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Bangladesh Institute of Governance and Management (BIGM)
Plot No.: E-33, Agargaon Administrative Area
Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh
PABX: +8802-48113589, 48116857, 48115073
E-mail: director@ bigm.edu.bd, journal@bigm.edu.bd
Website: www.bigm.edu.bd

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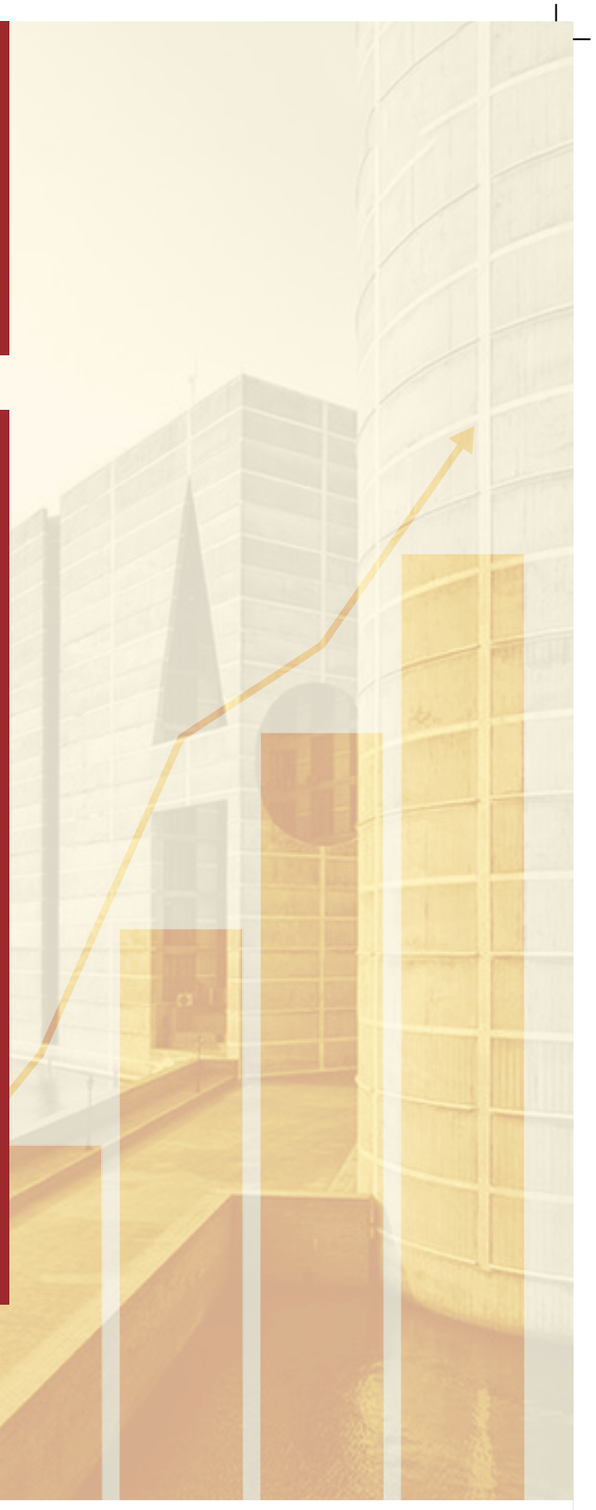

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Editor's Note

Dear Readers

We are delighted to present the second issue of the *BIGM Journal of Policy Analysis*. This journal continues to serve as a vital platform for incisive and multidisciplinary analyses of pressing national and global policy issues.

A society's progress is shaped by its aspirations and policies, which must evolve through continuous scrutiny and refinement. The BIGM Journal of Policy Analysis embodies this vision, striving to create a lasting repository of knowledge that transcends time, place, and context.

In this issue, we present articles that explore critical policy issues in Bangladesh, including the impact of dietary changes on water resource planning, change management in teaching practices during and after the COVID-19 pandemic, restructuring of public debt, trade dynamics of Bangladesh with India and China, and the relationship between budget deficits and economic growth using both empirical and structural equation modeling approaches. As we move forward, we remain committed to expanding our scope to encompass a broader range of policy domains and to introducing cutting-edge analytical perspectives.

The Editorial Team extends heartfelt gratitude to the Board of Trustees and Governing Body of BIGM for their unwavering support in making this publication possible. We are also deeply appreciative of the Editorial Advisory Board for their expertise in curating the articles featured in this issue.

We hope this journal will continue to serve as a vital resource for policy-makers, researchers, and stakeholders committed to advancing policy discourse. We invite feedback from our readers and look forward to delivering impactful, high-quality content in future issues.

Sincerely
The Editorial Team

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Implications of Dietary Change on the Next National Water Management Plan (NWMP) of Bangladesh

Partho Das[1], *Animesh K. Gain*[2], *Rezaur Rahman*[3]

Abstract

The first National Water Management Plan (NWMP), framed in 2001 for a 25-year period, is due to be terminated soon, necessitating the formulation of the next NWMP. Since 2001, significant changes in the socio-economic condition of Bangladesh have been reported, including shifting dietary patterns towards more animal-based proteins and less rice. This shift is raising concerns about livestock water footprint (WF), especially the country's water resource constraints during dry seasons and in certain water-scarce regions. This article has attempted to assess the effect of dietary change on future water stress in Bangladesh by employing the WF approach. Findings reveal that while rice consumption has decreased more than anticipated, there has been a rising intake of animal protein, which requires additional fresh water. This additional water demand to support this changed diet could exacerbate water scarcity, particularly in the dry season and northwest region of Bangladesh. As the first NWMP did not account for critical aspects like shifts in dietary patterns in the estimation of the nation's freshwater demand or scarcity, we suggest incorporating the impact of such diet changes in the next NWMP. Policy recommendations for the next NWMP, along with the incorporation of dietary changes into national policies, have been suggested, such as emphasizing fish over livestock for protein needs, reallocating and zoning agricultural practices,

1 Assistant Professor, Institute of Water and Flood Management, Bangladesh University of Engineering and Technology, Dhaka 1000, Bangladesh. E-mail: partho@iwfm.buet.ac.bd

2 Senior Lecturer, Murdoch University, School of Environmental and Conservation Sciences, 90 South Street, 6150, Murdoch, WA, Australia. animeshkumar. E-mail: gain@murdoch.edu.au

3 Professor (Retd.), Institute of Water and Flood Management, Bangladesh University of Engineering and Technology, Dhaka 1000, Bangladesh. E-mail: rezaurrahman037@gmail.com

and prioritizing water-efficient agricultural production. The next NWMP should plan for a detailed analysis of stress on freshwater in each of the nation's hydrologic regions, incorporating existing and projected dietary patterns and socio-economic factors. Incorporating this aspect of diet change will enhance understanding of the nationwide demand for fresh water and ultimately lead towards improved and sustainable water resources management in future Bangladesh.

Keywords: dietary change; water footprint; water stress; national plan; policy

1 Introduction

Food security is inextricably linked to water resources due to the highest amount (which is 90%) of freshwater consumption in the agriculture sector (Carr et al., 2015; Hoekstra and Mekonnen, 2012; Oki and Kanae, 2006; Yang et al., 2003). Freshwater consumption for food production exceeds any other sector that consumes freshwater as a resource (Carr and D'Odorico, 2017; Falkenmark and Rockström, 2006).

However, water has become scarce in many parts of the world, negatively impacting food security (Jalava et al., 2014). For example, freshwater scarcity has been reported as a limiting factor for sufficient food production in a larger part of Asia and Africa (Fader et al., 2013; Kummu et al., 2014). Water is scarce due to both supply and demand-side changes (Gain et al., 2016). Water supply changes due to high variability in time and space (Postel et al., 1996). Temporal variation refers to 'too much' water during the wet season and 'too little' water during the dry season, while spatial variation indicates the uneven water distribution resulting from the land-use pattern and climate system (Oki and Kanae, 2006). Climate change is considered one of the main driving forces for supply-side changes in water resources, affecting both the temporal and spatial distribution (Gain and Wada, 2014). Due to climate change, it is expected that there will be wide variability in precipitation and the occurrence of droughts and floods (Coumou and Rahmstorf, 2012; Hertel et al., 2010; Pachauri et al., 2014). Besides supply-side changes, water demand changes due to multiple factors, including population growth, economic development, land use change, changes in food habits, and policy changes (Gain and Giupponi, 2015).

