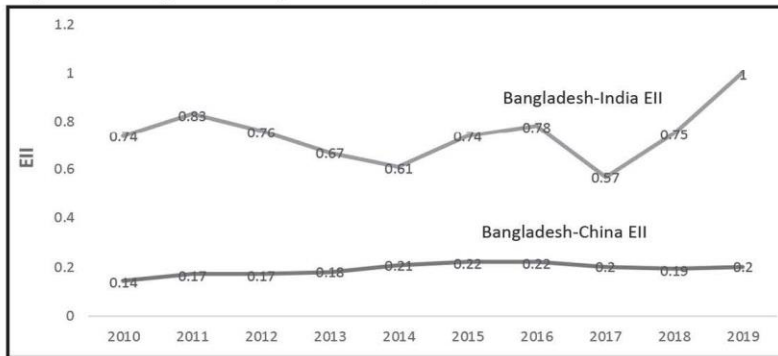
Source: Author's calculation

Bangladesh's exports to India stood at about US$1 billion (S$1.36 billion), which is less than one per cent of Indian total imports in 2019. The EII value for Bangladesh's exports to India has been consistently below the value of one. This value indicates that Bangladesh is trading less intensely with India than with the rest of the world. Further, Figure 4 indicates the inconsistencies surrounding trade relations between Bangladesh and India. It shows that New

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29 EII=(xij / Xiw) / (xwj / Xww), where xij is Bangladesh's exports to China/India, Xiw is Bangladesh total exports into the world, xwj is the world exports to China/India, and Xww is world total exports. An index of more than one indicates that trade flow between countries is larger than expected given their importance in world trade.

30 Technical Indicators, Asia Regional Integration Center, 2020, https://aric.adb.org/integrationindicators/technotes.

Delhi and Dhaka restored trade intensity in 2019. India offered duty free imports for all except 25 products from Bangladesh under the SAFTA.

The EII value for Bangladesh's exports to China has remained consistently low, indicating that Bangladesh is not an active export partner of China due to Dhaka's limited export baskets. However, Figure 4 displays a steady increase over the last decade, signalling the potential for improving Bangladesh's export share to China.

Export Potential to India and China

The Revealed Comparative Advantage (RCA) is widely used as a standard indicator of a country's competitive export strength.[31] A country is said to have a revealed comparative advantage in a given product when its ratio of exports to its total exports of all products exceeds the same ratio for the entire world. When the RCA value for a given product is greater than one for a country, that country is a competitive producer and exporter of that product relative to a nation exporting that good at or below the world average. Table 5 shows Bangladesh's bilateral RCA with China and India.

The export potential of Bangladesh to Indian and Chinese markets is mostly in apparel items, footwear, jute and jute products. Dhaka has a significantly higher RCA value in exporting jute products to both India and China. Although Bangladesh is an agriculture-based country, the RCA on food products against India is low. This could be due to India being a leading exporter of essential commodities to Bangladesh. However, amongst Bangladesh's top 30 exports, it has a much higher RCA with China than India. However, exports to the Chinese market are meagre.

Table 5: Bangladesh Top Export Products Level RCA with China and India

HS 4-digit level Commodities	Bangladesh Exports to China	China Total Imports	RCA China market	Bangladesh Exports to India	India Total Imports	RCA India market	Global Export
6109: T-Shirts, knitted or crocheted	120.4	955	1.01	30.3	87	0.26	46,800
6203: Men's or boys' suits, jackets, trousers	123.0	1,088	0.94	145.0	216	1.11	51,373
6110: Jerseys, pullovers, knitted or crocheted	60.5	1,192	0.45	24.8	75	0.17	57,192
6204: Women's or girls' suits, jackets, dresses	87.4	1,088	0.56	41.6	130	0.24	67,341
6205: Men's or boys' shirts	35.3	253	0.98	76.8	108	2.14	14,111
6104: Women's or girls' suits, knitted or crocheted	18.4	397	0.20	10.7	48	0.12	25,640

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[31] To calculate the bilateral RCA index, please see Balassa, (1965). If RCA > 1, in which Bangladesh has a comparative advantage in exporting that product to India/China; and B Balassa, "Trade liberalisation and revealed comparative advantage", The Manchester School, 33(2), 1965: pp. 99-123, https://doi.org/ https://doi.org/10.1111/j.1467-9957.1965.tb00050.x.

6201: Men's or boys' overcoats, & articles	35.3	609	0.84	4.2	30	0.10	16,505
6108: Women's panties, knitted or crocheted	3.0	79	0.09	6.3	22	0.19	12,911
6105: Men's or boys' shirts, knitted or crocheted	9.3	174	0.43	11.2	32	0.51	8,563
6202: Women's or girls' overcoats, and articles	10.9	594	0.21	2.0	14	0.04	19,342
5307: Yarn of jute or textile bast fibres of 53.0	84.0	85	61.96	51.3	54	37.48	540
6206: Women's or girls' blouses, shirts	7.3	142	0.23	5.9	33	0.19	12,517
6403: Footwear, with rubber, plastics, leather	33.3	2,254	0.24	1.0	72	0.01	54,151
6103: Men's suits, ensembles, knitted or crocheted	14.0	284	0.42	8.1	42	0.24	13,080
6107: Men's or boys' briefs, knitted or crocheted	9.0	63	0.48	2.5	9	0.13	7,318
6212: Brassieres, girdles, corsets, braces, garters	1.0	157	0.03	13.3	60	0.45	11,728
6302: Bed linen, table, toilet & kitchen linen	6.3	95	0.12	0.1	7	0.00	20,052
6210: Garments, made up of fabrics of 56.02, 56.03, 59.03, 59.06 or 59.07	5.9	102	0.23	0.2	16	0.01	10,316
6111: Babies' garments, cloths, knitted or crocheted	11.4	112	0.59	3.5	39	0.18	7,492
0306: Crustaceans, fresh, chilled or frozen	62.1	7,027	0.83	0.0	35	0.00	29,529
6211: Track suits, ski suits and swimwear;	10.4	434	0.29	0.8	10	0.02	14,222
6209: Babies' garments and clothing accessories	9.4	30	1.61	2.8	23	0.49	2,297
4202: Trunks, suit-cases; handbags, leather items	38.8	3,552	0.21	27.9	437	0.15	74,514
6505: Hats and other headgear, knitted or crocheted	2.1	68	0.15	2.3	16	0.16	5,684
6305: Sacks and bags, used for packing goods	0.7	28	0.05	17.9	50	1.29	5,446

6102: Women's or girls' overcoats articles, knitted	0.9	47	0.10	0.8	5	0.10	3,463
6404: Footwear with rubber, plastic, leather soles	2.3	2,099	0.02	10.2	322	0.10	42,473
5303: Jute, etc. (excl. flax.)	17.4	18	39.25	47.2	47	106.90	174

Source: Authors Calculation from UN COMTRADE data (2020)

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Why Non-Tariff Measures and Trade Facilitation Matter

Although China and India are vast markets and Dhaka has a huge comparative advantage in many products, Bangladesh's exports to these neighbours are relatively low. Having said that, there is significant and unrealised potential.

Against this backdrop, this Scan explores the NTM scenario in these markets. NTMs are policy measures other than customs tariffs that have the potential of affecting international trade. NTMs comprise all policy-related trade costs that arise from production to the final consumer, apart from tariffs.[32] Under the United Nations Conference on Trade and Development (UNCTAD) NTMs classification, 15 out of the 16 NTMs relate to imports. There are three technical measures: technical barriers to trade (TBT), sanitary and phytosanitary measures (SPS) and pre-shipment inspection. Twelve NTMs are non-technical measures under this classification while three measures are called antidumping contingency measures, countervailing duties and safeguards. However, 85 per cent of measures that have been reported to the World Trade Organization (WTO) are related to the SPS and the TBT.[33]

Both China and India offer generous tariff reductions on imports from Bangladesh under either the APTA or the SAFTA. Bangladesh has been exporting almost all products to India under zero duty tariffs. Recently, China offered tariff elimination on 97 per cent of Bangladesh's exports to the country. Although China and India's tariffs on Bangladesh's goods are low to zero, they have been increasing the rates through different forms of NTMs every year. The recent COVID-19 pandemic has accelerated the number of NTMs by both giants.

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[32] Deep Regional Integration and Non-Tariff Measures: A Methodology for Data Analysis Policy Issues in International Trade and Commodities Research Study, Series No 69, UNCTAD (2015), https://unctad.org/system/files/official-document/itcdtab71_en.pdf.

[33] TBT Information System, WTO, http://tbtims.wto.org/en.

Table 6: The Trend of Chinese and India NTM on Imports from Bangladesh

	Chinese NTM on Bangladesh			Indian NTM on Bangladesh		
Year	Harmful Interventions	Liberalising Interventions	Total	Harmful Interventions	Liberalising Interventions	Totalt
2009	18	12	30	9	5	14
2010	10	9	19	16	6	22
2011	13	8	21	13	25	38
2012	13	5	18	13	16	29
2013	10	7	17	20	3	23
2014	16	13	29	12	3	15
2015	33	16	49	20	5	25
2016	20	23	43	17	3	20
2017	19	24	43	10	2	12
2018	22	12	34	21	3	24
2019	1	2	3	8	1	9
2020	1	8	9	9	2	11
Total	176	139	315	168	74	242

Source: Global Trade Alert 2020

Table 6 shows that China has imposed about 315 different NTMs whereas India has imposed 242 NTMs on imports from Bangladesh – most of these are harmful to Bangladesh exports, according to the Global Trade Alert 2020. The COVID-19 pandemic has accelerated the rate of NTMs exponentially in 2020.

Table 7 shows a product-level NTM index of China and India on their imports. Three indices are commonly used to explain the extent and influence of NTMs. The Frequency Index (FI) is used primarily to show the percentage of products affected by one or more NTMs. On the other hand, the Coverage Ratio (CR) indicates the share of trade affected by NTMs, as one product could be affected by more than one NTM. The Prevalence Score (PS) identifies how many NTMs apply to a given number of products.

Both the FI and CR are almost one for Chinese imports, which indicates that China imposes NTMs on almost every one of its imported products – from agricultural to textiles. Compared to China, India places a lower number of NTMs on its imported products (Table 7).

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All three NTMs indices, including the FI, CR and PS for India, are much lower than China. Although India's weighted average applied tariffs are comparatively higher compared to Chinese import tariffs, Indian NTMs seem to be lower than Chinese NTMs.

Table 7: Chinese and Indian NTM Index (Imports)

Products	China			India		
	FI	CR	PS	FI	CR	PS
1. Animal	100	100	25	79	86	8
2. Vegetable	100	100	24	97	100	11
3. Food	100	100	24	100	100	11
4. Mineral & Fuels	90	98	5	27	71	1
5. Chemicals	69	76	8	23	24	1
6. Plastics & Rubbers	71	64	7	3	3	0
7. Hides & Leather	100	100	12	37	49	1
8. Wood	68	91	6	5	30	0
9. Textiles	99	100	3	100	100	3
10. Footwear	74	90	4	21	4	0
11. Stone & Glass	82	79	5	3	32	0
12. Metals	97	97	4	15	27	0
13. Electrical	100	100	6	16	13	0
14. Transportation	100	100	5	68	41	1
15. Miscellaneous	89	99	5	6	6	0

Source: UNCTAD (2021), https://trains.unctad.org/forms/Analysis.aspx,
Note: Frequency Index (FI), Coverage Ratio (CR), Prevalence Score (PS)

This analysis indicates that agricultural products are affected by more measures, compared to industrial products. Table 7 shows China imposes much higher NTMs on its imports, compared to India. China imposes more than one NTM on all its imported products. This indicates that although import tariffs have been reduced, NTMs are the main export barriers to China and India.

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Table 8: Product-wise Chinese and Indian NTM on Imports from Bangladesh

Indian NTMs Importing from Bangladesh			Chinese NTMs Importing from Bangladesh		
Product Code	Product Name	No. of Harmful Measures	Product Code	Product Name	No of Harmful Interventions
282	Apparel, except fur	53	461	Electric motors, generators, transformers	43
271	Made-up textile articles	51	282	Apparel, except fur apparel	31
019	Fibre crops, plants beet, forage plant, flower seeds, rubber, tobacco, vegetables	29	469	Other electrical equipment and parts thereof	27
263	Textile yarn and thread of natural fibres	24	354	Chemical products	11
292	Luggage, handbags; saddlery and harness; articles of leather	22	392	Non-metal wastes or scraps	11
265	Woven fabrics (except special fabrics) of natural fibres other than cotton	22	483	Optical instruments & photographic equipment	9
352	Pharmaceutical products	21	346	Fertilisers and pesticides	8
291	Tanned or dressed leather; composition	21	381	Furniture	8
392	Non-metal wastes or scraps	21	042	Fish live, fresh or chilled for human consumption	8
293	Footwear, leather or textile materials	21	393	Metal wastes or scraps	7
266	Woven fabrics (except special fabrics) of cotton	21	846	Broadcasting, programming, and distribution services	5
464	Accumulators, primary cells and batteries	19	352	Pharmaceutical products	5
296	Parts of footwear; removable insoles, heel cushions	17	482	Instruments and appliances for testing, navigating	5
272	Carpets & other textile floor coverings	17	043	Crustaceans, live, fresh or chilled	5
461	Electric motors, generators, transformers	16	161	Chemical & fertiliser minerals	5
273	Twine, cordage, ropes and cables, and articles	15	843	Online content	5
393	Metal wastes or scraps	15	844	News agency services	5
012	Vegetables	14	342	Basic inorganic chemicals	5
239	Food products n.e.c.	14	961	Audio-visual services	4
212	Prepared and preserved fish, crustaceans, molluscs, aquatic	14	962	Performing arts, live entertainment, presentation services	4
499	Other transport equipment and parts thereof	14	836	Advertising services and provision of advertising	4

384	Sports goods	13	963	Services of performing and other artists	4
389	Other manufactured articles	13	474	Goods of classes 4721 to 4733 and 4822	4
381	Furniture	12	838	Photography and photo processing services	4
216	Vegetable oils	12	964	Museum and preservation services	4
364	Packaging products of plastics	12	499	Other transport equipment and parts thereof	4
471	Electronic valves and tubes, electronic components, parts	11	415	Semi-finished products of copper, nickel, aluminum, lead, zinc, and tin, alloys	4
281	Knitted or crocheted fabrics	11	347	Plastics in primary forms	3
385	Games and toys	11	271	Made-up textile articles	3

Source: Author's calculation from Global Trade Alert (2021)

Table 8 shows the product-wise NTMs imposed by India and China on imports from Bangladesh. Most of the Indian NTMs are on the textiles and apparel sectors, which are the main export items for Bangladesh. Table 8 illustrates that 80 per cent of the NTMs are imposed on apparel sector imports from Bangladesh. India has also imposed many NTMs on pharmaceutical, footwear and agricultural products from Bangladesh. Historically, the Indian agricultural sector is highly protective, and the average applied MFN tariff was about 61 per cent in 2020, while Bangladesh's average applied tariff rate was about 12.5 per cent in the same year.[34]

On the other hand, Chinese NTMs are mostly placed on the import of electronics machinery and chemical items, which are not the main export items of Bangladesh. Although China has imposed some NTMs on apparel items, these are much less than those by India, which indicates that Bangladesh has a vast advantage in exporting apparel products to the Chinese market, compared to the Indian market.