Among the demand-side changes, population growth is important. The world population is growing at a rate of 1.1% per year, yielding an additional 83 million people annually. The current world population is around 7.6 billion, which is expected to reach 8.6 billion in 2030, 9.8 billion in 2050, and 11.2 billion in 2100 (United Nations, 2017). Given

the population growth rate and supply-side changes in water resources, ensuring food security is one of the significant challenges for the future (Carr and D'Odorico, 2017; Sun et al., 2015). Factors like population growth, economic development, land-use change, and changes in international and national policies have major implications on changing water consumption (Sophocleous, 2004). Although scientific literature on multiple factors of supply and demand-side changes in water resources is available, the changes in food habits (more specifically, changes in diet) and their implication on water resources are less explored (Jalava et al., 2014).

Food habits or diet are recognized as an important factor for the sustainable use of natural resources and future food security (Falkenmark and Lannerstad, 2010; Foley et al., 2011; Jalava et al., 2014; Pimentel and Pimentel, 2003; Rockström et al., 2009). Several studies provide valuable evidence regarding the impact of diet change on freshwater resources. Aleksandrowicz et al. (2016), for example, found that a shift in the dietary pattern can reduce more than 70% of greenhouse gas emissions and 50% of water use. By employing an inter-regional input-output model of the world economy, Springer and Duchin (2014) showed that a combination of less resource-intensive diets and improved agricultural productivity could make sustainable use of freshwater resources. By analyzing the Water Footprint (WF) of 13 primary crop and animal products in China, Sun et al. (2015) concluded that adjustments to diet patterns (providing enough calories and nutrition) have significant effects on agricultural water usage and, eventually, the change in diet pattern can potentially alleviate stress on water resources. Liu and Savenije (2008) identified the impact of food consumption patterns on China's already stressed water resources. They reported that due to an increase in the consumption of animal products, the water requirement for food was reported to increase from 255 m3/cap/year in 1961 to 860 m3/cap/year in 2003. A study (Liu et al., 2023) reported that such dietary restructuring increases pressure on water resources. Some recent studies (Hossain, 2010; Mottaleb et al., 2018a; Mottaleb et al., 2018b) assessed the changing food consumption in Bangladesh due to changes in income and urbanization. A recent study (Jia et al., 2023) also investigated the drivers of food consumption patterns in Bangladesh. Mukherjee et al. (2011) assessed that due to a change in food consumption pattern, the total consumptive water use would increase by 33% and 57% in the years 2030 and 2050, respectively, with respect to 2001.

The shift in dietary practice and its impact on water resources is not well recognized in any policy or plan in Bangladesh. Bangladesh prepared a 25-year National Water Management Plan (NWMP) in 2001 (WARPO, 2001). As the next plan is due in 2025, preparatory work for that plan is expected to

start soon. This study aims to assess the impact of observed dietary change on future water stress and provide policy directions to achieve sustainable water resources management in Bangladesh. The results of this study aim to contribute to and support the formulation of the next NWMP.

2 Methods

The food we choose is determined by multiple factors such as biological (e.g., hunger, appetite, and taste), economic (e.g., cost, income, availability), physical (access, education, cooking skill, time), social (e.g., culture, family), psychological (e.g., mood, stress), and spiritual (e.g., beliefs) (Leng et al., 2017). In Bangladesh, the primary drivers of dietary changes are population growth, urbanization, and economic development (Waid et al., 2018). We analyze these three drivers' historical trends and future projections based on available data from the Bangladesh Bureau of Statistics (BBS), the World Bank, and the United Nations. Then, we assess the trend of agricultural production by using data from the BBS, Department of Livestock Services (DLS), Department of Fisheries (DOF), and the World Bank.

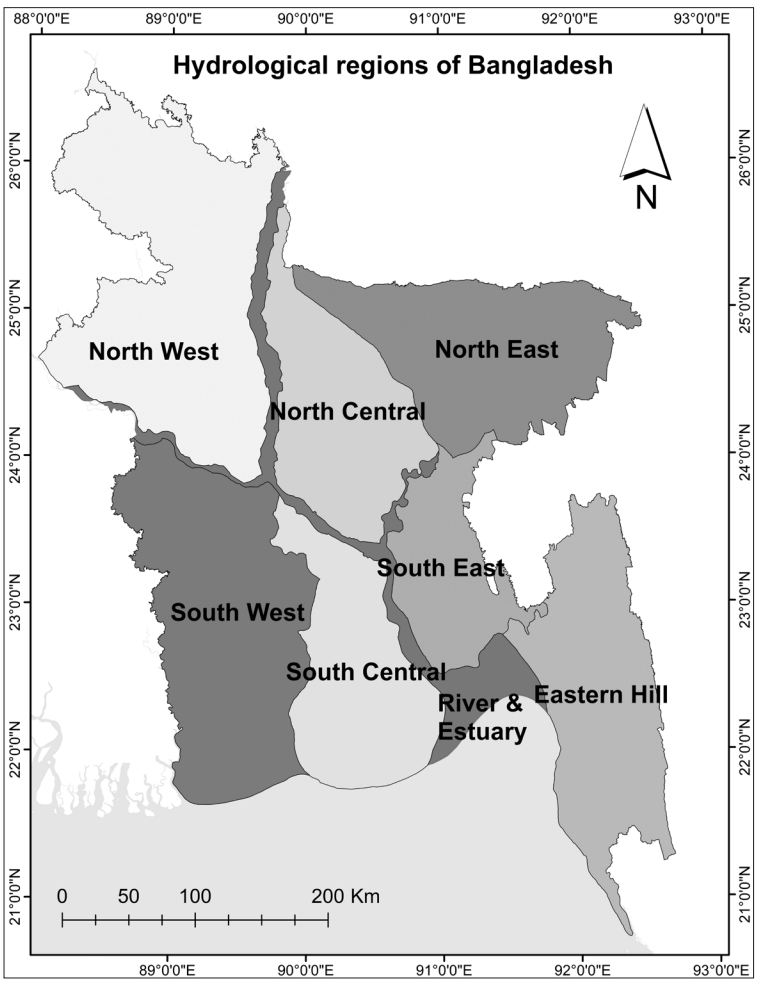
We assess the consumption pattern of major food items in Bangladesh using data from the BBS Household Income and Expenditure Survey (HIES) for the years 1995, 2000, 2005, 2010, 2016, and 2022. To evaluate the impact of dietary change on water stress, we assess the water footprint (Hoekstra and Mekonnen, 2012) for 2001 and 2025, the beginning and the end year of NWMP. The year 2025 is the last year of the current NWMP and, therefore, may be considered the base year for the next plan. We consider two main food items (i.e., rice and meat) for the analysis, as they have the primary water consumption. Based on the projected GDP of Bangladesh, the consumption and water footprint for two major food items (i.e., rice and meat) are projected for the year 2025.

As there is no direct measurement or reported water footprint for different food products in the context of Bangladesh, we adopted the water footprint for rice and meat from published and available national and global datasets. For rice, the water footprint of 3,404 m3/ton was used as per the most recent estimation for Bangladesh from a previous study (Mullick and Das, 2021). The water footprint of meat from beef cattle (15,400 m3/ton as a global average) is much larger than the footprints of meat from sheep (10,400 m3/ton), pig (6,000 m3/ton), goat (5,500 m3/ton) or chicken (4,300 m3/ton) (Chapagain and Hoekstra, 2011). In HIES 2022, per capita per day consumption for beef, mutton, and chicken/duck is 11.66, 1.28, and 26.17 gms, respectively. Thus, the consumption rate for beef,

mutton, and chicken is 29.8%, 3.3%, and 66.9% of total meat consumption. Therefore, WF for meat for Bangladesh can be assumed as (15,400 × 0.298) + (5,500 × 0.0128) + (4300 × 0.669) =7537 m3/ton by combining global and national datasets. Based on these WF and consumption patterns, the changed stress on future water resources management is assessed. The future policy directions are then suggested to ensure sustainable water resources management and the food-secured future of Bangladesh.