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[34] Tariff Profiles, WTO, https://www.wto.org/.

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Bangladesh is one of the top jute producers and exporters globally, as the country has substantial comparative advantages in jute production and exports. Its main jute export market is India. However, India imposed an anti-dumping duty, ranging from US$19 to US$351 per tonne (S$26 to S$478 per tonne), on Bangladesh's jute yarn/twine, hessian and sacking bags in January 2017.[35] Bangladesh exported about US$816 million (S$1.1 billion) worth of jute and jute products to India in 2018, which dropped to US$650 million (S$885 million) in 2019 due to the anti-dumping duties. Dhaka has been unable to convince New Delhi to eliminate the anti-dumping duties on jute good imports from Bangladesh and has since lodged an appeal with the WTO.

Trade Facilitation Matters

The Trade Facilitation Agreement (TFA) is one of the key WTO agreements to simplify and harmonise the export and import processes to reduce trade costs. Bureaucratic delays, customs inefficiency and red tape pose a huge burden for the trading of goods across borders. The WTO has reckoned that the full realisation of the TFA could slash trade costs by an average of 14.3 per cent and improve global trade by up to US$1 trillion (S$1.36 trillion) per year, with the biggest gains taking place in the poorest countries.[36]

A detailed trade facilitation update is presented in Appendix I. Bangladesh has only implemented five TFA measures while 22 are partially implemented. There are another 17 trade facilitation measures in the planning stage while nine measures are not implemented at all. On the other hand, the Chinese have already implemented most of the trade facilitation measures as described by the WTO. China has already implemented 26 measures and 24 are partially implemented. Only three measures are not implemented, as shown in Appendix I. India has also improved its performance in implementing the TFAs significantly over the years.

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[35] Corrigendum notification on "Anti-Dumping investigation concerning imports of 'Jute Product' viz- Jute Yarn/Twine (multiple folded/cabled and single), Hessian fabric and jute sacking bags from Bangladesh and Nepal reg", 9 February 2017, Directorate General of Anti-Dumping & Allied Duties, Department of Commerce, Ministry of Commerce & Industry, Government of India, https://www.dgtr.gov.in/sites/default/files/Jute%20-%20English%20Corrigendum.pdf.

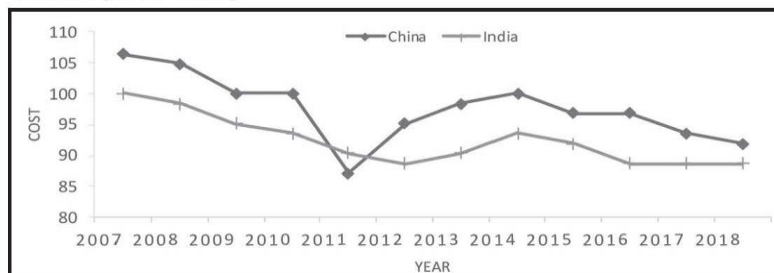[36] WTO | Trade facilitation.

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Box 1: Bangladesh's Bilateral Trade Costs with China and India[37]

Rahman & Strutt (2021) investigate the bilateral trade costs of Bangladesh and its major trading partners using the inverse gravity model. Figure 5 reflects that the bilateral trade costs of Bangladesh with China and India have been gradually reduced over the last decade. Bangladesh's trade costs reduced by about 12 per cent in 2018, compared to 2007, with China and India.

The authors find that trading with India and China poses the lowest cost for Bangladesh. Bangladesh has a long traditional trading relationship with China as an APTA partner and with India under the SAFTA and the APTA. The bilateral trade costs analysis signals that Bangladesh's trade costs have decreased moderately over the decade, which might be due to reduced tariffs but this requires further investigation to understand the determinants of the trade costs.

Figure 5: Bangladesh's Trade Costs with China and India over the Decade (2007-2018)

Source: Rahman & Strutt (2021)

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[37] Rahman, M M and Strutt, A, "Trade Restricting Impact of Non-Tariff Measures in Bangladesh", Journal of the Asia Pacific Economy, 2021, https://www.tandfonline.com/doi/abs/10.1080/13547860.2021.1963043.

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The implementation status of the trade facilitation measures indicates that Bangladesh's domestic trade facilitation measures are critical barriers to export. Improved trade facilitation and seamless connectivity have created a huge supply chain in East Asia. Bangladesh is significantly behind in implementing trade facilitation measures, compared to its East Asian competitors. Malaysia, Vietnam and Thailand have been implementing most of the trade facilitation measures[38] and are the top-most FDI recipient countries in the Asia Pacific region.

Additionally, Bangladesh ranked 168th out of 190 countries in the Ease of Doing Business index in 2019.[39] Customs clearance at Chittagong port takes about five days, whereas in Vietnam, it clears within two days.[40] Compared to competitors like Vietnam, Malaysia and Thailand, there is a huge gap in many areas – from basic infrastructure to trade facilitation.

Bangladesh needs to deal with its trade facilitation measures and be proactive in the regional integration process, which may boost investors' confidence and enable capitalisation on the benefit of regional integration.

Bangladesh's Market Access to India and China: Issues of Rules of Origin

Bangladesh, China and India are members of the APTA, while Bangladesh and India are members of the SAFTA, BIMSTEC[41] and BBIN sub-regional trade agreement. The tariff concessions are varied in terms of product coverage as well as the margin of preferences under the various agreements. The rules of origin criteria that must be met to be eligible for tariff concessions are slightly different for all these agreements. The margin of preference is higher in the case of the APTA.

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[38] Trade Intelligence and Negotiation Adviser (TINA), 2021; https://tina.trade.
[39] World Development Report 2020: Trading for Development in the Age of Global Value Chains, Washington, DC: World Bank, 2020, https://doi.org/10.1596/978-1-4648-1457-0.
[40] Mohammad Masudur Rahman, "Resilient Supply Chain Initiative: Attracting Japanese Investment to Bangladesh," ISAS Brief No. 813, 12 October 2020, https://www.isas.nus.edu.sg/papers/resilient-supply-chain-initiative-attracting-japanese-investment-to-bangladesh/.
[41] The SAFTA is fully functional while BIMSTEC is yet to be functional.

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The rules of origin criteria followed in the APTA are given below:

i. In the case of single country content, the value addition requirement is 35 per cent for the least developed countries (LDCs) and 45 per cent for the non-LDCs; and

ii. In the case of regional cumulation, the local content requirement is 50 per cent for the LDCs and 60 per cent for the non-LDCs.

Tariff Concessions and Sensitive Lists under the SAFTA

The Tariff Liberalisation Program (TLP) under the SAFTA commenced on 1 July 2006. Under the first phase of the TLP, all the non-LDCs lowered their tariffs to 20 per cent while the LDCs brought the tariffs down to 30 per cent by 2007. In the second phase of the TLP, the non-LDCs brought the tariffs down from 20 per cent to 0-5 per cent in 2012 (Sri Lanka by 2013) while the LDCs did so by 1 January 2016. This TLP would cover all tariff lines except those reserved in the sensitive or negative lists of the member states. The third phase of the TLP is under negotiation. The sensitive lists comprise products on which the member states do not provide any tariff concession. Recently, the sensitive lists have been revised and 20 per cent of the items from the total number have been withdrawn from the sensitive lists. India has offered duty-free for all except 25 products for the LDCs but there are 614 products under the negative lists for the non-LDCs which would be a major concern for Bangladesh after its LDC graduation.

Rules of Origin under the SAFTA

The rules of origin criteria followed in the SAFTA are given below:

i. In the case of single country content, value addition requirement is 30 per cent plus change of tariff heading (CTH) for the LDCs and 40 per cent plus CTH for the non-LDCs; and

ii. In the case of the South Asian Association for Regional Cooperation cumulation, along with CTH regional content requirement in 40 per cent for the LDCs and 50 per cent for the non-LDCs, with the requirement of 20 per cent value addition in the exporting country.

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Impact of the Non-Tariff Measures and Trade Facilitation on Exports

Methodology

In this section, we investigate the impact of Bangladesh's export potential to China and India if the two giants reduce their NTMs and increase trade facilitation. We use the Global Trade Policy Analysis Project (GTAP) framework and model for this analysis. The GTAP is well known for international trade policy analysis. The computable general equilibrium (CGE) model and the GTAP structure are presented in Hertel (1997).[42]

The basic structure of the GTAP database includes industrial sectors, households, governments and global sectors across countries. Countries and regions in the world economy are linked together through trade. Prices and quantities are simultaneously determined in both factor markets and commodity markets. The main factors of production are skilled and unskilled labour, capital, natural resources and land.

We have used the statistic GTAP model and database for the NTM impact and trade facilitation analysis.[43] The approach we use is a well-known "iceberg trade cost" that increases the technical coefficient "import augmenting technical change". Here, the iceberg trade costs "ams" import-augmenting "technical change" variable has been used to represent trade facilitation. The parameter "ams (i,r,s)" has been introduced to handle bilateral services liberalisation as well as other efficiency-enhancing measures that serve to reduce the effective price of goods and services imports.[44] The introduction of this variable facilitates simulation of efficiency improvements such as customs automation or e-commerce. An increase in "import augmenting technical change" confirms a fall in the effective domestic price of goods exported from Bangladesh to partner countries like China and India. We use GTAP version 10, which has the base year of 2014. A detailed sectoral and regional aggregation are presented in Appendix II.

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[42] See Hertel Refer (1997) for a full introduction to the database. T W Hertel, "Global Trade Analysis Project: Modelling and applications", Cambridge University Press, 1997.

[43] Ibid.

[44] Rahman, M M, C Kim and P De, "Indo-Pacific cooperation: what do trade simulations indicate?", Economic Structures 9:45, 2020, https://doi.org/10.1186/s40008-020-00222-4.

Simulation Results

The economic effects of the trade facilitation simulations are presented in Figure 6. The results show that if India and China reduce their NTMs, Bangladesh is expected to experience a considerable gain in real GDP, exports and imports. The real GDP could be increased by 0.34 per cent and exports may increase by 3.14 per cent. Bangladesh imports will also increase.

Figure 6: Impact on Chinese and Indian NTM Reduction and Trade Facilitation on Bangladesh
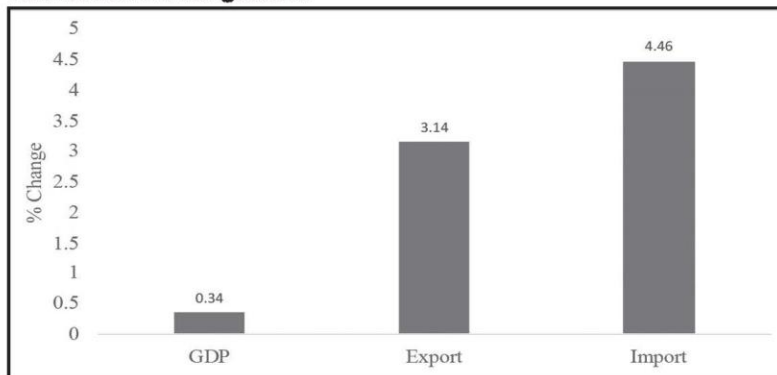
Source: Author's calculation

Table 9 shows Bangladesh's sectoral export potential to China and India. If trade facilitation increases by 50 per cent, Bangladesh's export to China and India will increase significantly. The simulations show that the impact of textiles and apparel exports to the two markets will not increase significantly, compared to the other sectors. As the textiles and apparel sector is one of the biggest sectors for China and India, Bangladesh has a lower comparative advantage than these two giants exporting readymade garments products.[45] Light manufacturing and agricultural sectors are the main competitive sectors of Bangladesh's exports to its neighbours. Therefore, the elimination of NTMs will increase the exports of light manufacturing and the agricultural sector from Bangladesh.

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[45] China's textile and clothing industry is the largest manufacturer and exporter in the world, while India is the third-largest exporter globally.

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Table 9: Bangladesh's Potential Exports to Chinese and Indian Market (% Change)

Sectors	China	India
Grains & crops	2.78	2.94
Meat & livestock	5.34	5.56
Processed food sector	3.56	3.68
Textiles & apparel	0.02	0.32
Light manufacturing sector	5.72	5.84
Heavy manufacturing sector	3.9	4.08

Source: Author's calculation

Concluding Thoughts

Conventionally, when two elephants fight, the grass suffers. However, the China-India rivalry has created enormous opportunities for the smaller South Asian countries. Bangladesh has been quite successful in balancing ties with these titans. Dhaka's current strategy is to get political support from India and financial support from China. However, this may not be sustainable in the future. China has become Bangladesh's top trading partner, especially being the main importing country — Beijing accounts for about 30 per cent of Bangladesh's total imports. India is the second-biggest trading partner of Bangladesh and its second largest import partner.

Bangladesh imports almost similar products from India and China which are mostly cotton, vehicles and trains, nuclear reactors and heavy machinery. Bangladesh's main exports to India and China are garments, textiles products and several agricultural products, including jute and leather.

Bangladesh has a huge a comparative advantage in the apparel, jute and leather sectors, and, at the same time, both countries offer generous tariffs elimination to imports from Bangladesh. However, various NTMs and a lack of trade facilitation are mounting barriers in exporting to the giants' markets. Indian anti-dumping duty on jute and jute products from Bangladesh is an example of recent NTMs. Although Bangladesh has enormous potential for exports to these markets, it remains largely unrealised due to NTMs and trade facilitation. The computable general equilibrium modelling simulations indicate that if India and China reduce their NTMs through the harmonisation of rules and increased trade facilitation by 50 per cent, Bangladesh's exports may increase by 3.14 per cent to these two markets.

Both countries are the main sources of investments in mega projects in Bangladesh, ranging from power plants to tunnels under rivers. Chinese investments accounted for about US$40 billion (S$54.48 billion) under different projects when Xi visited Dhaka in 2016 as Bangladesh joined the BRI. In contrast, Indian project loans and project investments are much lower. According to the UNCTAD World Investment Report released in 2020, Chinese global FDI outflow was

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US$117 billion (S$159.34 billion), whereas Indian FDI outflow was only US$12 billion (S$16.34 billion) in 2019. Bangladesh is striving to attract FDI while both China and India want to extend their influence through investments and connectivity. While Bangladesh is actively trying to capitalise on the opportunity by attracting their investments, it may become a passive victim of the India-China rivalry. To curb dependency on Indian and Chinese investments, Bangladesh is seeking alternative sources, especially through attracting Japanese investments.

Modi visited Dhaka in 2021 to commemorate the 50th year of the independence of Bangladesh and signed more than 50 agreements, ranging from trade and commerce to security. However, the sharing of the Teesta River water has consistently been a point of contention between Dhaka and New Delhi. Concurrently, the Chinese government has proposed a massive Teesta River development project which is another concern for India.

Recently, the China-India strategic rivalry has been intensified due to their border conflict. Australia, India, Japan and the US have developed the Quad to tackle Chinese influence in the region. Moreover, most of the Asian countries, including Japan, South Korea, Singapore and Taiwan, are looking for alternative investment opportunities, either in a 'China exit' or a 'China plus' strategy. Both China and India have their own interests in the region.

In an effort to avoid any conflict or becoming a passive victim of this geopolitical competition, Dhaka should stress on its foreign policy principle of 'Friendship towards all, malice towards none' and use its strategic position tactfully without swaying one way or the other. Maintaining good working relations with both India and China is vital for Bangladesh's sustainable economic growth. At the same time, Bangladesh should attract FDI from other markets and attempt at regional integration with the Asian countries as Dhaka has both geopolitical and economic advantages in the Asia Pacific region.

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Appendices

Appendix I: WTO's Trade Facilitation Measures Implementation Status

Trade Facilitation Measures	Bangladesh	China	India
1. Formulation of National Trade Facilitation Committee	Fully Implemented	Partially Implemented	Fully Implemented
2. Online publication of import-export rules and regulations	Partially	Fully	Partially
3. Stakeholders' consultation on new draft regulations	Partially	Partially	Fully
4. Proper notification of new regulations before implementation	Partially	Fully	Fully
5. Advance ruling on tariff & rules of origin	Fully	Fully	Fully
6. Risk management analysis	Planning stage	Fully	Fully
7. Pre-arrival processing of the shipment	Partially	Fully	Fully
8. Post-clearance audits service	Partially	Fully	Fully
9. Independent appeal mechanism	Partially	Fully	Fully
10. Separation of release from final customs duties	Fully	Fully	Fully
11. Publication of average release times	Fully	Partially	Fully
12. Trade facilitation measures for authorised operators	Planning Stage	Fully	Fully
13. Expedited shipments	Planning Stage	Fully	Partially
14. Acceptance of copies of original supporting documents required for trade	Fully	Partially	Partially
15. Automated customs system	Partially	Fully	Fully
16. Internet available to customs	Partially	Fully	Fully
17. Electronic single window system	Planning Stage	Partially	Partially
18. Online submission of customs declaration	Partially	Fully	Partially
19. Online application & issuance of both import & export permits	Planning Stage	Partially	Partially
20. Online submission of ocean cargo manifests	Partially	Fully	Fully
21. Electronic submission of air cargo manifests	Partially	Fully	Fully
22. Online application & issuance of Certificate of Origin	Partially	Partially	Planning Stage
23. E-Payment of customs duties, tax and other fees	Planning Stage	Fully	Fully
24. Online application for customs refunds	Not Implemented	Partially	Fully
25. Laws & regulations for electronic transactions	Partially	Partially	Fully
26. Recognised certification authority	Planning Stage	Fully	Fully
27. Electronic exchange of customs declaration	Planning Stage	Partially	Planning Stage

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28. Electronic exchange of certificate of origin	Not Implemented	Partially	Planning Stage
29. Electronic exchange of sanitary & phyto-Sanitary certificate	Not Implemented	Partially	Partially
30. Paperless payment from a documentary letter of credit	Planning Stage	Partially	Not Implemented
31. National legislative framework for border agencies cooperation	Partially	Fully	Fully
32. Government agencies delegating controls to Customs authorities	Planning Stage	Not Implemented	Not Implemented
33. Alignment of working days & hours with neighbouring countries	Planning stage	Partially	Partially
34. Alignment of formalities & procedures with neighbouring countries at border crossings	Planning Stage	Partially	Partially
35. Transit facilitation agreements	Partially	Partially	Partially
36. Limiting physical inspections of transit goods	Partially	Partially	Partially
37. Supporting pre-arrival for transit facilitation	Planning Stage	Partially	Partially
38. Cooperation between agencies of countries involved in transit	Not Implemented	Partially	Partially
39. Trade-related information measures for SMEs	Partially Implemented	Fully	Partially
40. SMEs in the Automatic Economic Operators (AEO) program	Not Implemented	Fully	Fully
41. SMEs access in the National Single Window	Not Implemented	Fully	Partially
42. SMEs participation in National Trade Facilitation Committee	Not Implemented	Fully	Fully
43. Special measures for SMEs	Planning Stage	Partially	Fully
44. Testing laboratory facilities to meet SPS	Planning Stage	Fully	Fully
45. National standards & accreditation bodies to compliance with SPS	Partially	Fully	Fully
46. Electronic application and issuance of SPS certificates	Partially	Fully	Partially Implemented
47. Special treatment for perishable goods	Partially	Fully	Partially Implemented
48. Female traders in the trade facilitation strategy	Planning Stage	Not Implemented	(Data not available)
49. Female membership in the National Trade Facilitation Committee	Partially	Partially	(Data not available)
50. Single window facilitates traders to access finance	Not Implemented	Partially	(Data not available)
51. Electronic exchange of data between trading partners allow by bank	Not Implemented	Partially	(Data not available)
52. Variety of trade finance services	Planning Stage	Partially	(Data not available)

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	Bangladesh	China	India
Fully Implemented	5	26	26
Partially Implemented	22	24	16
Planning Stage	17	0	3
Not Implemented	9	3	2
(Data not Available)	0	0	5

Source: Trade Intelligence and Negotiation Advisor (TINA) 2021

Appendix II: Product and Regional Aggregation of GTAP Dataset

SL	Region Aggregated	GTAP Region	SL	Aggregated Products	GTAP Products
1	China	China	1	Grains Crops (10 products)	Paddy rice, wheat, cereal grains, vegetables, fruit, nuts oil seeds, sugar cane, sugar beet, plant- fibres
2	United States	United States	2	Meat Lstk (8 products)	Cattle, sheep, goats, horses, animal products, meat, raw milk wool, silk-worm cocoons
3	EU25	EU25 Cuntries	3	Extraction (6 products)	Forestry, fishing, coal, oil, gas, minerals
4	Canada	Canada	4	ProcFood (7 products)	Vegetable oils & fats, dairy products, processed rice, sugar, food, beverages & tobacco
5	Australia & New Zealand	Australia & New Zealand	5	Text Wapp (2)	Textiles & clothing
6	India	India	6	LightMnfc (7)	Leather products, wood products, paper products, publishing, motor vehicles, transport equipment, manufacturers NEC, metal products
7	Japan	Japan	7	HeavyMnfc (11)	Electronic items, machinery and equipment, petroleum, coal, rubber, plastic products, mineral products, ferrous metals, chemical products
8	ASEAN	ASEAN	8	Util & Cons (4)	Electricity, gas manufacture and distribution, water and construction service
9	Korea	Korea	9	Trans Comm (6)	Trade, transport, land, sea & air transport communication, accommodation and food service, warehousing and support activities
10	Latin America	All Latin America	10	Other Services (6)	Financial services, business services, recreation, pub admin, defence, health, education, dwellings, real estate activities
11	Bangladesh	Bangladesh			
12	Rest of the world	Rest of countries In the GTAP Database			

Source: GTAP version 10

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About the Author

Dr Mohammad Masudur Rahman is a Visiting Research Fellow at the Institute of South Asian Studies in the National University of Singapore. He is an international trade economist by training, with over 17 years of work experience in New Zealand, China, Japan, Vietnam, Korea, Switzerland and Bangladesh. His primary research focuses on international trade policy analysis using the Computable General Equilibrium and gravity modelling.

Dr Rahman has held research and faculty positions at several leading institutions, including the United Nations University, Japan; The University of Waikato, New Zealand; Zhejiang Agricultural and Forestry University, China; Microcredit Regulatory Authority, Bangladesh; and the World Trade Organization, Switzerland. He was a Visiting Fellow at the Asia Growth Research Institute and Aoyama Gakuin University, Japan; and Korea Institute for International Economic Policy, Korea.

He has been a consultant for several projects for the International Finance Corporation, United Nations, Asian Development Bank and Korea University of Foreign Studies. Recently, he developed two trade portals – Vietnam Trade and Information Portal and Bangladesh Trade Portal, with support from the World Bank.

Dr Rahman has also published extensively in several academic journals, including *the Journal of Asia Pacific Economy, Singapore Economic Review, South Asia Economic Journal* and *Sustainability.*

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CHAPTER VI: CONCLUSION AND SYNTHESIS

The research presented in this thesis makes several significant contributions to quantifying emerging trade issues, including NTMs in Bangladesh. This thesis consists of four main chapters, along with the contribution of Bangladesh's product level NTM dataset and a contribution to developing a dataset for the UN Secretariat to monitor LDCs graduation progress. I use both econometric and CGE modelling to analyse the economic implications of these emerging trade policies.

I examine the impact of NTMs on Bangladesh's imports in chapter two. I first deploy Novy's (2013) inverse gravity to determine bilateral trade costs and then use augmented gravity, applying the PPML estimation method, to investigate the impact of tariffs and NTMs on Bangladesh imports. I developed an HS 6-digit product level new NTM database designed for this thesis. The results show that imports to Bangladesh are related in an expected way to common trade cost proxies and that NTMs negatively impact imports.

Chapter three analyses the impact of eliminating export subsidies for Bangladesh. This chapter analyses the impact of eliminating export subsidies using the MyGTAP framework. The simulations indicate that the elimination of export subsidies positively affects GDP. If we reduce the export subsidy by 50 percent and transfer this amount of money from the government to targeted seven low-income household groups, real GDP may increase by about 0.81 percent. Government transfers to households lead to an increase in real income for all different households, especially on average, rising by 2.5 percent for rural households. This study indicates there is a substantial opportunity cost

of export subsidies, and household income could be enhanced by redirecting the spending to more productive channels.

The fourth chapter estimates the costs of LDC graduation in Bangladesh using a computable general equilibrium modeling framework. The graduation of a LDC status to a developing country is a critical policy choice for many emerging economies as they will lose preferential market access in the most advanced markets. The macroeconomic analysis indicates that Bangladesh's economy will face substantial adverse situations after graduation. The findings show that if developed countries impose standard GSP tariffs when importing from Bangladesh, Bangladesh's GDP may drop by about 0.38 percent, and exports could fall by about six percent. The ready-made garment sector could be affected severely, and exports may decline by about 16.9 percent.

The fifth chapter explores how Bangladesh is dealing with balancing its relationship with its two important neighbours, India and China. China now holds the position of Bangladesh's top trading and investment partner, while India is its second-biggest trading partner. Bangladesh imports similar products from India and China, mostly cotton, vehicles and train, nuclear reactor, and heavy machinery. Bangladesh's main exports to India and China are readymade garments and agricultural products. Bangladesh has significant comparative advantages in the apparel, jute, and leather sector, and at the same time, both countries offer generous tariffs elimination importing from Bangladesh, but various NTMs and lack of trade facilitation are mounting barriers to exporting to the giants' markets. The computable general equilibrium modelling

simulations indicate that if India and China reduce non-tariff-related barriers through increased trade facilitation by 50 percent, Bangladesh's exports may increase by 3.14 percent to these two markets. Bangladesh should cultivate and use this unique position to its advantage through tactful involvement in trade and investment with the two countries.

This thesis presents several important trade policy insights, which could be valuable for policymakers to make evidence-based decisions on emerging trade policies. This thesis may also provide valuable insights for other graduating LDCs, the UN, the WTO, the World Bank, and other international organizations dealing with the LDC graduation process. Moreover, similar research can be carried out for other graduating LDCs. Future work could also focus more explicitly on global supply chains, including how they affect the industrial composition of output, the occupational composition of employment, and the regional distribution of incomes in Bangladesh or other graduating LDCs.

APPENDIX I: STRUCTURE OF THE MYGTAP MODEL

CGE modelling in the MyGTAP framework requires accounting relationships and behavioral equations between different economic variables on one side. On the other hand, it requires the response of various economic indicators to the policy shock for example eliminating tariffs, non-tariff measures, subsidies, etc. In contrast to a regional single household of the GTAP model, the MyGTAP model allows incorporating remittance flow, capital income transfer between government and households of a country.

Government Income and Expenditure Accounts

Walmsley & Minor (2013) show how the government receive income from different sources like taxes, foreign aid and then uses this income for its expenditure.

$$govinc(r) = aidi(r) - aido(r) + ttax (r) - sum (h, hhld, trng(h,r)) \qquad (1)$$

Households' Income and Expenditure Accounts

Similarly, different private households accumulate income from various sources that is factors income, remittances inflow, and foreign capital income transfers income as shown in the following equation.

$$hhldinc(h,r) = [sum(i,endw\_comm, evoah(i,h,r)]) - vdeph(h,r)] + [remih(h,r)- remoh(h,r)] +$$

$$[fyih(h,r) - fyoh(h,r)] + [sum(k, hhld, trnh(k,h,r) - trnh(h,k,r)) +trng(h,r)] (2)$$

Then this household's income is used for consumption and some savings that nested using Cobb Douglas utility function where private consumptions and savings nested

as constant shares. The following equation explains this relationship.

$$income(r)*u(r)=privexp(r)*up(r)+save(r)*[qsave(r)-pop(r)] \qquad (3)$$

where *[income(r)*u(r)]* implies a total change in income, which is the sum of the total change in private consumption and savings. Term 'income [r)] indicates households' income and *[u(r)]* and *[up(r)]* demonstrate percentage changes of income and expenditure.

Remittances Inflows and Outflows

The MyGTAP model allows incorporating the remittance inflows as a source of domestic households' income. This introduces an additional model closure, i.e. equality between remittances inflows and outflows. The following equation shows how remittances are determined in the MyGTAP model (Walmsley & Minor, 2013).

$$remoh(h, r) = sum(i, endw - comm, shrlab(i, h, r) * psh(i, h, r) +$$
$$qoh(i, h, r) + sremoh(h, r) + remavo \qquad (4)$$

Where the term *[remoh(h, r)]* indicates remittances outflow by household *[h]* in the region *[r]* and is assumed to change due to changes in the average labour wage and change in the labour endowments. The term *[psh(i, h, r)]* denotes a change in average labour wage. Where *[qoh(i, h, r)]* expresses percentage change in the labour endowments of factor *[i]* owned by household *[h]* in the region *[r]*. The term *[sremoh(h,r)]* is the shifting factor of the changes in the rate of remittances outflows while *[remavo]* depicts the average rate of remittances outflow.

In the following equation, how changes in the remittances' inflow occur in the framework of the MyGTAP model due to policy shock are shown. Left-hand side terms in the above equation show 'remittances inflow' by household *[h]* in the region *[r]*. While *[remavi]* stands for the change in the average rate of remittances' inflow, and *[sremih(h, r)]* is the shifting factor that captures the change in the rate of remittances' inflow.

$$remih(h, r) = remavi + (sremih(h, r)) \qquad (5)$$

Introducing remittances' flows facilitates the setting of an additional model closure for the solution of the model. In the following equation, the remittances change in 'inflow' on the left-hand side is allowed to adjust to the remittance's 'outflow' that in the right-hand side is used to satisfy the model closure.

$$sum(h, hhld, sum(r, reg, regi(h, r) * remih(h, r)) = sum(h, hhld, sum(r,$$
$$reg, remo(h, r) * remoh(h, r)). \qquad (6)$$

Income Outflows and Income Inflows

The MyGTAP model permits the transfer of factors' income across the regions as an additional source of households' income. The following equation shows how the income outflow is determined in the MyGTAP model framework.

$$fyoh(h, r) = [sum(i. endwcomm, sh(i, h, r) * (psh(i, h, r))] + qoh(i, h, r)) +$$
$$sfyoh(h, r) + fyavo \qquad (7)$$

Where, *[fyoh(h, r)]* implies the percentage change in the income outflow by households from the region *[r]*. While *[psh(i, h, r)]* indicates is the percentage

change in the supply price of endowment, and $[qoh(i, h, r)]$ represents the percentage change in the supply of endowment, $[sfyoh(h,r)]$ is the shifting factor of change in the income outflow from the region [r]. The term $[fyavo]$ illustrates the percentage change in the average income outflows.

$$fyih(h,r) = fyavi + sfyih(h,r) \qquad (8)$$

The term $[fyih\ (h,r)]$ indicates the inflow in income, and $[favi]$ represents the percentage change in the average inflow of income to region 'r' by household 'h'. while $[sfyih(h,\ r)]$ is the shifting factor of the change in the income outflow. Equations (7) and (8) allows an additional model closure, which is indicated by the following equation.

$$(h, hhld, sum(r, reg, fyi(h, r) * fyih(h, r)) = (hhld(r, reg(h, r) * fyoh(h, r)) \qquad (9)$$

Foreign Aid Inflow and Outflow

In addition to the above discussed various sources of households' income, the MyGTAP model identifies two sources of government income: taxes, which it collects from households, and foreign aids. The following equation shows how changes in the foreign aid outflow occur due to an exogenous shock.

$$aidout(r) = gincome(r) + saidout(r) + aidavo \qquad (10)$$

Likewise, aid inflow to the region [r] is determined by the percentage change in the shifting factors of the aid inflow and percentage change in average aid inflow. This relationship is revealed by the following equation.

$$aidin(r) = saidin(r) + aidavi \qquad (11)$$

Introducing the foreign aid in the MyGTAP model allows an additional model closure., which is given by the following equation.

$$sum(r,reg.aidi(r)*aidin(r)) = sum(r,reg,aido(r)*aidouy(r)) \quad (12)$$

Income Transfers

MyGTAP introduces the income transfer in the regions. They are of two types. First is 'the transfers to intra-household that is transferred from households [k] to the household [h] in the region, i.e. [trnh (k, h, r)]. The second is the transfers from the household to the government [trng (h, r)]. These transfers are treated as fixed in the model. The users of the model need to specify these transfers in the model, however, if they are not specified, then they are treated as zero.