The NWMP delineated the country into eight hydrological regions: Northwest (NW), North Central (NC), Northeast (NE), Southeast (SE), South Central (SC), Southwest (SW), Eastern Hills (EH), plus the active floodplains and islands of the Main Rivers and Estuaries (RE) (See Figure 1).

Figure 1: Hydrological regions of Bangladesh



NWMP carried out water balance for these hydrological zones based on the demand and supply of water resources of each zone. The above-mentioned policy directions are discussed in the context of these hydrological regions.

3 Impact of dietary changes on water resources in Bangladesh

Population growth

The total population of Bangladesh was around 170 million in 2022, with an average annual population growth rate of 1.12% (BBS, 2023). There has been a decreasing trend in population growth, and the decreasing trend is expected to continue due to social awareness, economic improvements, and other interventions. The UN projection for the future population for the year 2025 will vary between 174 and 183 million (United Nations, 2017).

Urbanization

While experiencing a decreasing trend in population, Bangladesh has experienced a sharp rise in urbanization in the last few decades. Currently, the urban population is about one-third of the total population (BBS, 2023). According to the UN projection, by 2035-2040, the urban population of Bangladesh will exceed the rural population. This increase in the urban population has a direct implication for future food security and water resources management. NWMP (WARPO, 2001) reported that the urban population tends to consume varied diets, with consumption of 16-23% less rice and more non-food grain items than the rural population. The urban population tends to consume more processed food, livestock, and horticultural products.

Economic development

Bangladesh became a lower middle-income country in 2015. The country has experienced a remarkable improvement in its economy over the last few decades. The per capita income increased from 410 USD in 2001 to 2,688 USD in 2022 (World Bank, 2023). Economic improvements in the population have a direct influence on food consumption. NWMP (WARPO, 2001) reported that with increased income, consumers take more wheat (in the form of bread or noodles) and more livestock products, vegetable oils, and other higher–valued food items.

Agricultural production trend in Bangladesh

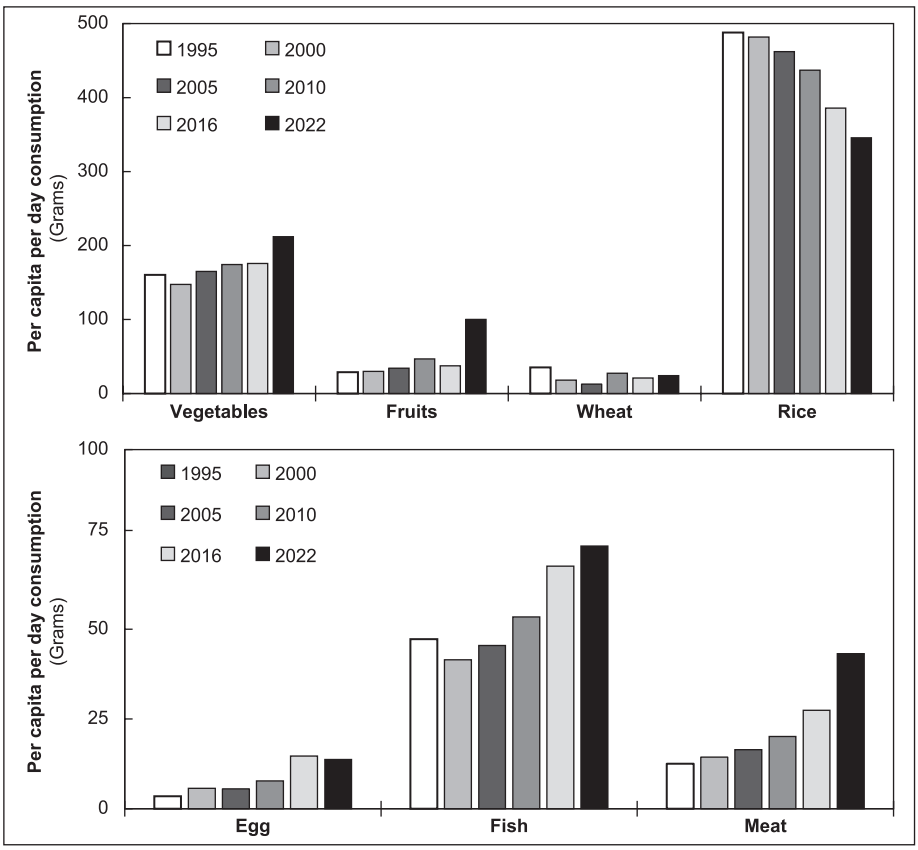
Bangladesh has experienced remarkable progress in the agriculture sector. Though the arable agricultural land is decreasing at an alarming rate of 1% (CSIRO, 2014; Quasem, 2011), the crop yield rate and total production show an increasing trend. There is a potential for further increase in crop yield in the future (CSIRO, 2014). In fishery production, Bangladesh ranked 3rd in inland open-water capture production and 5th in world aquaculture production (FAO, 2022). The fisheries sector contributes 2.41% of the national GDP and 21.52% of the agricultural GDP. During 2021-22, the total fish production increased by 55.4% compared to 2010-11 (MOFL, 2023). Moreover, during 2022-23, meat, milk, and egg production increased by 92.7%, 131%, and 130% compared to 2013-14, and the livestock sector solely contributed to 16.5% of the agricultural GDP (MOFL, 2017; MOFL, 2023). This changed scenario has important implications as the agriculture sector is the principal water user of the country and accounts for 88% of total water use (Rahman and Mondal, 2015). Annual water uses for irrigation vary from 25 to 33 km3, of which 80% is based on groundwater.

Change in food habits in the last few decades in Bangladesh

Due to the population increase, urbanization, and economic improvements, the food habits of the people of Bangladesh have changed dramatically over the last few years. Growth in the country's GDP, more specifically, the increase in household income, has changed the pattern of food intake of the inhabitants of Bangladesh.

The consumption of major food items and protein items is shown in Figure 2, which denotes that there is a significant amount of change in food habits in Bangladesh. People are consuming more protein-based food compared to staple foods like rice. Per capita, per day meat consumption has increased from 11.6 gm to 40.0 gm from 1995 to 2022. In contrast, rice consumption (per capita per day) has decreased from 464.3 gm to 328.9 gm from 1995 to 2022.

Figure 2: Consumption of major food (top), protein (bottom) items in the last two decades in Bangladesh (Data source: BBS 2023, 2011; WARPO 2000)



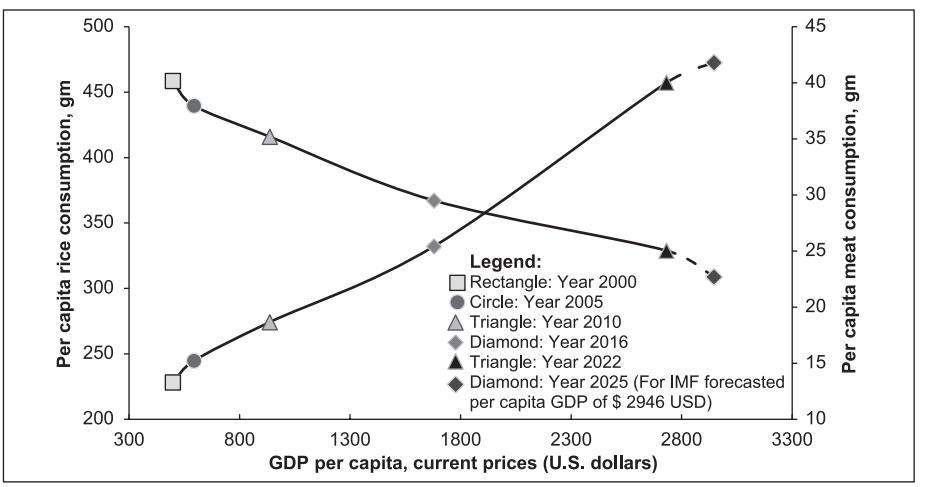
Impact of change in food habits on future water resources

Future population projection, urbanization trend, and economic advancement clearly depict that the ongoing shift in dietary intake will be more pronounced in the near future. Though the NWMP (WARPO, 2001) reported that wheat demand would definitely increase in the future, it stated that there is uncertainty regarding the reduction of rice demand due to the rise in income. However, the recent consumption pattern undoubtedly indicates that rice consumption is decreasing and will follow this trend in the near future. Consumption of animal protein items, such as meat, fish, and eggs, is increasing. This changing dietary pattern has direct implications on water resources management in Bangladesh, where freshwater resources are already reported to be under stress. Such an increase in animal protein consumption trends may put more pressure on water resources. The reason behind this

excess stress on freshwater resources is that one calorie of meat-based food requires 4-10 times more water compared to one calorie of vegetable food (Carr and D'Odorico, 2017; Falkenmark and Rockström, 2004). The global study has reported increased pressure on freshwater resources in the future due to increasing meat consumption. (Hoekstra and Mekonnen, 2012).