Multiple households

MyGTAP model incorporates multiple private households and a separate government household. The following equation explains this relationship.

$$qo(i,r) = sum(h,hhld,shrevomh(i,h,r)*qoh(i,h,r)) \quad (13)$$

Where [$qo(i, r)$] indicates the total supply of endowment [i] in the region [r], while, [$qoh(i, h, r)$] stands for the supply of endowment, and [$shrev(i, h, r)$] is the share of a single household in the total value of the endowment. Introducing multiple households also requires introducing the households' labor supply in the model. This allows the model users to set the unemployment closure. It is reflected in the following equation.

$$qoh(i,h,r) = qoh\_s(i,h,r) + semlh(i,h,r) \quad (14)$$

Here $[qoh(i, h, r)]$ indicates the supply of the unemployed endowment $[i]$ by household $[h]$. Whereas $[qoh(i, h, r)]$ is the total supply of the household's endowment and $[semplh(i, h, r)]$ expresses the employment of that endowment in the concerned region. The exogenous shock alters the employment of households' endowments, by altering the two factors, i.e. shift factor of households' endowment and the common shift factor of all households' endowments in the region. This relationship is also revealed in the following equation.

semplh(i,h,r) = emplh(i,h,r) + empl(i,r)   *(15)*

Where $[emplh(i, h, r)]$ is the shift factor of endowments' employment of household whereas, $[empl(i, r)]$ is the common shift factor of all endowments' employment in the region.

APPENDIX II: MYGTAP PROGRAM: UPDATING DATASET

The following summarises the steps followed to implement MyGTAP in this application for Bangladesh:

1. GTAP aggregation prepared

2. Download MyGTAP Multi-household model from MyGTAP.com

3. Then place this aggregated zip file into the MyGTAP multi-household model of datatool32 (under *INPUT* folder of MyGTAP multi-sector model)

4. Create a folder called MyGTAP under directory C and place all these files into the MyGTAP folder

5. Then check the three files from the MyGTAP folder

    5.1 base.har

    5.2 batch.har

    5.3 hhsplit.har

6. splitting HH (hhsplit.har)

    6.1 REGS header: Bangladesh

    6.2 Then header ENDS: split the factors (8 factors)

    6.3 EMAP: mapping the factors

    6.4 Then header HHS: split the households (10 households for Bangladesh)

    RUN

7. Then open the Command Prompt (click search window and type command) and type MyGTAPf and run

8. Will generate another file called user.har in the OUTPUT directory

9. This includes new GTAP data files: basedata.har, BaseView.har, sets.har, default.prm and a new file called userwgt.har will be created

10. Then require to split userwgt.har file

11. Splitting weight or share are required for the following value flows

    11.1   factor use split (WTF)

    11.2   factor ownership shares (OWN)

    11.3   household consumptions splits (WTC)

    11.4   STRE

    11.5   TRNH etc.

    Re-RUN Then re-run MyGTAP by typing MyGTAPf (MyGTAP will rescale the weights and share to make them compatible with economically reasonable splitting share.

APPENDIX III: MONITORING BANGLADESH'S LDC GRADUATION PROGRESS

DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS

Bangladesh

Report of the DESA project, "Establishing crisis response process in the LDC monitoring framework for graduating and graduated countries"

19 November 2021

Introduction

Bangladesh is one of the leading emerging economies in South Asia, with a steady average economic growth rate of about 6.5 percent over the decade. It has managed to maintain a growth rate of about 3.5 percent during the pandemic in 2020.[14] The country has made huge strides in the areas of Gross National Income (GNI) per capita, Human Asset Index (HAI) and Economic Vulnerability Index (EVI) over the years. As a result, Bangladesh was recommended for graduation from the Least Developed Countries (LDC) status by the Committee for Development Policy (CDP) of the UN Economic and Social Council on 25th February 2021.[15]

Graduation is an uphill journey, especially phasing out of the transition period, as Bangladesh will lose its preferential market access in most global markets. The country also aims to become an upper-middle-income country by 2031 and a developed nation by 2041, as laid out in the Perspectives Plan 2021-2041 of the Bangladesh Planning Commission.[16] To achieve this ambitious goal, it is critical that Bangladesh has a solid graduation roadmap and the disruptions from graduation do not hinder their larger developmental goals. In this context, the main objective of this study is to identify the most important high frequency socio-economic indicators that need to be monitored for tracking the developmental progress of Bangladesh and identify the potential risks that could disrupt Bangladesh's growth. Thus, the specific objectives and scope of the study are:

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[14] Extracted from Bangladesh GDP annual growth rate, Tradingeconomics.com; https://tradingeconomics.com/bangladesh/gdp-growth-annual

[15] Committee for Development Policy: Report on the twenty-third session (22-26 February 2021), Economic and Social Council, Official Records 2021, Supplement No. 13, E/2021/33, United Nations; https://undocs.org/en/E/2021/33

[16] Making Vision 2041 a Reality: Perspective Plan of Bangladesh, 2021-2041, Bangladesh Planning Commission, Ministry of Planning, Government of the People's Republic of Bangladesh, March 2020; http://oldweb.lged.gov.bd/UploadedDocument/UnitPublication/1/1049/vision%202021-2041.pdf

- ✓ To review the current socio-economic structure of Bangladesh and identify the strengths as well as the vulnerabilities of the State.
- ✓ To review existing national indicators/systems in place and identify ten high-frequency indicators as the crisis monitoring indicators covering three categories – a) macroeconomics, b) natural disasters and c) health and other emergencies. The most critical indicators for each of the categories will also be highlighted; and
- ✓ To analyse each indicator and identify an average threshold level that can be used as a trigger value for indicating crisis.

Socio-economic Structure of Bangladesh

Bangladesh has made significant progress on the GNI per capita, HAI,[17] and EVI.[18] The GNI per capita has increased five-fold over two decades (Figure 1). With respect to the GNI per capita, the graduation threshold is US$1222, and Bangladesh's is at US$1827 in 2021. The country has also surpassed Pakistan and India in GNI per capita.[19] However, compared to developing countries (US$6666) it is still much lower.[20]

Bangladesh has made remarkable progress in its social and human asset development. The adult literacy rate has increased sharply over the decades and the mortality rate has also dropped significantly. As reviewed by the CDP, the HAI index for Bangladesh

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[17] The HAI comprises six social indicators which are (1) Under-five mortality rate, (2) Gross secondary school enrolment ratio, (3) Prevalence of stunting, (4) Adult literacy rate, (5) Maternal mortality rate and (6) Gender parity index for gross secondary school enrolment.

[18] Lower the index, lower the risk. The EVI comprises eight indicators which are (1) Share of agriculture, forestry and fishing in GDP, (2) Merchandise export concentration, (3) Instability of exports of goods and services, (4) Instability of agricultural production, (5) Share of population in low elevated coastal zones, (6) Remoteness and landlockedness, (7) Share of population living in drylands, (8) Victims of disasters.

[19] The CDP prepared the data for 2021 for a triennial review averaging the value of the last three years.

[20] "Least Developed Country Category: Bangladesh Profile", Department of Economic and Social Affairs Economic Analysis, United Nations; https://www.un.org/development/desa/dpad/least-developed-country-category-bangladesh.html

accounted for 75.3 in 2021, where the threshold level for graduation is 66. It's worth noting that the average HAI index for developing countries is 78.3 and Bangladesh is still behind the developing countries average.

Figure 1. Trend of HAI, EVI and GNI per Capita
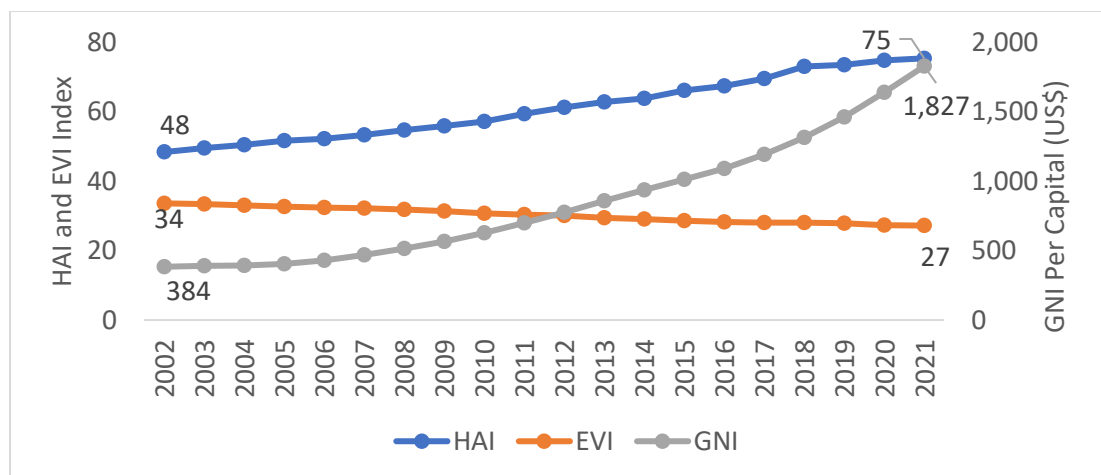
Source: UN CDP database, Accessed on 10 September 2021 (Triennial review report)

The EVI shows how much a country is vulnerable in terms of economic and environmental shocks. Although the GNI per capita and HAI have substantially increased over the decades, the EVI didn't decrease considerably due to environmental vulnerability. The EVI index was 34 in 2000 and was at 27 in 2021.[21] As Bangladesh continues to face different types of environmental shocks - both natural and human-related disasters - there is huge scope for improvement particularly in the area concerning environmental vulnerability. Table 1 shows different types of indicators that we use for this analysis.

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[21] *Ibid.*

Table 1 Potential Indicators for Crisis Monitoring.

SL	Indicators	Measurement	Frequency	Threshold	Sources
Economic Indicators					
1	Government revenue	% of GDP	Quarterly	≤ 3% of GDP	Economic Review (various issues), Ministry of Finance
2	Government Expenditure	% of GDP	Quarterly	≥4% of GDP	Economic Review, Ministry of Finance
3	Private Investment	% of GDP	Yearly	≤ 25% of GDP	Economic Review, Ministry of Finance
4	Current account balance	% of GDP	Quarterly	≤0	Quarterly Economic Trend, Bangladesh Bank (BB)
5	Inflation	Percentage change	Monthly	≥6%	Bangladesh Bank
6	Remittance	US$ Million	Monthly	≤ 2 billion per month	Monthly Economic Trend, BB
7	Overseas Employment	Number of persons per month	Monthly	≤ 50000 per month	Bureau of Manpower, employment and Training (BMET)
8	Export	US$ Million	Monthly	≤ 3.5billion per month	EPB, Bangladesh Bank
9	Foreign Reserve	US$ Million	Monthly	≤30 bill or ≥ 6months import capacity	Bangladesh Bank
10	Rice Price	US$/ MT	Quarterly	≥10 % increase	Bangladesh Bank
11	Cotton Price	US$/lb	Weekly	≥5 % increase	Macrotrends
Social and Health Indicators					
12	Weekly Trend of Covid Case	Total number of positive cases	Weekly	≥1000 confirmed cases per week	Director General of Health Service, GOB
13	Productive capacity index	Index	Yearly	≥31 (same as Vietnam index level)	UNCATD PCI

14	Human Development Index (HDI)	Index	Yearly	≥0.7 which is South Asian average	HDI, UNDP and UNCDP
15	Current health expenditure	% Of GDP	Yearly	≥4 % of GDP	WDI, World Bank
16	Female labour force participation rate	% of total Pop	Yearly	≥50 of total population	WDI, World Bank
17	Government expenditure on education	% of GDP	Yearly	≥4 of GDP	WDI, World Bank
Environment and disaster related Indicators					
18	Flood/Cyclone/ Strom (Natural)	Number of people affected	Yearly	≥ 100000	Compilation from EM-DAT, CRED/UCLouvain
19	Ferry accident/fire in the factories/ Human induced	Number accidents	Yearly	≤ 5	EM-DAT, CRED/UCLouvain, Brussels
20	New diseases	Number of new diseases	Yearly	New disease outbreak	EM-DAT, CRED/UCLouvain, Brussels
21	Air quality	AQI or PM 2.5 concentration	Daily	AQI >100 or PM2.5 >35.4 µg/m³	IQAir
22	Renewable electricity output	% of total electricity output	Yearly	≤10 %	WDI, World Bank; WDI, World Bank;
23	Access to clean fuels for cooking	% of population	Yearly	≤50%	International Energy Agency (IEA) dataset
24	Global Adoption Capacity	Global Adaptation Capacity Index	Yearly	≤40 (average index of LDCs)	University of Notre Dame-Global Adaptation Index (ND-GAIN)

Source: Author's compilation.

A detailed justification of each indicator and suggested threshold level are discussed. However, relevant yearly indicators are presented in the Appendix.

1. **Government Revenue**

   - **Justification**: The slow pace of revenue mobilisation and the simultaneous increase in government expenditure in response to the pandemic has created a stern fiscal challenge for Bangladesh. The government introduced a stimulus package amounting to US$15.1 billion which is 4.2 of GDP (Ministry of Finance, 2021), to recover the economy, which requires huge resource mobilization and government borrowings.

   - **Frequency**: Quarterly

   - **Measurement**: % of GDP

   - **Source**: Various issues of Economic Review, Ministry of Finance

   - **Threshold**: ≥3%. Figure 2 shows the quarterly moving average revenue collection is about 2.5 to 3 percent of GDP. In this regard, a minimum of 3% revenue of GDP is suggested for the quarterly threshold.