To assess the stress on water resources, the consumption rate of two major food items, rice and meat, was calculated for the year 2025. This was done based on the consumption rate over the last few decades and corresponding per capita GDP, as the dietary pattern is largely influenced by the household income. As per the International Monetary Fund (IMF) projection, the per capita GDP for Bangladesh will be around 2,946 USD in 2025. Based on this projection, the projected rice and meat consumption will be about 309 gm/capita/day and 42 gm/capita/day, respectively.

Figure 3: GDP and consumption of rice and meat trend in Bangladesh



Considering the projected population of 181 million in 2025, total rice and meat consumption for the year 2025 will be around 20.41 Million Tons (MT) and 2.761 MT, respectively. As per HIES data, rice and meat consumption in 2000 were 458 gm/capita/day and 13.3 gm/capita/day, respectively. For a population of 129 million, the total rice and meat consumption was around 21.73 MT and 0.63 MT, respectively. During the NWMP period (2001-2025), the total consumption of rice will decrease by 1.32 MT, and meat consumption will increase by 2.13 MT. Using the water footprint value as described in the methodology, we calculated the water footprint (WF) for rice and meat in Bangladesh. The change in WF for rice and meat consumption between the years 2001 and 2025 is shown in Table 1.

Table 1: Change in WF due to change in consumption of two food items between 2001 and 2025

	Total Demand in 2001 (Million Tons)	Total Demand in 2025 (Million Tons)	Per unit water footprint (WF) (m^3 water per Ton)	WF in 2001 (× 108 m^3)	WF in 2025 (× 108 m^3)	Change in WF between 2001 and 2025 (× 108 m^3)
Rice	21.73	20.41	3404	739.5	694.4	45.1
Meat	0.63	2.76	7537	47.3	208.1	-160.7

Note: Here, a positive change in WF value means the water-saving condition in 2025 compared to 2001 and vice versa.

From Table 1, it appears that around 45.1 × 108 m^3 of water will be saved due to decreased rice consumption, and 161 × 108 m^3 of water will be required in excess due to increased meat consumption during 2025 compared to the year 2001. Thus, in this 25-year period, the extra stress on freshwater resources can be as high as 116 × 108 m^3 due to the diet change of those two food items.

Based on water demand and supply for A1B and A2 climate scenarios in the Brahmaputra river basin, Gain and Wada (2014) found that during the dry season (November to May), water scarcity is expected to increase in the future years, although the country is one of the water abundant regions of the world. The analysis of Gain and Wada (2014) did not incorporate changes in food consumption patterns. Therefore, the HIES reported that the food consumption pattern would cause additional scarcity compared to the estimated one during dry periods for the Brahmaputra river basin. This remains true for estimated dry season water scarcity for other hydrological basins of Bangladesh and needs to be considered in future assessments.

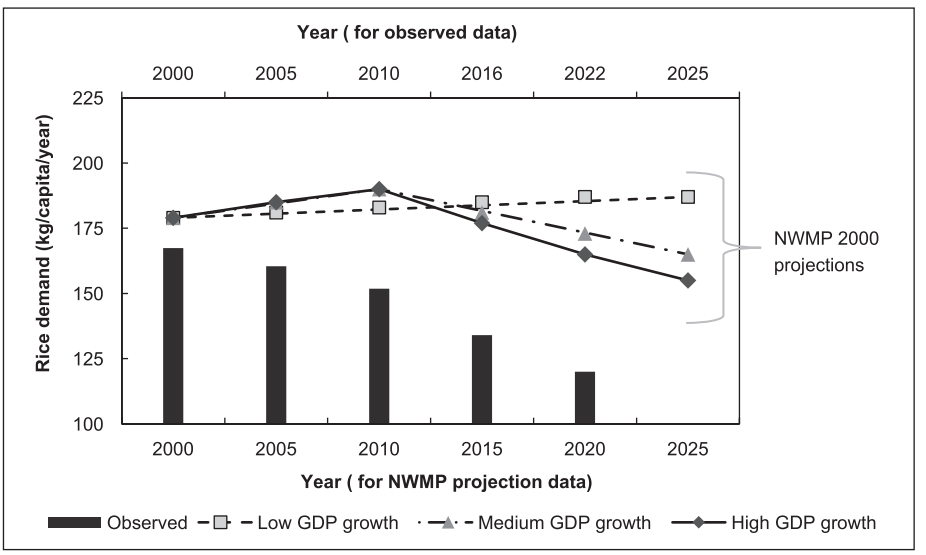
4 Policy implication

Incorporation of the impact of food habit change in national water resources planning

NWMP (WARPO, 2001) projected the per capita demand of rice up to the year 2025 for three scenarios of GDP growth, as shown in Figure 4. As per the projection, during the year 2025, the per capita rice consumption will vary between 155 and 187 kg per year. However,

the HIES 2022 data reported that the per capita rice consumption had already fallen to 120 kg per year. With the growing economy, the shift towards more protein-based dietary consumption reduces pressure on staple food items such as rice. This dietary change is expected to accelerate in the future and needs to be more accurately addressed in the next NWMP.

Figure 4: Observed and NWMP projection regarding per capita annual rice demand



Shifting of agricultural practices (Paddy) from stressed freshwater regions

Dry-season Boro rice cultivation comprises 90% of the total irrigation demand, while dry-season crop cultivation and supplementary wet-season irrigation constitute the rest of the demands (CSIRO, 2014). A study (Kirby et al., 2013) has reported that groundwater-fed irrigation is around 40% in the SW region and nearly 100% in the NW region of Bangladesh. Thus, overexploitation of groundwater (GW) resources is reported in NW Bangladesh (CSIRO, 2014). To preserve the already stressed surface water system, the cropping pattern can be changed. Moreover, the Government has specific plans to reduce the area of Boro in the NW and increase it in the SW and SC regions. Furthermore, there is a plan to increase the wheat cultivation area in the NW (CSIRO, 2014). Implementing such actions can restore the deteriorated GW systems of NW Bangladesh and provide sustainable agricultural water use in Bangladesh.

Prioritizing agricultural production practices based on future demand

Though several past studies (Huang and David, 1993; Ganesh et al., 2012) reported a positive income elasticity for rice in Bangladesh, Mottaleb et al. (2018a) econometrically demonstrated that households are consuming more wheat and less rice with increasing income and urbanization. Our assessment shows the same trend of decreasing rice consumption practices. Bangladesh is now self-sufficient in rice production to meet its local demand, but around 70% of the wheat is imported. As economic improvement and urbanization will be more in the future, wheat cultivation and extension should be prioritized at the policy level, thus creating opportunities to reduce pressure on the water resources system. Otherwise, importing an increasing amount of wheat in future years may not be a sustainable solution to ensuring food security in Bangladesh, which is already evident during the recent global food grain crisis and the consequent pressure on the country's foreign currency reserve. Similarly, there should be a specific plan to enhance the cultivation of other food grains and protein-based food items, as consumption will increase in the future.

Livestock farming in agricultural water surplus regions

For the water resources planning during 2001-2025, the NWMP considered the demand for rice but not the demand for meat, a major water-consuming food item. For the updating of NWMP by 2025, it needs to focus on livestock production and fulfilling the water requirement for livestock production.

NWMP assessed the water availability for different regions of Bangladesh. Regions like SW, NC, SE, and Eastern hilly regions are reported to be water-deficient during the dry season. Regions like SC, NW, and NE were reported to have surplus water during the dry season. However, regions like NW are mostly GW-dependent, and the augmentation of livestock farming is not advised in this region. On the other hand, regions like NE are abundant with freshwater and have vast barren land where agricultural practices like rice and wheat cultivation are not that popular. During the dry season, vast agrarian land remains barren in this region. Despite this, only 9.3% of the total livestock and poultry production takes place in Haor areas (BARC, 2023). The Master Plan of Haor Areas (BHWDB, 2012) has identified that traditional livestock farming is in practice in the NE region, which is suffering from various problems. This master plan also illustrated that commercial livestock

farming had not been developed yet. As there is an increasing trend of consuming protein items, those barren lands can be utilized for large-scale livestock farming using modern scientific techniques to avoid loss due to infectious diseases or others. Moreover, such livestock farming may reconstruct the economy of this region, which is often reported as lagging behind the national development pace.

The water requirement for livestock development is always neglected in the livestock policy of the country, such as in MOFL (2007). The policy also did not mention the region-specific development plan for a sustainable outcome. All sectoral policies and plans need to duly consider the water and land required for sustainable development.

Promoting fish consumption and production

As a Bengali adage goes, Bangalis are mache-bhate bangali (a nation of fish and rice). The country is situated in a delta with large water bodies, including three of the world's largest rivers, namely the Ganges, Brahmaputra, and Meghna, and their floodplains. These water bodies support very high fish production along with many species. The country is self-sufficient in fish production, and 60% of the animal protein intake of its citizens is derived from fish (Planning Commission, 2015). It still has vast potential to increase fish production (WorldFish, 2020). Fish also have a negligible water footprint compared to livestock (Joyce et al., 2019). Moreover, water use for fish is mostly non-consumptive.

On the other hand, the sustainability of livestock production has been a significant concern due to its large water and carbon footprint (Smith, 1996). Various policy instruments are in place in many countries, discouraging the consumption and production of livestock (Mehrabi et al., 2020). Therefore, from a sustainability point of view, it may be beneficial for the country to focus on fish consumption and produc-tion instead of livestock to fulfill most of the animal protein needs of its people.

Required synergies with relevant national policies

In our country, food security has traditionally been synonymous with the security of rice, leading our policies to focus primarily on this staple. However, with rapid socio-economic development, food habits are changing quickly, and our national policies must evolve to reflect this shift. Future policies should aim towards establishing a balanced consumption and sustainable production of rice, fish, and meat.

The relevant policies that need to reflect such a changed narrative are National Food and Nutrition Security (NFNSP) (GoB, 2021), National Agriculture Policy (NAP) (GoB, 2018), National Fisheries Policy (NFP) (GoB, 1998), and National Livestock Development Policy (NLDP) (GoB, 2007). One of the objectives of the NFNSP is to ensure the availability of safe and nutritious food for healthy diets, and it recognizes that livestock and fisheries have multiple roles in food security. The updated versions of other policies must align with the objectives outlined in NFNSP and consider freshwater availability across different regions of Bangladesh. We suggest a few entry points here.

Overall, these policies must acknowledge and address the diverse water availability across the nation's regions. The Agriculture Policy addresses changing food habits and advocates the production of nutritious crops like vegetables, fruits, etc. One of the principal planning tools in this regard is crop zonation. The NAP recommends crop zonation based on soil characteristics; however, integrating water resources consideration in such zoning is equally important. Fisheries policy should emphasize capture fisheries rather than the current focus on aquaculture. The livestock policy should also adopt zonation and encourage free-ranging livestock development in haor areas and char lands to enable enhanced livestock production while considering sustainable use of the nation's water resources.

5 Conclusions

With the economic development of Bangladesh, a sharp shift in dietary patterns is being observed. The water footprint for livestock is thus becoming more important due to this dietary change. Though Bangladesh is now self-sufficient in rice production, the current dependency on protein-based food will push toward more animal-based protein production in the near future. However, the extent to which our existing strained freshwater resources will react to such a shift is relatively unknown at the policy level. In this study, we assess the impact of dietary changes on water resources in Bangladesh using a water footprint approach. We found that the consumption of rice decreased more than what NWMP projected, while the consumption of animal protein, which requires more water, is increasing. Due to changes in the dietary pattern, an extra amount of 11,600 million m3 of water may be needed annually by 2025. As the dry season is known for freshwater scarcity in Bangladesh, these dietary changes would cause additional water scarcity, especially in the northwest part of the country.

The issue of changing dietary patterns was not considered when the NWMP was formulated in 2001, although projections were made. In order to address the impact of dietary change, we provide the following policy recommendations for the next NWMP: incorporation of the effects of food habit change in national policies, shifting of agricultural practices from water-stressed regions, prioritizing agricultural production practices based on future demand, livestock farming in water surplus regions and putting more emphasis on fish production than on livestock production for fulfilling protein needs. We suggest incorporating these policy recommendations in the revised NWMP, which is expected to be updated in 2025. The impact of such a diet change must be immediately included in all agriculture and water resources-related policies and plans. Accounting for the effects of change in food habits will help to achieve a future sustainable water resources management plan in Bangladesh.

In this study, we have a few limitations. First, we consider only two main food items, i.e., rice and meat, while assessing dietary changes. For a comprehensive assessment, more food items need to be considered. A detailed assessment of the change in consumption patterns of all major food items is needed to quantify stress on freshwater resources more precisely in the next NWMP, and this can be assessed based on hydrologic regions, as dry season water stress varies across hydrologic regions of Bangladesh. Second, the water footprint assessment for rice and meat is based on global literature rather than Bangladesh-specific values. This implies that the projected water stress based on available studies might vary for Bangladesh. However, we believe this variation will be minor, and still, the projections on future water stress are highly useful for formulating the upcoming National Water Management Plan by 2025. Third, the projection of dietary change and future water stress is limited until 2025 in order to feed the next NWMP. More longer-term projections might be feasible for achieving Sustainable Development Goals and climate change adaptations. However, the calculated value for the long-term period can fluctuate highly due to uncertainty regarding the economy and technological advancement. Through consistent, plausible scenarios of the future economy and technological development, such long-term projections can be accomplished. Considering these limitations, further research is needed to develop sustainable water and agricultural management policies.

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Nexus of Change Management and Effective Teaching During and Post-COVID-19 Pandemic: A PLS-SEM Approach

Mohammad Ekramol Islam[1], *Md. Mominur Rahman*[2], *Serena Aktar*[3], *Prince Das*[4]

Abstract

This study aims to assess the factors of change management in teaching during and after the COVID-19 pandemic. A structured questionnaire was developed and pre-tested, yielding a sample size of 132 participants selected through convenience sampling. The data were analyzed using path analysis with Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that while organizational and structural changes do not significantly affect change management, technological change has a positive impact. Furthermore, effective change management is shown to positively influence teaching effectiveness. These insights emphasize the necessity for organizations to invest in change management strategies to facilitate successful implementation. The changes in the educational environment have profound implications for teachers' beliefs and attitudes, which can lead to shifts in teaching practices that ultimately affect student learning outcomes. To adapt to these evolving demands, professional development and training for teachers are essential. Additionally, changes in educational policy and funding can influence the broader social context of education, impacting the quality of education and opportunities available to students.

1 Department of Mechanical Engineering and Treasurer, Sonargaon University, Dhaka, Bangladesh. Email: meislam2008@gmail.com

2 Bangladesh Institute of Governance and Management (BIGM), Dhaka, Bangladesh. Email: mominurcou@gmail.com
Corresponding author: Md. Mominur Rahman. Email: mominurcou@gmail.com

3 School of Business, Uttara University, Dhaka, Bangladesh. Email: serena@uttarauniversity.edu.bd

4 Department of Business Administration, Northern University Bangladesh, Dhaka, Bangladesh. Email: dasprince702@gmail.com

Practically, it is crucial for teachers to embrace adaptation to meet new expectations, and adopting learner-centered approaches can significantly enhance student motivation and engagement.