**Figure 2: Govt Revenue as percentage of GDP (Quarterly)**
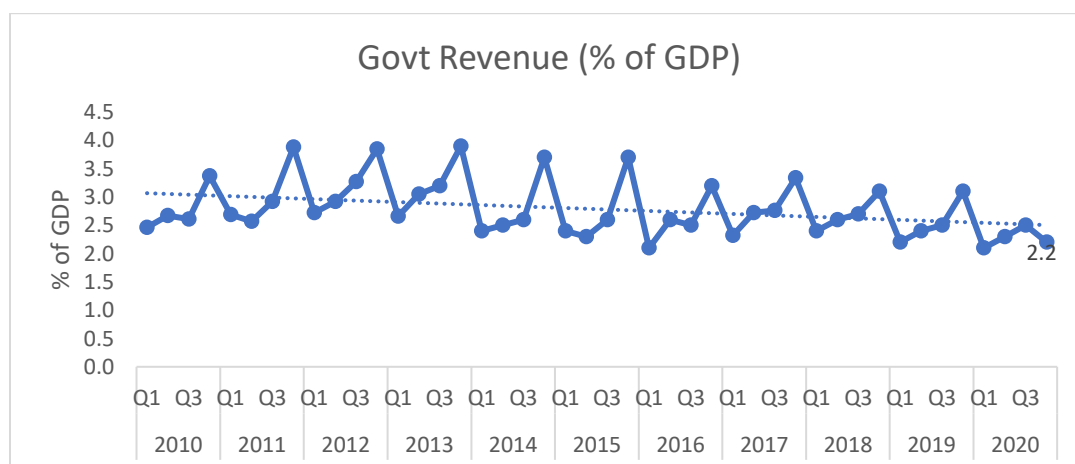
Source: Compiled from Bangladesh Economic Review (Various Issues), Ministry of Finance

2. Government Expenditure

- **Justification**: According to the 'Public Money and Budget Management Act 2009', the government should keep the budget deficit within 5 percent of the GDP. In the revised budget of FY 2020, due to the 'COVID-19' pandemic, the budget deficit accounted for 5.5 percent of the GDP and was forecasted at 6.1 percent for FY 2021. The government borrowed about 3.3 percent of the GDP from domestic sources in 2020. In 2019, the figure was 2.9 percent (Ministry of Finance, 2021). These additional domestic borrowing could reduce potential domestic private investment and hence the government needs to monitor and maintain fiscal discipline to move forward.

- **Frequency**: Quarterly

- **Measurement**: % of GDP

- **Source**: Various issues of Economic Review, Ministry of Finance

- **Threshold**: ≥4% of GDP. Figure 3 shows the quarterly moving average government expenditure is about 4 percent of GDP. In this regard, 4% government expenditure of GDP is suggested for the quarterly threshold.

Figure 3: Govt Expenditure as percentage of GDP (Quarterly)
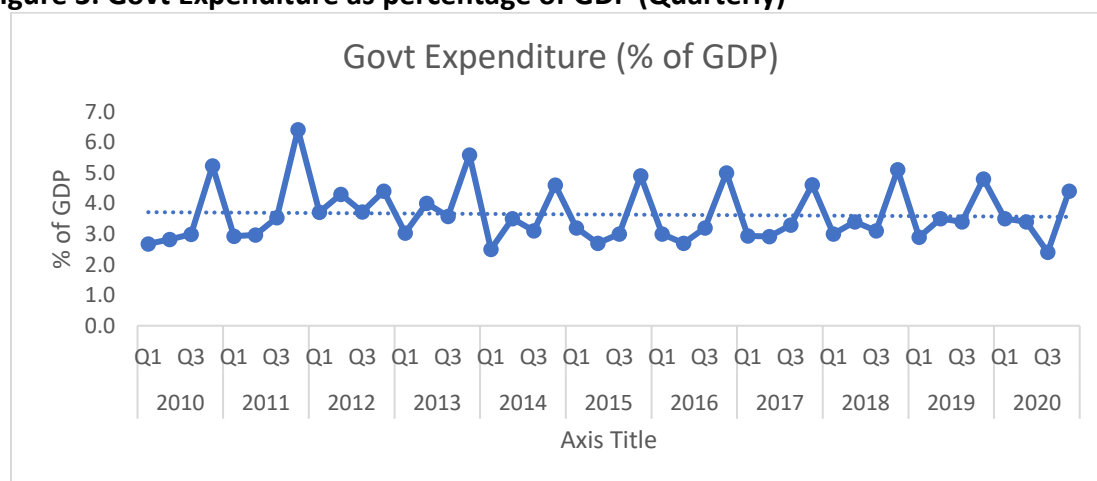
Source: Compiled from Bangladesh Economic Review (Various Issues), Ministry of Finance

3. **Private Investment**

- **Justification:** Savings and investment play a vital role in enabling capital that translates into long-term economic growth. According to the provisional data, Bangladesh's domestic savings increased to 24.2 percent of the GDP in the 2021 fiscal year from 23.8 percent in the preceding fiscal year. National savings also increased to 30.4 percent in 2021 from 28.7 percent in 2020. However, gross investment decreased in 2021 compared to the previous fiscal year. The total investment fell marginally in 2021 to 29.92 percent from 30.47 percent in 2020. Public sector investment has been growing at a decreasing rate and was at 8.67 percent in 2021.

- **Frequency**: Yearly

- **Measurement**: % of GDP

- **Source**: Various issues of Economic Review, Ministry of Finance

- **Threshold**: ≤25% of GDP. Figure 4 shows the quarterly moving average of private sector investment is about 24% of GDP. In this regard, 25% is suggested for the yearly threshold.

Figure 4: Investment Trend
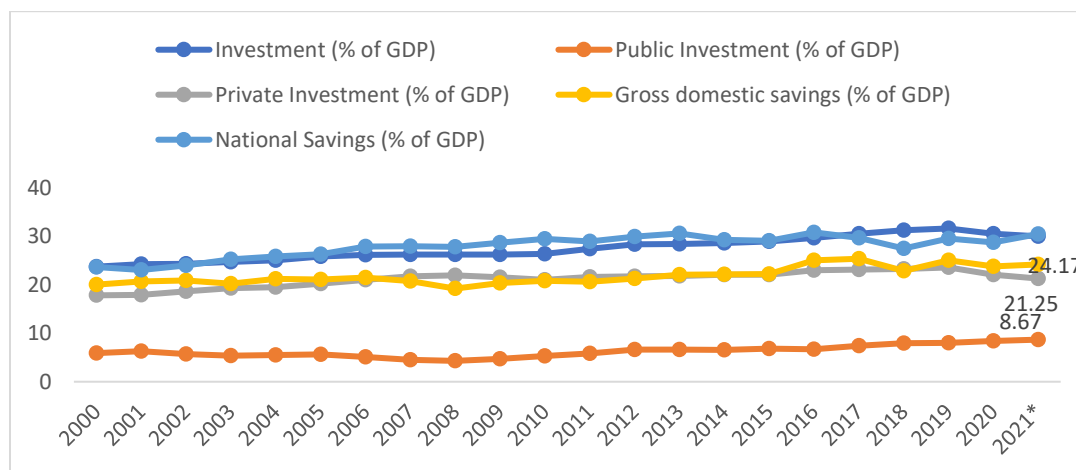
Source: Bangladesh Economic Review (Various Issues), Ministry of Finance)

4. **Current Account Balance:**

- **Justification:** A positive current balance indicates the country is capable to payment its import bills. Bangladesh's trade to GDP ratio is 37 percent in 2020, reflecting its current robust integration with the global economy. Despite the deficit of current account balance, the overall balance achieved a surplus of US$ 7.5 billion during FY 2021 as stemmed by the surplus in capital and financial account. Due to the surplus in the overall balance, the foreign exchange reserve reached to US$ 50 billion in September 2021.

- **Frequency**: Quarterly

- **Measurement**: % of GDP

- **Source**: Various issues of Economic Review, Ministry of Finance

- **Threshold**: ≤ 0. Figure 5 shows the quarterly moving average current account balance (CAB). In this regard, a negative (≤ 0)CAB is suggested for the quarterly threshold.

Figure 5 (a): Quarterly Current Account Balance (US$ Million)
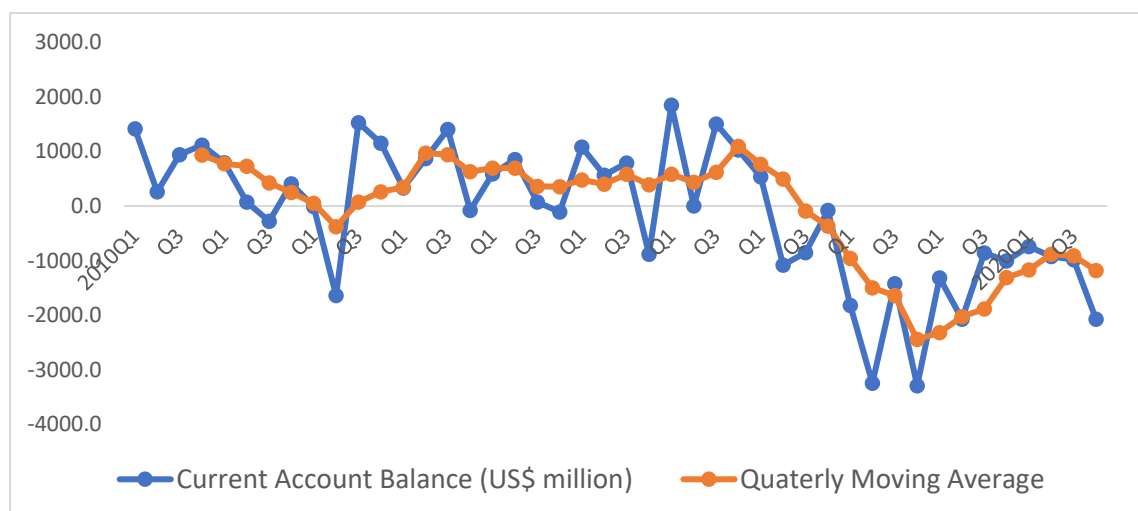
Figure 5(b): Current Account Balance (% of GDP)

Current account balance (% of GDP)
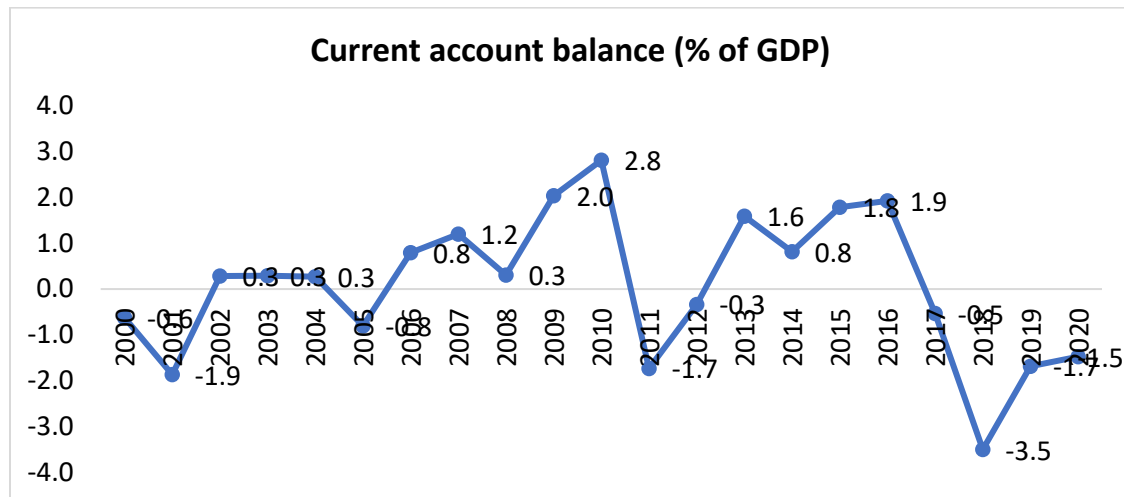
Source: Compiled from Bangladesh Bank Quarterly Economic Trend (Various Issues)

5. Inflation Rate

- **Justification**: Rising inflation rate increases the living cost of the locals. The rising cost of living has heavily impacted those with low incomes.

- **Frequency**: Monthly

- **Measurement**: Percentage Change

- **Source**: Bangladesh Bank

- **Threshold**: ≤6%. The average annual inflation is about 5.65% (Figure 6). The government target to keep inflation below six percent. In this regard, less than 6% is suggested for the monthly threshold.

Figure 6: Inflation Rate (12 months average)
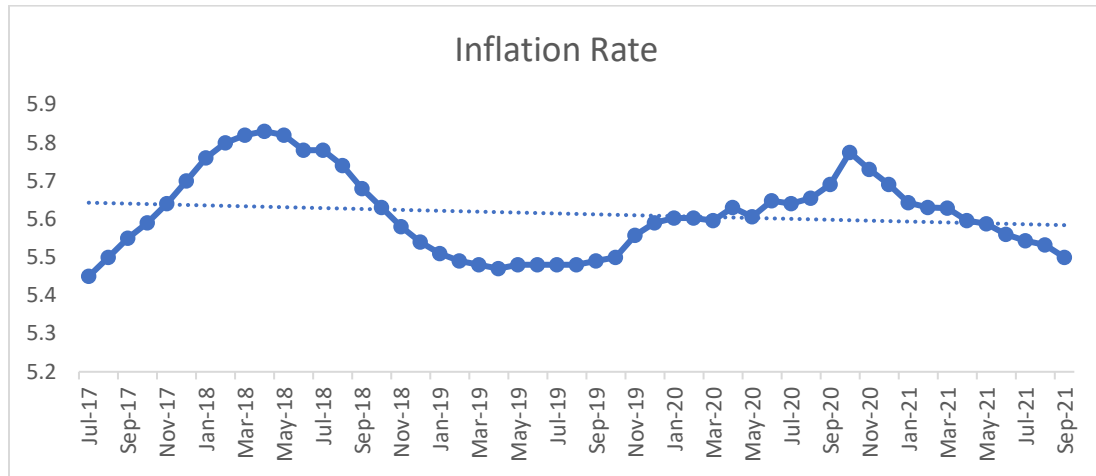
Compiled from Bangladesh Bank Monthly Economic Trend (Oct 2021)

6. **Remittance**

- **Justification:** Remittance is the lifeline of Bangladesh's economy. Bangladesh received an average of US$1.6 billion every month until the pandemic hit in 2020 (Figure 7). The wage-earner fell to US$ 1 billion in April 2020 and then bounced back sharply.

- **Frequency**: Monthly

- **Measurement**: USD billion

- **Source**: Bangladesh's Bank

- **Threshold**: ≤ 2 billion per month. Figure 7 shows the country receives about US$ 1.6 billion per month over the decades. In this regard, ≤ 2 billion per month is suggested for the monthly threshold.