Keywords: Change management; Effective teaching; Organizational culture; Teaching technology; PLS-SEM.

1 Introduction

Organizational change is a critical issue that affects an organization's ability to achieve its mission. By adapting a set of activities, an organization can move towards a desired state and increase its effectiveness. This set of managerial actions is initiated in response to environmental forces to achieve operational excellence by exploiting opportunities and countering threats. According to Huang et al. (2020), there is a positive correlation between acceptance of change and change in actions. As a result, organizations take initiatives to neutralize resistance and ensure greater acceptance of change, which is positively related to implementation effectiveness.

Since the COVID-19 lockdown began in March 2020, countries have implemented significant measures to contain the spread of the virus. Firstly, the international community closed borders and suspended international flights, followed by restrictions on domestic mobility. Secondly, many countries imposed restrictions on individuals below the age of 20 or over the age of 65, prohibiting them from leaving their homes. Thirdly, to protect employees, many countries have banned companies from terminating employment or service contracts for at least three months. As a result, people were compelled to stay at home, and educational institutions underwent a radical change. Teachers around the world had to quickly learn how to set up virtual classrooms, record and upload lessons, and create new online courses. Although the change management process was initially challenging, with the help of each other and online platforms like iReady, Delta Math, and Khan Academy, the learning process improved. For students, the transition to online learning was also a crucial learning experience (Barrows, 1986). However, it was not an easy task for many students in Bangladesh who lack high-functioning devices and fast internet access. Despite the challenges, the learning curves for both teachers and students have been growing positively. While the world was working to create a vaccine and save lives, teachers around the world were striving to bring consistency, clarity, and structure to online education.

To provide quality online education in Bangladesh, factors such as high-volume internet access and electronic devices for teachers

and students are required. Western countries have been using online techniques for years, and it is suggested that Bangladesh's infrastructure needs to be more powerful to support online education. To explore the feasibility of online higher education in Bangladesh, the University Grants Commission (UGC) conducted an online survey of 200 university students from both undergraduate and postgraduate levels using a Likert scale. The UGC separated the research findings into two categories, hardware and software requirements, which included financial problems, digital tools, training for teachers on taking online classes, lack of content, boost in ZOOM application, and facilities of the Bangladesh Research and Education Network (BdREN). Private universities in Bangladesh are ahead of public universities as they started e-learning at the beginning of the pandemic, and they are providing IT support to students and faculty to conduct classes smoothly. Conducting classes smoothly refers to the seamless operation of online teaching and learning processes, ensuring minimal disruptions and an effective learning environment. This involves reliable technology, clear communication, user-friendly platforms, and readily available support for any technical issues.

Rahman et al. (2022) focused on the challenges and prospects faced by the learners during this pandemic situation; the authors tried to identify the variables that affected learners while they were availing online classes and the evaluation process. They also suggested a change management model for overcoming the challenges.

Change is a critical issue for all organizations as it does not always lead to optimized job performance. However, adapting to new activities can enable an organization to move towards its desired state and increase effectiveness (Lunenburg, 2010). Changes are necessary not only for survival but also for remaining competitive in the face of technological advancements and rapid communication. Despite the numerous theories and models for change management (Berger et al., 1994; Bushe & Shani, 1991; Cummings & Worley, 1993; Kanter, 1983; Lewin, 1951; Lippitt, 1958; Schein, 1969), there is no comprehensive guide to successfully managing change. Change management in education involves preparing for upcoming changes and managing the process effectively. Without proper management, change can result in confusion and chaos. Therefore, a set of organized processes, such as informing people why the change is necessary and training them accordingly, must be followed. When implementing change in education, its effectiveness should be estimated before deciding how to organize it at different levels.

Scholars have classified changes as evolutionary, revolutionary, gradual, or radical (Hayes, 2022; Weick & Quinn, 1999). This paper specifically focuses on revolutionary or radical changes and aims to assess the factors that affect change management from the perspective of teachers. The study seeks to address two primary research questions: 1.) What are the factors that affect change management in educational institutions? 2.) What is the relationship between change management and effective teaching? By exploring these questions, the research aims to uncover the critical elements that influence successful change initiatives and how these initiatives impact teaching practices and educational outcomes.

This paper makes a significant contribution to the existing literature by providing a comprehensive examination of the factors influencing change management within the framework of effective teaching during and after the COVID-19 pandemic. While prior research has investigated change management in various organizational contexts, there remains a considerable gap in understanding its specific ramifications in educational settings, particularly in light of the abrupt transition to online learning (Gutiérrez et al., 2022; Zhang & Diao, 2023; Fawaz et al., 2021). By analyzing both phases of the pandemic, this study offers a nuanced comparative analysis that illustrates how change management practices have adapted in response to immediate challenges and have evolved into long-term teaching methodologies.

Moreover, the research uncovers critical insights into how these changes have influenced educators' beliefs, attitudes, and overall teaching effectiveness. This exploration of the intricate relationships between change management and effective teaching not only enriches the academic discourse on the subject but also highlights the pressing need for educational institutions to develop robust change management strategies (Gupta, 2021; Sung & Kim, 2021). By addressing these crucial dimensions, the paper not only fills a vital gap in the literature but also provides actionable strategies for educational leaders and policymakers. These strategies are essential for guiding institutions through future disruptions, thereby ensuring that they can maintain educational quality and adapt effectively to ongoing changes in the learning environment.

2 Literature review

The concept of organizational change has been a focus of management scholars since the late 1980s and early 1990s, especially as they sought to understand why American companies struggled to compete with Japanese firms (Schein, 1990). Organizational change reflects the processes and adjustments that organizations undergo in response to internal or external pressures.

Organizational change is more than just adjustments initiated by top management; it involves shifts in the everyday practices and behaviors of all employees, from leadership to staff (Raza et al., 2018). The alignment between an organization's culture and its change management strategies is critical for ensuring that change is effectively managed. This is because organizational culture establishes the foundation for how change is perceived, accepted, or resisted by employees. Research suggests that an organization's ability to manage change is closely tied to its culture, as certain values and beliefs may either support or inhibit the implementation of change (Ojo, 2010).

During the COVID-19 pandemic, educational institutions worldwide faced unprecedented challenges that required significant organizational change to ensure the continuity of teaching and learning (Nabokikh et al., 2020). One of the most critical changes was the rapid shift from traditional in-person instruction to online and hybrid learning environments. This transformation necessitated not only technological adaptations but also shifts in organizational processes, communication structures, and teacher-student interactions. Teachers had to quickly adapt to new digital tools, learning management systems, and virtual teaching platforms, which fundamentally altered the traditional classroom dynamics. Institutions that embraced flexible organizational structures were able to provide timely training for teachers, invest in necessary technological infrastructure, and establish new protocols for virtual classrooms.

Moreover, Baker (2002) highlighted that the concept of organizational culture became prominent in the early 1980s, with scholars such as Deal and Kennedy (1983) suggesting that a strong corporate culture is essential for managing organizational change effectively. When an organization's culture supports adaptability, it can ease the resistance to change and foster a more seamless transition, enabling the organization to align its structure, strategies, and processes with evolving external demands. Thus, organizational change is inherently associated with change management, as the effectiveness of managing change is often determined by the underlying culture that supports or resists these efforts.

In the context of Bangladesh, the COVID-19 pandemic led to significant organizational changes in the education sector, particularly regarding the adoption of online learning. The sudden shift to virtual classrooms exposed existing infrastructural challenges, such as inadequate access to high-speed internet and the lack of digital devices for both teachers and students (Islam, 2023; Al-Amin et al., 2021). To manage this change, many educational institutions, particularly private universities, were quicker to adapt by providing IT support, training educators to navigate digital tools,

and modifying teaching methods to suit the online format (Gezer, 2023). Teachers had to shift from traditional teaching methods to conducting classes through platforms like Zoom and Google Meet, which required significant organizational restructuring in terms of communication, resource allocation, and training (Tahar et al., 2021).