Figure 7. Monthly Remittance and Overseas Employment
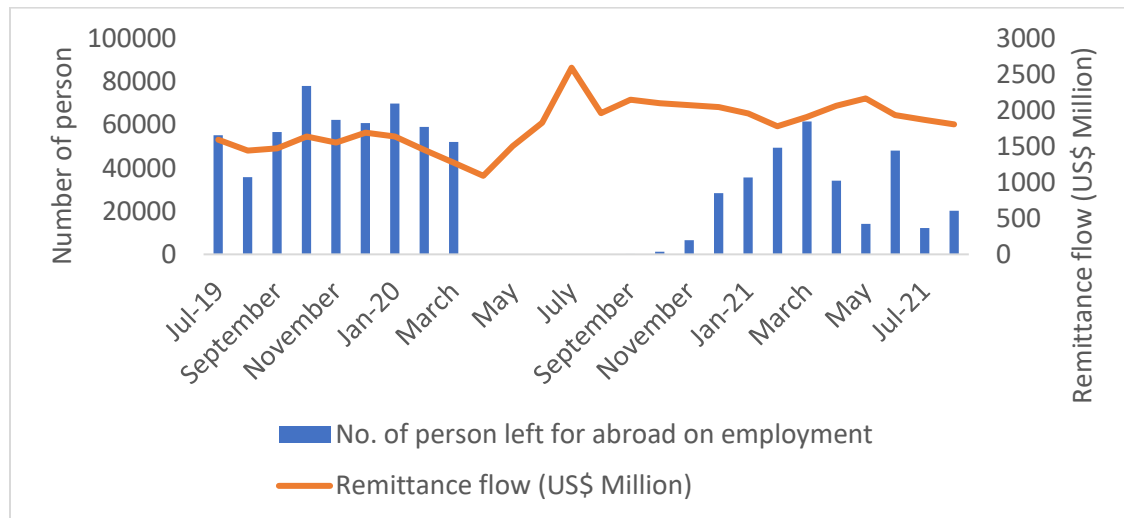
Source: Bangladesh Bank Monthly Economic Trend Sept 2021, Accessed on 4 Oct 2021

7. Overseas Employment

- **Justification**: The country sends, an average, of about 58,000 people aboard to every month until the pandemic hit in 2020 (Figure 7). But not a single person migrated overseas to work from April 2020 to November 2020, although remittance inflow has increased suspiciously.

- **Frequency**: Monthly

- **Measurement**: Number of persons per month

- **Source**: BMET.

- **Threshold**: ≤ 50000 person. Bangladesh usually sends, on average, about 58,000 people aboard every month until the pandemic over the last decades. It suggested that ≤ 50000 people could be a threshold for overseas employment.

8. Export:

- **Justification:** In the last decade, Bangladesh's total trade has increased from an estimate of US$15 billion in 2000 to US$110 billion in 2019 before it hit the

pandemic.[22] Export earnings drastically fell by 13 percent to US$33.6 billion in 2020 compared to the previous fiscal year. The export sector has bounced back recently to its pre-pandemic level, which shows a strong recovery.

- **Frequency**: Monthly

- **Measurement**: US$ Million

- **Source**: Bangladesh Bank and Export Promotion Bureau.

- **Threshold**:   ≤ US$3.5 billion per month. As Bangladesh's 12 months moving average export is US$ 3.0 t0 3.5 billion. It is suggested the threshold of ≤US$3.5 billion per month exports value.

Figure 8: Monthly Export Trend (FOB)
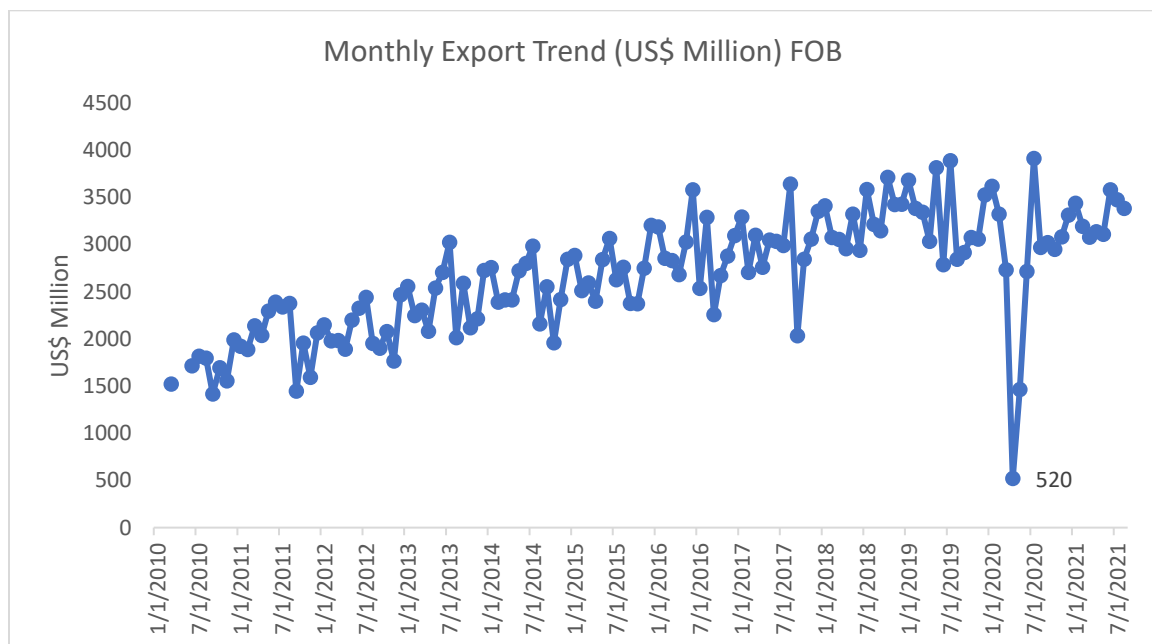
Source: Export Promotion Bureau (EPB), Accessed on 4 Oct 2021

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[22] Bangladesh TCdata360, World Bank;
https://tcdata360.worldbank.org/countries/BGD?indicator=1541&countries=BRA&viz=line_chart&years=1970,2019&country=BGD

9. Foreign Exchange Reserve:

- **Justification:** A robust foreign reserve is a critical macroeconomic indicator that indicates the financial strength of balance of payment and a country's positive image. It's also essential to get a healthy financial rating by the international rating agencies, which allows lower interest rates on borrowing from the global financial market.

- **Frequency**: Monthly

- **Measurement**: US$ Billion

- **Source**: Bangladesh Bank

- **Threshold**: If reserve falls to less than six months import value which is about US$ 30 billion in 2020.

Figure 9: Monthly Foreign Exchange Reserves (end period) US$ Billion
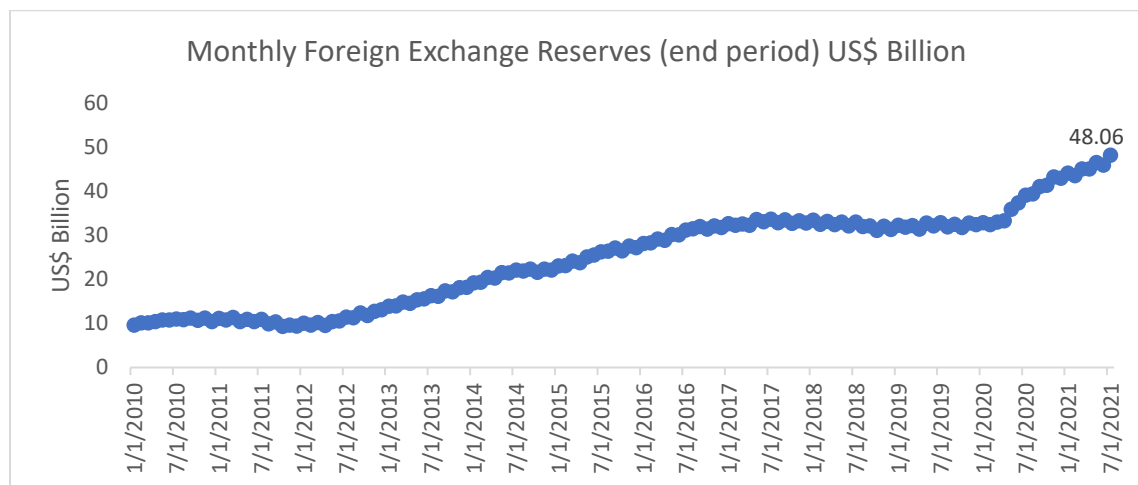
Source: Bangladesh Bank Monthly Economic Trend Sept 2021, Accessed on 4 Oct 2021

10. Rice Price:

- **Justification:** Rice is the staple food, and people depend heavily on rice for their life and livelihood in Bangladesh. Rice price increase has a tremendous socio-

economic impact on society. Recently rice prices increased about 66 percent in the fourth quarter of 2020.

- **Frequency**: Quarterly
- **Measurement**: Percentage Change
- **Source**: Bangladesh Bank
- **Threshold**: ≥10 % increase monthly. Rice price has increased in a wide range. In this regard, ≥10 % increase is suggested for the quarterly threshold.

**Figure 10: Rice Price (US$/M. T) and percentage change (quarterly)**
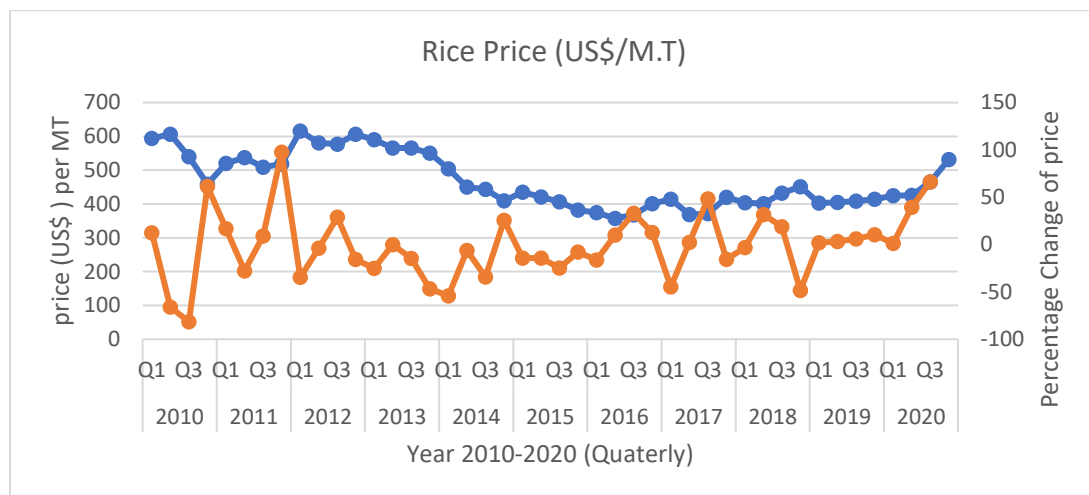
Source: Bangladesh Bank Quarterly Economic Trend (various issue), Accessed on 4 Oct 2021

11. Cotton price:

- **Justification:** Bangladesh's main export item is the readymade garment which requires huge amount of cotton. Bangladesh's top import item is cotton which about US$ 6.5 billion in 2020. An increase in cotton price significantly impacts its RMG exports as production costs increases due to higher cotton prices.
- **Frequency**: weekly/daily
- **Measurement**: US$

- **Source**: Bangladesh Bank
- **Threshold**: ≥5 % price increase weekly/daily. Cotton price has increased over the years. In this regard, ≥5 % is suggested for the weekly threshold.

Figure 11: Daily Cotton price (US$/Pound)

Source: macrotrends: https://www.macrotrends.net/2533/cotton-prices-historical-chart-data
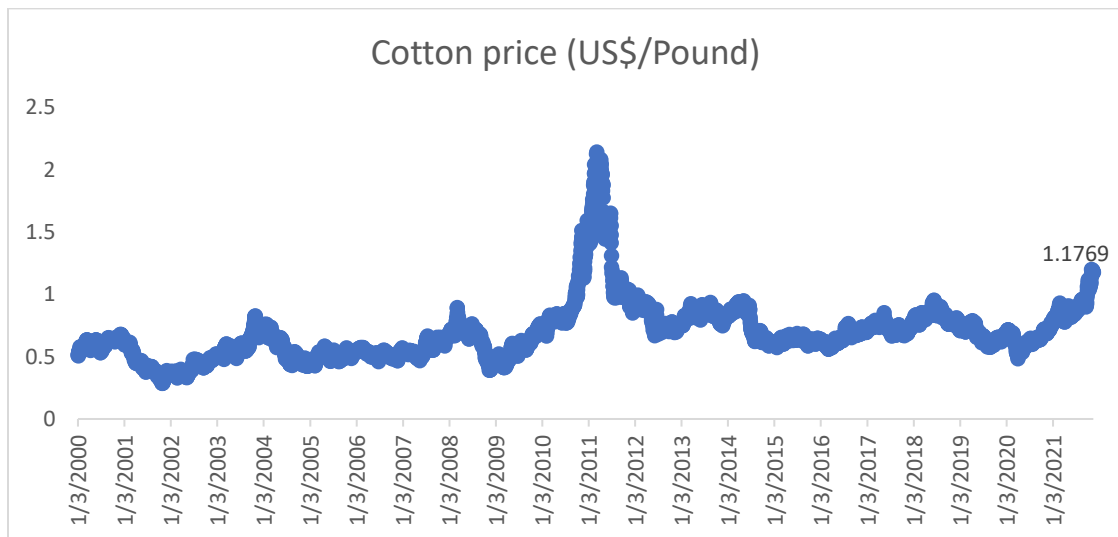
12. Number of confirmed COVID-19 cases

- **Justification:** With the COVID-19 pandemic, the lives and livelihood of people have been affected in an unprecedented manner. The total COVID positive cases in Bangladesh reached over 1.5 million as of 7 October 2021 and the death toll exceeds 27000. Bangladesh began rolling out the COVID-19 vaccine in January 2021 and since then only about 40 million double doses have been administered which is about 20 percent of country's total population.[23] Bangladesh's target is to fully inoculate about 118 million people of its total population (18+ people)

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[23] Directorate General of Health Services, Ministry of Health and Family Welfare, Government of People's Republic of Bangladesh; http://dashboard.dghs.gov.bd/webportal/pages/covid19.php

that requires 238 million doses of vaccines and is a daunting task [24] which requires an all-out effort by the government.

- **Frequency**: Weekly

- **Measurement**: Number of confirmed cases.

- **Source**: Director General of Health Service, Ministry of Health

- **Threshold**: More than 1000 confirmed cases per week. Figure 12 shows that about 1000 new positive cases every week. The threshold is established based on recent data trends.

Figure 12: Weekly Trend of Covid Case
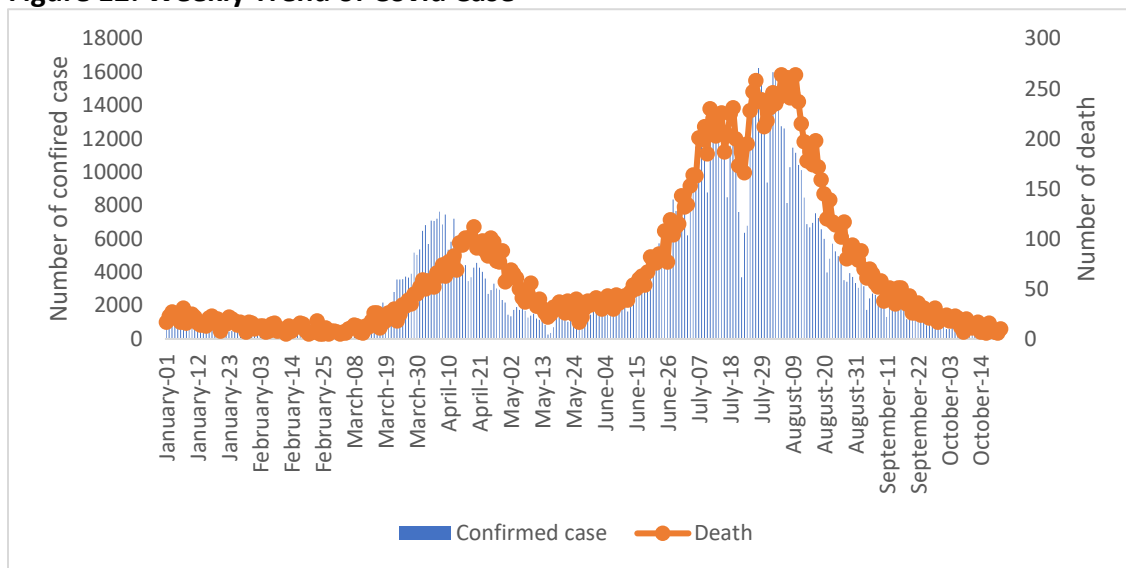
Source: Director General of Health Service (DGHS), Accessed on 7 October 2021.
103.247.238.92/webportal/pages/covid19.php

13. Floods & Cyclones

- **Justification:** Bangladesh is a natural disaster-prone county and is extremely vulnerable to frequent monsoons, floods, cyclones, and storms surges. Bangladesh faces about ten different natural disasters every year (Table 2).

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[24] 103.247.238.92/webportal/pages/covid19-vaccination-update.php

Bangladesh also faces at least two major floods and two major cyclones every year, which destroy's coastal people's lives and livelihoods, which is 20 percent of Bangladesh territory under 19 districts.

- **Frequency**: Yearly/Adhoc
- **Measurement**: Number of disasters.

Table 2: Composition of main disasters over the years in Bangladesh (Flood & Cyclone)

	Flood	No of people Affected	Cyclone/Tornado	No of people Affected
2000	3	2679198	5	75599
2001	2	700000	4	28150
2002	1	1500000	2	100400
2003	2	550000	2	400
2004	3	36871700	2	17050
2005	3	1150000	2	22000
2006	2	211775	4	17999
2007	2	13851440	2	8978766
2008	2	635640	2	400
2009	2	500000	2	3954550
2010	2	575000	2	257110
2011	1	1570559	0	0
2012	2	5398475	0	0
2013	0	0	2	1523664
2014	1	2800447	0	0
2015	2	1411901	1	2600000
2016	1	1900000	1	1203555
2017	1	86025	1	3300012
2018	2	14000	0	0
2019	1	7600000	2	261551
2020	1	5448271	1	2600000
2021	1	268744	1	1300000
Average	1.7	3896508	1.7	1192782

Source: Compilation from EM-DAT, CRED/UCLouvain, Brussels, www.emdat.be Accessed on 15 September 2021

- **Threshold**: ≥ 100000, Table 2 shows that about 4 million people are affected by floods every year, while cyclones affect about 1.1 million people, two major devastating natural disasters in Bangladesh (Table 2). In this regard, 100000 is suggested for the threshold.

14. Man-made disaster (ferry accidents and fires in the factories)

- **Justification:** Many man-made/induced disasters are also frequent in Bangladesh, including factory fires and ferry accidents.
-

Table 3: Composition of disasters over the years in Bangladesh

	Ferry accident	Factory Fire	Viral disease
2000	5	2	2
2001	3	1	0
2002	2	1	1
2003	6	0	0
2004	6	0	2
2005	8	2	0
2006	1	3	0
2007	0	1	2
2008	1	0	0
2009	4	0	0
2010	2	3	0
2011	1	0	0
2012	3	2	0
2013	1	1	0
2014	3	0	0
2015	2	1	0
2016	2	1	0
2017	3	1	1
2018	0	0	0
2019	1	4	0
2020	1	1	1
2021	4	3	1
Average	2.7	1.2	0.4

Source: Compilation from EM-DAT, CRED/UCLouvain, Brussels, www.emdat.be Accessed on 15 September 2021

- Table 3 shows the composition of different disasters over the years. Bangladesh has about 700 rivers, and ferry accidents are frequent due to limited safety and monitoring systems. Bangladesh has faced at least three massive ferry accidents every year, which killed hundreds of people. Massive fires in factories are also frequent owing to compromised safety standards adhered to.

- **Frequency**: Yearly/Adhoc

- **Measurement**: Number of disasters.

- **Source**: *Compilation from EM-DAT, CRED/UCLouvain, Brussels, www.emdat.be*

- **Threshold**: ≥ 5, Bangladesh faces about ten different natural disasters every year.

15. Air quality

- **Justification**: According to the World Air Pollution Report, Bangladesh is the most air polluted country in the world, and Dhaka is the second worst polluted city (Table 4).

Table 4: Live Air Quality (daily)

Rank	Most Polluted countries	Country Score	Most Polluted Cities
1	Bangladesh	77.1	Delhi, India
2	Pakistan	59	Dhaka, Bangladesh
3	India	51.9	Ulaanbaatar, Mongolia
4	Mongolia	46.6	Kabul, Afghanistan
5	Afghanistan	46.5	Doha, Qatar
6	Oman	44.4	Bishkek, Kyrgyzstan
7	Qatar	44.3	Sarajevo, Bosnia & Herzegovina
8	Kyrgyzstan	43.5	Manama, Bahrain
9	Indonesia	40.7	Jakarta, Indonesia
10	Bosnia Herzegovina	40.6	Kathmandu, Nepal

Source: https://www.iqair.com/world-most-polluted-countries, Accessed on 30 October 2021

- **Frequency**: Daily

- **Measurement**: Air Quality Index

- **Source**: https://www.iqair.com/laos.

- **Threshold**: Air Quality Index is not more than 101 (healthy level is 1-100) or PM2.5 concentrations not more than 35.4 µg/m³

Conclusions

This study explores potential indicators that need to be monitored to track the developmental progress of Bangladesh and identify the potential risks that could disrupt Bangladesh's growth. Most of the monthly and quarterly data are presented collected from different publicly available government sources. A threshold level for each indicator is suggested to monitor the risk as well as development progress. Bangladesh has made significant progress in its socio-economic development over the decades, led by the export and foreign workers' remittance inflow. The economy has also undergone a substantial structural change over the years. While the economy is growing, the main challenge is the lack of export diversification, both in products and markets. Also, COVID-19 has significantly impaired overseas employment, which may substantially impact the current account balance. The pandemic has also affected people's health, livelihoods, and employment, especially in the vast informal sector. Thus, low productivity, informal labour market, workplace safety, controlling disease outbreaks, and dealing with seasonal floods and cyclones are critical issues the country has to tackle to ensure sustained long-term economic growth.

Appendix 1. Additional Potential Indicators (Yearly data)

A1. Health Sector Expenditure:

- **Justification:** Bangladesh's health sector has been neglected over the years. As a percentage of GDP, health sector expenditure is about two percent, which is the lowest among South Asian countries (WDI, 2021).

- **Frequency**: Yearly

- **Measurement**: % of GDP.

- **Source**: WDI

- **Threshold**: ≥ 4%, The average expenditure is about 4 to 5 percent in most of the developing countries. In this regard, 4% of GDP is suggested for threshold expenditure on the health sector.

Figure A1. Current health expenditure (% of GDP)
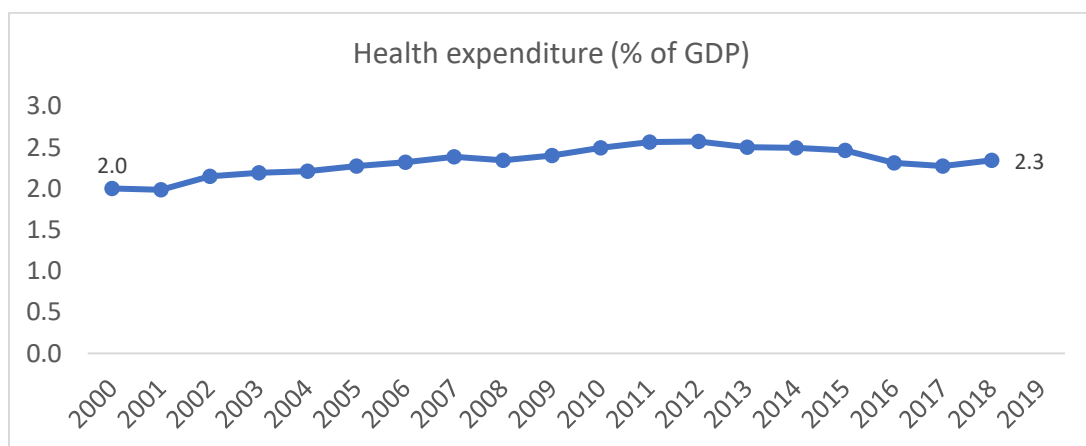
Source: World Development Indicators, 2021 (WDI), World Bank

A2. Expenditure on Education

- **Justification:** Public expenditure in education as a percentage of GDP has decreased over the years in Bangladesh. Bangladesh's average schooling years have increased at a languid pace, about six years in 2019. The adult literacy rate is

at 74 percent, which is much lower compared to its South Asian neighbours (Human Development Index, UNDP, 2021) and hence shows urgency for improvement.[25]

- **Frequency**: Yearly

- **Measurement**: % of GDP.

- **Source**: WDI

- **Threshold**: ≥ 4%, Bangladesh's expenditure in the education sector is about 1.3 percent of GDP while India spends about 3.8 percent and Vietnam spends about 4.1 percent. (WDI, 2021). In this regard, 4% of GDP is suggested for threshold expenditure on the education sector.

Figure A2: Government expenditure on education, total (% of GDP)
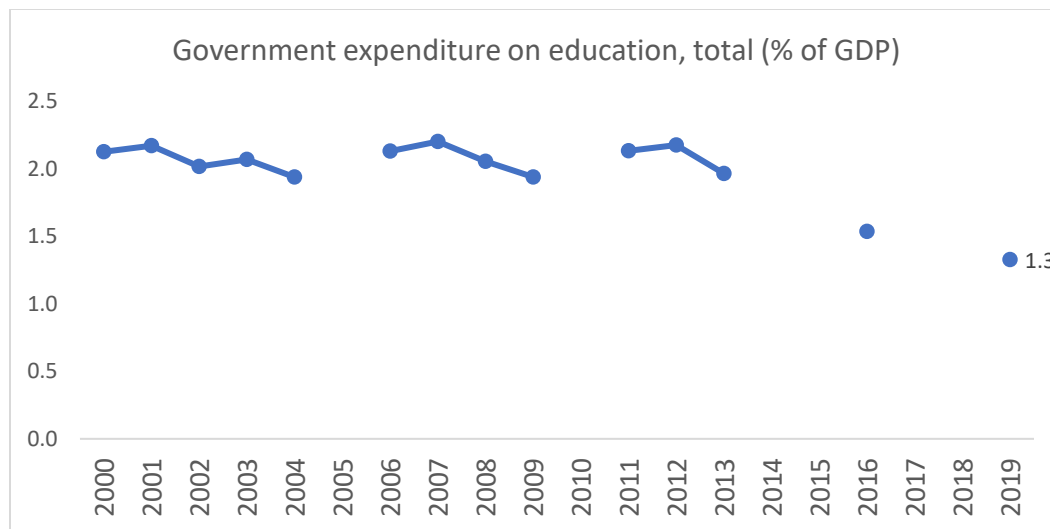
Source: World Development Indicators, 2021 (WDI), World Bank

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[25] Human Development Reports, United Nations Development Program, 2020; http://hdr.undp.org/en/countries

A3. Productive Capacities Index (PCI)[26]

- **Justification:** The UNCTAD's productive capacities index (PCI) indicates the key drivers and enabling factors that foster productive capacities of a country.[27] The PCI is composed of 46 indicators across eight categories of productive capacities: natural capital, human capital, energy, ICTs, transport, private sector, institutions, and structural change. Although the PCI for Bangladesh has increased gradually over the years, it is still much lower compared to its competitors like Vietnam and India (UNCTAD, 2021). The sectoral productivity index shows that Information and Communication Technology (ICT), energy and transport sectors have the lowest productive capacities, while the private sector has made significant improvements in productive capacity in Bangladesh (Figure A3)

- **Frequency**: Yearly

- **Measurement**: Index.

- **Source**: Productive Capacities Index, UNCTAD; https://pci.unctad.org

- **Threshold**: ≥31. Bangladesh's index is 26 while Vietnam is at 31.7 and India at 30. Bangladesh threshold index is suggested 31 while is same as Vietnam.

A4. Human Development Index (HDI)

- **Justification:** The human development index (HDI) shows how a country performs on its socio-economic development front. Bangladesh has made steady progress in human development relating to education, women and children, social welfare, etc. According to the UNDP's "Human Development Report-2020" Bangladesh's HDI rank was 133. However, among South Asian countries Sri Lanka (72), Maldives (79) India (131) and Bhutan (129) are ahead of Bangladesh which shows there is
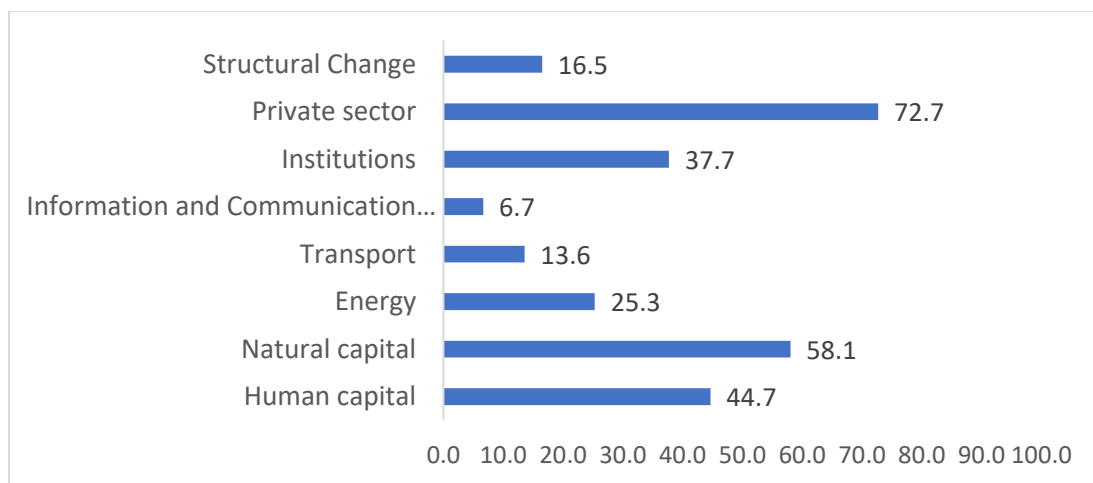
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[26] The PCI defines by UNCTAD (2021) that "productive capacities are the productive resources, entrepreneurial capabilities and production linkages that together determine a country's ability to produce goods and services that will help it grow and develop".
[27] Productive Capacities Index, UNCTAD; https://pci.unctad.org

huge scope for improvement. Over the years, quality of education and financing to the health sector which are crucial HDI indicators have not been given proper focus in Bangladesh and expenditure on them as a percentage of GDP is lowest among South Asian countries (WDI, 2021). The informal labour market is another major concern that leads to lower productivity in the economy.
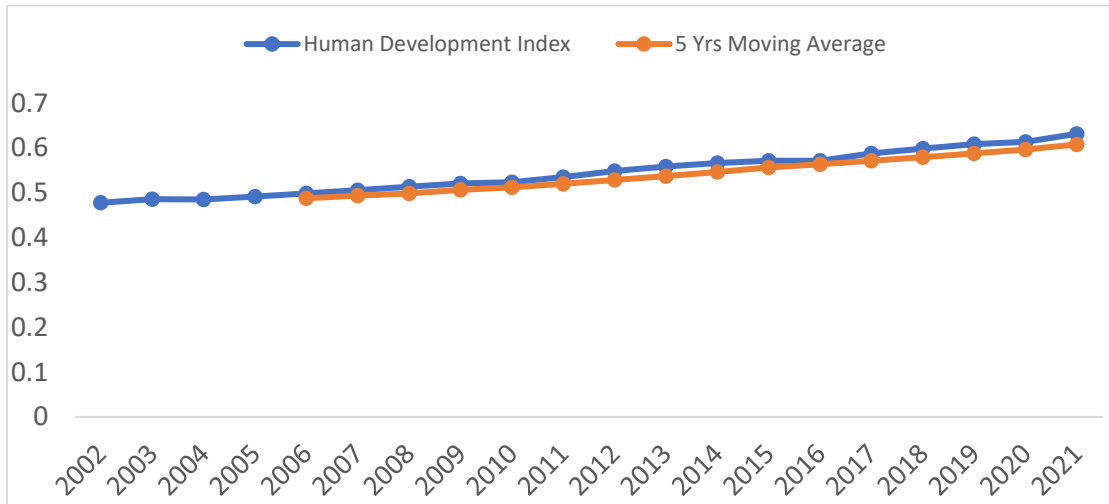
Figure A3: Sectoral PCI of Bangladesh in 2018

*Source: UNCATD PCI (2021). Accessed on 7 October 2021,
https://unctad.org/topic/least-developed-countries/productive-capacities-index*

- **Frequency**: Yearly

- **Measurement**: Index.