Public universities faced a slower transition due to infrastructural limitations and the lack of widespread digital literacy among teachers and students (Al-Amin et al., 2021). However, institutions, with support from government bodies like the University Grants Commission (UGC) and the Bangladesh Research and Education Network, gradually introduced policies and training programs to facilitate online learning (Islam, 2023; Al-Amin et al., 2021). The pandemic brought structural changes in teaching strategies, requiring more collaboration among faculty and administrators to ensure continuity in education (Tejedor et al., 2020). Post-pandemic, many institutions continued to use hybrid teaching models, demonstrating how organizational change during the pandemic has had a lasting impact on effective teaching in Bangladesh (Islam, 2023). These changes underscore the importance of organizational adaptability in navigating crises and fostering a more resilient educational environment for both teachers and students (Tejedor et al., 2020).

This relationship is further reinforced by the research of Raza et al. (2018), which demonstrated a positive and significant link between organizational culture and employee performance. As organizational changes unfold, management must recognize the crucial role culture plays in shaping the outcomes of change management initiatives. A supportive organizational culture can help manage change more effectively by fostering collaboration, innovation, and open communication, all of which are essential to achieving successful outcomes in educational settings.

H1: Organizational change affects change management in effective teaching

Understanding organizational structure is essential because it functions as a sub-system within the broader management system. Organizational structure refers to the formal division, grouping, and coordination of tasks and roles within an organization (Habte, 2020). It encompasses the system of rules, authority, and tasks that dictate how individuals collaborate to achieve the organization's objectives (Usman et al., 2011). In educational institutions, this structure includes vertical and horizontal interactions between different work units, describing how tasks are divided, how communication flows, and how cooperation is maintained across various levels (Pidarta, 2011).

The COVID-19 pandemic brought about significant structural changes in educational institutions globally, including in Bangladesh. As educational institutions were forced to close, the traditional classroom model of teaching was abruptly replaced by online and remote learning systems (Islam, 2023; Al-Amin et al., 2021). This shift demanded rapid adjustments in organizational structures to support new methods of instruction. In Bangladesh, where digital infrastructure was not as robust, educational institutions faced immense challenges. Schools and universities had to restructure their internal systems to accommodate remote teaching, which involved reorganizing communication channels, redefining roles, and reallocating resources.

Structural changes, which involve adjustments in roles, responsibilities, or lines of communication, are a fundamental aspect of organizational change management. These changes have a direct impact on how efficiently institutions operate and, by extension, on their ability to implement change effectively. As noted by Habte (2020), organizational structure affects employee performance and job satisfaction, which are influenced by personal preferences and cultural norms. Changes in structure, such as the reorganization of work units or the delegation of authority, can lead to improved task performance and communication patterns (Colquitt et al., 2014).

Key structural changes included the establishment of virtual teaching platforms, the introduction of digital tools like Zoom and Google Classroom, and the reallocation of administrative duties to support online learning environments (Islam, 2023; Al-Amin et al., 2021). Teachers, who traditionally worked within the confines of a physical classroom, now had to coordinate with IT staff and management to ensure smooth operations. Additionally, universities had to create new policies for online assessments, student-teacher interactions, and administrative support.

In the context of educational institutions, structural changes can significantly influence teaching effectiveness. A well-designed structure can streamline processes, enhance communication, and improve collaboration between teachers and administrative staff, ultimately fostering a more dynamic and innovative learning environment (Pidarta, 2011). For instance, implementing cross-functional teams where teachers collaborate and share best practices can lead to more effective teaching approaches. Moreover, transparent communication and active teacher involvement during structural changes can facilitate greater acceptance and smoother transitions, promoting a work environment that supports educators and motivates them to deliver high-quality instruction (Robbins & Judge, 2007).

Private universities in Bangladesh adapted more quickly to these structural changes than public universities. They provided IT support to both faculty and students, ensuring smoother transitions to online platforms (Islam, 2023; Al-Amin et al., 2021). Structural changes also involved rethinking the hierarchical dynamics within institutions, with more emphasis on technology support staff, and cross-functional teams working to ensure the continuity of teaching during the pandemic (Tahar et al., 2021). The effectiveness of these structural changes was critical for maintaining the quality of education during and after the COVID-19 pandemic, as institutions had to navigate both the immediate demands of online teaching and the longer-term adaptations required for future disruptions.

Hutabarat (2015) found that both organizational structure and culture directly influence teacher motivation and performance. In particular, there is a significant relationship between organizational structure and effective teaching, with structural changes impacting the ability of teachers to adapt to new teaching methods and organizational requirements. Based on this literature, it is evident that structural changes play a crucial role in managing change effectively within educational institutions.

H2: Structural change affects change management in effective teaching

The importance of technology in education has become even more pronounced in the 21st century, particularly with the rapid technological advancements and the increasing reliance on digital tools for knowledge transfer. The integration of Information, Communication, and Technology (ICT) into education has fundamentally transformed how instruction is delivered and received. This shift has not only changed traditional teaching methodologies but has also reshaped societal norms, influencing how individuals work, think, and learn. In educational settings, ICT refers to the use of computer-based tools to enhance classroom instruction, with teachers playing a pivotal role in integrating these technologies to create more dynamic and interactive learning environments (Arnseth & Hatlevik, 2010).

The technological shift, though initially challenging, opened up new opportunities for enhancing the effectiveness of teaching. Teachers had to quickly adapt to digital tools and platforms, reshaping their pedagogical methods to suit an online format (Al-Amin et al., 2021). This required significant changes in technological infrastructure, including the provision of necessary resources like internet access, devices, and training for teachers on how to effectively use these tools. Furthermore, the reliance on technology continued even after the pandemic, with many institutions

adopting a blended learning approach, combining both in-person and online teaching methods (Islam, 2023; Al-Amin et al., 2021). In Bangladesh, where digital divides still exist, these technological changes highlighted the need for greater investment in ICT infrastructure, especially in rural areas where students faced connectivity issues. Despite these challenges, the integration of technology into teaching methods has the potential to improve educational outcomes by making learning more accessible and interactive (Islam, 2023). Therefore, the technological changes brought about during and after COVID-19 have played a pivotal role in shaping the future of effective teaching in Bangladesh, enhancing both access to education and the quality of teaching.

In the context of Bangladesh, the COVID-19 pandemic accelerated the adoption of ICT in educational institutions, leading to widespread technological changes that impacted teaching effectiveness. Schools and universities were compelled to move online, making ICT the backbone of educational delivery. This shift was not without challenges, especially in regions with limited digital infrastructure. However, the adoption of ICT allowed institutions to continue providing education during the pandemic, ensuring that students remained engaged through virtual platforms, digital resources, and interactive tools. The use of ICT has been shown to improve the quality, accessibility, and efficiency of education, particularly when teachers are trained to leverage these tools creatively and effectively (Albirini, 2006). Prior to the pandemic, the use of technology in Bangladeshi educational institutions was often limited and underutilized, particularly in rural areas. However, during the pandemic, the rapid shift to online learning forced institutions to adopt digital platforms for teaching, significantly altering the educational landscape. Tools such as Zoom, Google Classroom, and Microsoft Teams became essential for delivering lectures and facilitating communication between teachers and students.

The ongoing process of ICT adoption in education offers continuous support for both teaching and learning, facilitating innovative methods for knowledge exploration and interaction. Teachers can now utilize a wide range of digital resources, such as educational videos, data storage systems, online collaboration tools, and the World Wide Web, to enhance student engagement and promote active learning (Finger & Trinidad, 2002). Research consistently indicates that the incorporation of ICT into teaching practices positively impacts the learning process, helping students to develop critical thinking skills and fostering an active learning environment (Jamieson-Proctor et al., 2013; Jorge et al., 2003). As educational institutions in Bangladesh continue to integrate technological

advancements, these changes significantly affect the management of change in teaching methodologies. The effective implementation of technological change has a direct impact on how well institutions manage transitions and improvements in teaching practices. Hence, this study proposes the following hypothesis:

H3: Technological change is closely associated with change management in effective teaching

Effective change management practices are essential to achieving effective teaching, especially in the context of significant changes like those brought about by the COVID-19 pandemic. As organizations adapt to new educational demands, it is crucial to identify the factors that drive these changes and implement appropriate strategies to ensure a smooth transition. Lawrence and Yarlett (1995) emphasize that change managers must create a supportive environment, train and prepare educators for new methodologies, and motivate them to embrace these changes.