- **Source:** UNDP

- **Threshold**: ≤0.7, The South Asian Average Index is 0.7 which index is suggested for the threshold.

Figure A4. Human Development Index (HDI)

Source: UNDP (2021)

A5. Female Labour Force Participation

- **Justification:** Bangladesh has a long way to go to achieve gender equality and women empowerment. As of February 2021, only 21 percent of seats in parliament were held by women in Bangladesh (UNWOMEN 2021).[28] Although female labour participation has increased, it is still much lower compared to its neighbours. Still, 63 percent of females are out of the formal labour market in Bangladesh as of 2020.

- **Frequency**: Yearly

- **Measurement**: % rate

- *Source:* WDI

- **Threshold**: ≤50%, The South Asian Average is 50% which rate is suggested for the threshold

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[28] "Bangladesh: COVID-19 and gender monitor", UNWOMEN, 26 Jun 2020; https://data.unwomen.org/resources/covid-19-and-gender-monitor

Figure A5: Female labour force participation rate
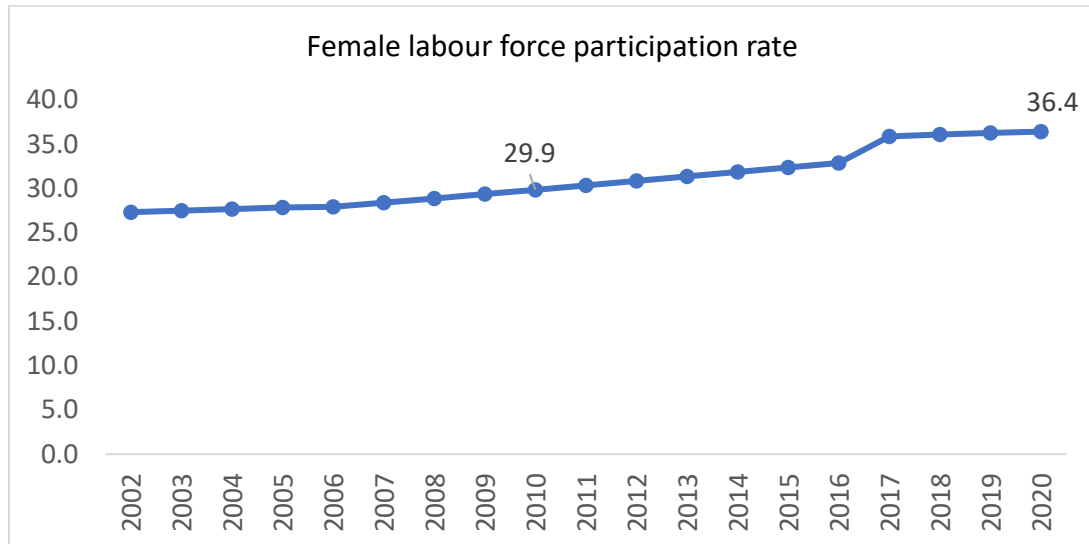
Source: World Development Indicators, 2021 (WDI), World Bank

A6. Renewable Electricity Output

- **Justification:** Environmental degradation is a crucial challenge for Bangladesh in attaining its sustainable development goals. Air pollution is increasing with rapid urbanisation and industrialisation. A rise in sea-level is also a major threat to the lives and livelihoods of people in the coastal belt of Bangladesh. The main source of power generation is natural gas and fossil fuel. The renewable energy output as a percentage of total electricity has been meagre and declining over the last two decades in Bangladesh (Figure A6). Renewable energy per capita is extremely low in Bangladesh. The various sources of power generation in Bangladesh includes natural gas (52 percent), furnace fuel (27.5 percent), diesel (6 percent), Import (5 percent), Coal (8 percent), Hydro and renewable energy generation (1.5 percent) (Power Division, *Ministry* of *Power*, *Energy* & Mineral Resources, 2021). Given the low share of renewables, Bangladesh is faced with a huge challenge to tackle the energy problem which is essential for long term sustained growth.

- **Frequency**: Yearly

- **Measurement**: % rate

- *Source:* Power Division, *Ministry* of *Power*, *Energy* & Mineral Resources

- **Threshold**: ≤10%, Bangladesh targets 10 % electricity from renewable energy by 2030 (Renewable Energy Policy in Bangladesh)

Figure A6. Renewable Electricity Output (% of total electricity output)
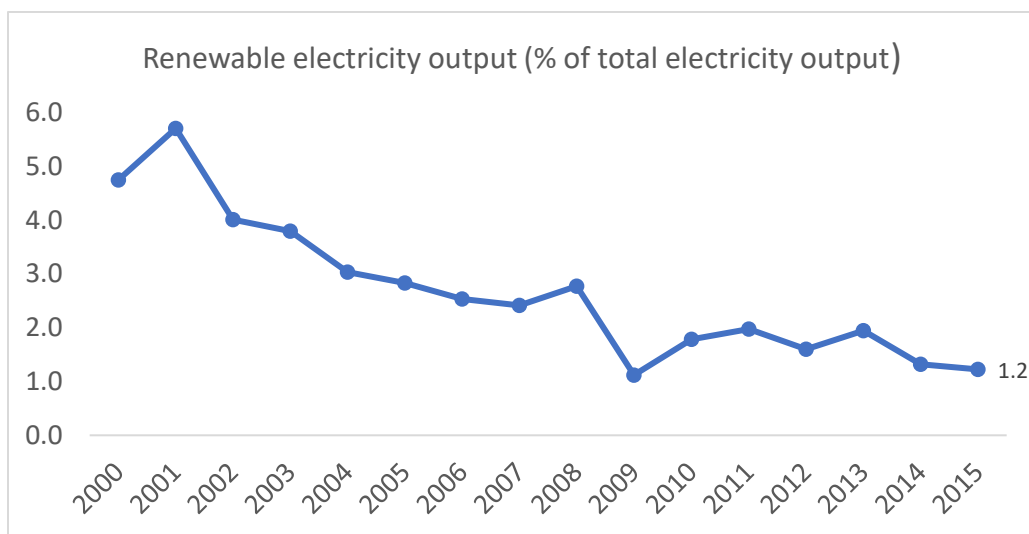
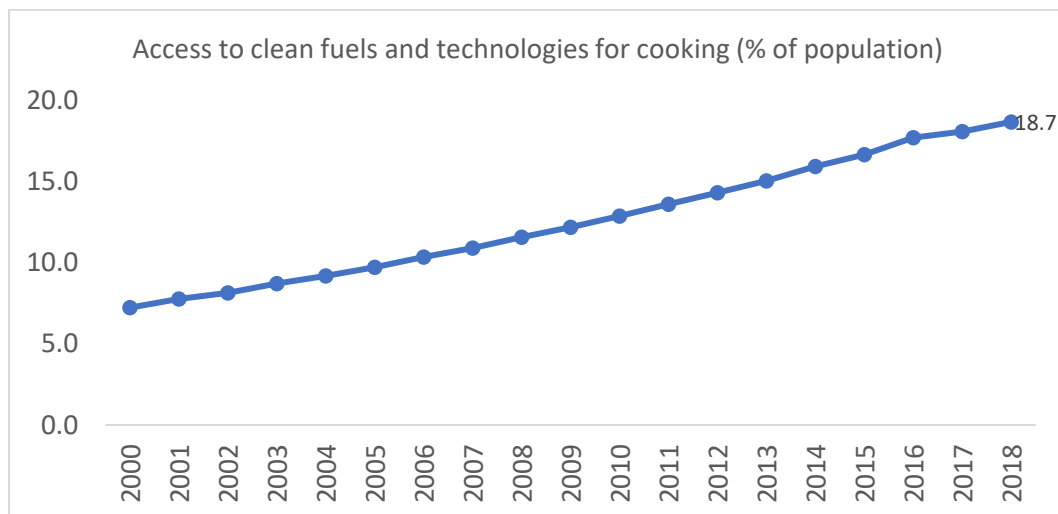*Source: World Development Indicators, 2021 (WDI), World Bank*

A7. Access to Clean fuel and Technologies for Cooking:

- **Justification** Access to clean fuel and technologies is one of the major mandates of SDGs (Goal 7). Bangladesh has made some incremental progress over the two decades in accessing clean fuel for cooking. However still, 81 percent of the population, which is about 134 million people, has no access to clean fuel and technologies for cooking (Figure A7). Although Bangladesh has huge natural gas reserves, it is not distributed in most cities. Rural Bangladesh uses wood fuel while most cities/towns use LNG gas, whose price has increased substantially recently.

The gap in access to clean fuel and technologies highlights the need for a substantial governmental effort to address this issue.

- **Frequency**: Yearly

- **Measurement**: % rate

- *Source: International Energy Agency (IEA) database. Accessed on 7 October 2021.* *https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking*

- **Threshold**: ≤50%, Developing countries average is 50% which rate is suggested for the threshold

Figure A7. Access to clean fuels and technologies for cooking (% of population)

Access to clean fuels and technologies for cooking (% of population)

18.7

Source: International Energy Agency (IEA) database. Accessed on 7 October 2021. *https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking*
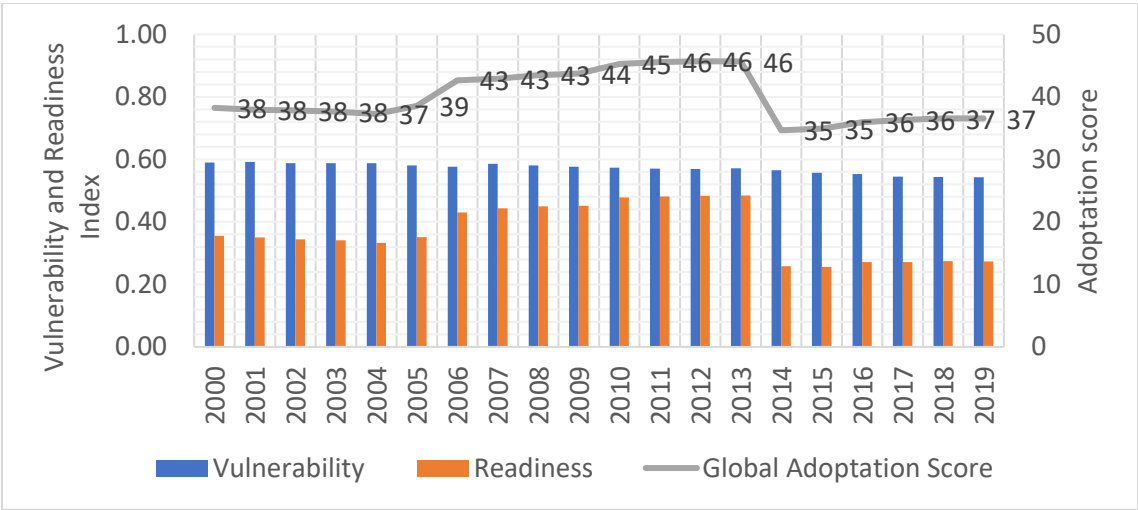
A8. Global Adoption Capacity

- **Justification:** The University of Notre Dame-Global Adaptation Index (ND-GAIN) presents a vulnerability index to climate disruptions. The Index captures a country's vulnerability to climate change and other global challenges as well as its readiness to improve resilience. The ND-GAIN brings together over 74 variables to form 45 core indicators to measure the vulnerability and readiness of 182

countries. A high adaptation score (0-100) means lower vulnerability. Bangladesh has a score of 36.5 in 2019, which is the 26th most vulnerable country and the 22nd least ready adaptation country (Figure A8). The high vulnerability score (0.543) and low readiness score (0.274) of Bangladesh gives it a score of 36.5 making it one of the high risk and low adaptation capacity countries, with a rank of 164 out of 182 countries in 2019. Thus, Bangladesh requires enormous investments and high-level innovations to improve its readiness, and this requires urgent action.

- **Frequency**: Yearly/Adhoc
- **Measurement**: Index.
- *Source: ND-GAIN,* https://gain.nd.edu/our-work/country-index/rankings/
- **Threshold**: ≤45, The average index of developing countries is 45 which index is suggested for the threshold.

Figure A8: Global Adaptation Index

Source: The University of Notre Dame-Global Adaptation Index (ND-GAIN),
https://gain.nd.edu/our-work/country-index/rankings/

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Nature of contribution by PhD candidate	Lead author. The research topic was proposed by Mohammad Masudur Rahman. Mohammad did all data and econometric work as well as drafting the paper. Mohammad led the response to journal referees.
Extent of contribution by PhD candidate (%)	80

CO-AUTHORS

Name	Nature of Contribution
Anna Strutt	Guidance and critical feedback, particularly on the research methodology and response to journal referees.

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The undersigned hereby certify that:
❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
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Anna Strutt		25/9/22

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Chapter III: Evaluating the Impact of Eliminating Export Subsidies in Bangladesh

Nature of contribution by PhD candidate	Lead author. The research topic was proposed by Mohammad Masudur Rahman. Mohammad did all data and econometric work as well as drafting the paper. Mohammad led the response to journal referees.
Extent of contribution by PhD candidate (%)	80

CO-AUTHORS

Name	Nature of Contribution
Anna Strutt	Guidance and critical feedback, particularly on the research methodology and response to journal referees.

Certification by Co-Authors

The undersigned hereby certify that:
- ❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
Mohammad Masudur Rahman		27/06/2022
Anna Strutt		25/9/22

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Nature of contribution by PhD candidate	Lead author. The research topic was proposed by Mohammad Masudur Rahman. Mohammad did all data and modelling work as well as drafting the paper. Mohammad led the response to journal referees.
Extent of contribution by PhD candidate (%)	80

CO-AUTHORS

Name	Nature of Contribution
Anna Strutt	Guidance and critical feedback, particularly on the CGE modelling and developed a baseline and response to journal referees.

Certification by Co-Authors

The undersigned hereby certify that:
- ❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
Mohammad Masudur Rahman	*[signature]*	27/06/2022
Anna Strutt	*[signature]*	25/9/22

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