There is no universal model for change management; each educational institution has its unique structure and culture that must be considered (Ongaro, 2004). However, a planned approach is critical for successful implementation. It involves conducting a thorough analysis of the institution's current state to recognize and prepare the necessary infrastructure for effective teaching (Yeşil, 2018). As articulated by Jing and Xuejun (2009), organizational change consists of four essential components: people, technology, duty, and structure. This comprehensive view is particularly relevant in educational settings, where the adaptation of new technologies and teaching practices can significantly enhance teaching effectiveness.

Lewin's (1951) three-stage process of organizational change—preparation, implementation, and consolidation—serves as a foundational framework for guiding educational institutions through transitions, particularly during and after the pandemic. Caldwell (2003) identified various change management models that highlight the importance of leadership, organizational culture, and stakeholder involvement in facilitating successful change initiatives. Engaging teachers and ensuring they understand the rationale behind changes are vital for fostering commitment and reducing resistance (Sunal, 1982).

In the Bangladeshi context, effective change management strategies have become increasingly important as educational institutions navigate the challenges of integrating technology and new teaching methodologies. For instance, a faculty development program designed to enhance teaching

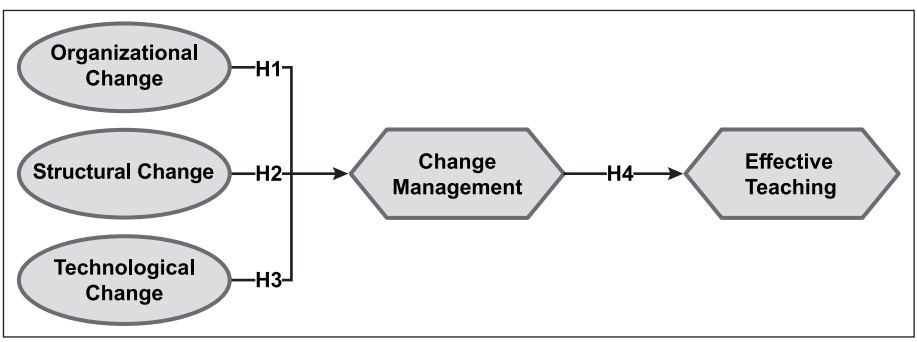
effectiveness has proven beneficial by providing ongoing support and training for educators. Such programs can significantly influence teachers' attitudes towards change and improve their pedagogical practices (Sherbino et al., 2006).

Ultimately, the relationship between change management and effective teaching is underscored by the necessity for leaders to communicate the reasons for changes clearly and engage all stakeholders in the process. By fostering a collaborative environment and equipping educators with the skills and knowledge needed to adapt to change, educational institutions can enhance teaching effectiveness and ensure that learning continues to thrive in the face of challenges.

H4: There is an association between change management and effective teaching

Based on the existing literature, the study develops Figure 1. Figure 1 illustrates the conceptual framework that depicts the relationships among key variables, including organizational change, structural change, technological change, change management, and effective teaching. This framework synthesizes insights from various studies, highlighting how effective change management strategies can facilitate organizational adaptations, enhance teaching practices, and improve educational outcomes, particularly in the context of the challenges posed by the COVID-19 pandemic.

Figure 1: Conceptual model of the research developed by the authors



3 Methodology

In order to ensure the quality of information and knowledge, acceptable and sound social science methods have been employed. Quantitative assessment through surveys and questionnaires serves as the primary

approach to achieve the objectives of the evaluation research. It prioritizes objective measurements, statistical analysis, and numerical data collection to explain phenomena and generalize across groups. This approach produces reliable and factual outcome data, often applicable to larger populations, as identified by Steckler et al. (1992). The study employed a convenience sampling technique, leveraging its practicality and efficiency in accessing participants within a limited timeframe. Data were collected using an online questionnaire survey from January to March 2023, targeting teachers, professionals, and researchers based in Dhaka City. This sampling approach was chosen due to the challenges of gathering data during the post-COVID-19 recovery phase, where accessibility to a broader population was constrained by time and logistical limitations. The respondents were deemed highly relevant to the study as they represent key stakeholders in the education sector, with direct experience and insights into the challenges and adaptations necessitated by the pandemic. Their diverse perspectives provided a robust foundation for examining the nexus between change management and teaching effectiveness, ensuring that the findings are contextually grounded and practically significant.

According to the Bangladesh Education Statistics (2019), the higher education system in Bangladesh encompasses a vast number of students and educators, exceeding 300,000. To ensure a confidence level of 95%, Yamane (1967) recommends a sample size of 400 for a target population exceeding 100,000. Furthermore, to determine an appropriate sample size for multivariate numerical investigation methods, Memon et al. (2021) suggest a sample size between 160 and 300. In consideration of the number of independent variables in this study, Green et al. (2018) propose a rule-of-thumb that $n \geq 50 + 8m$ (for multiple correlations) and $n \geq 104 + m$ (for partial correlations), where n is the sample size and m is the number of independent variables. As such, a minimum of 90 participants would be required for the current study. However, to ensure sufficient data for analysis, information from 132 respondents was collected for this study. A sample size around 150 (132 in this study) offers a balance between acquiring a comprehensive data set and ensuring thorough evaluation and analysis of each response. Therefore, the chosen sample size of 132 respondents embodies a balanced and well-thought-out approach to empirical research in the field of change management in teaching during and post the Covid-19 pandemic. We also interviewed a few experts on change management who are engaging in change management issues in the corporate world in order to pre-test the prepared questionnaire. After getting their affirmative indication, we have collected the data for the present study.

The operationalization of variables in this study involves defining and measuring key constructs related to change management, organizational change, structural change, information technology change, and effective teaching. Change management is assessed through indicators that capture the institution's training efforts, communication practices, staff involvement, and structured approaches to implementing changes. Organizational change is operationalized by evaluating the organization's adaptability, leadership communication, alignment of changes with educational goals, and staff support during transitions. Structural change focuses on collaboration among staff, the smooth implementation of structural adjustments, and clarity in roles and responsibilities. Information technology change is measured by examining the management of technology integration, training adequacy, alignment of technological changes with pedagogical objectives, and the overall enhancement of teaching and learning experiences. Finally, effective teaching is operationalized through a range of indicators reflecting diverse teaching methods, alignment with student needs, feedback mechanisms, classroom engagement, organization of lessons, assessment practices, use of technology, creation of inclusive environments, professional development efforts, responsiveness to student feedback, and contributions to student success. These operational definitions facilitate a comprehensive analysis of the relationships among these variables in the context of effective teaching during and after the COVID-19 pandemic in Bangladesh. Table 1 shows the measurement items.

Table 1: Measurement scales

Variables	Item Sign	Items
Change Management	CM1	Training programs for staff are effectively implemented.
	CM2	Communication regarding changes is clear and timely.
	CM3	Staff members are actively involved in the change process.
	CM4	There is a structured approach to managing changes.
	CM5	Feedback mechanisms are in place to assess the effectiveness of changes.
	CM6	The organization supports staff during transitions.

(Contd.)

(Table 1 continued)

Variables	Item Sign	Items
Organizational Change	OC1	The organization adapts well to changes in the educational environment.
	OC2	Leadership effectively communicates the rationale behind changes.
	OC3	Changes align with the overall educational goals of the institution.
	OC4	Staff members feel supported during organizational changes.
	OC5	There is a positive attitude toward changes among staff.
Structural Change	SC1	Collaboration among staff improves during structural changes.
	SC2	The implementation of structural adjustments is smooth.
	SC3	Roles and responsibilities are clearly defined during changes.
	SC4	There is an improvement in communication patterns as a result of structural changes.
Information Technology Change	ITC1	Technology integration in teaching is well managed.
	ITC2	Adequate training for staff on new technologies is provided.
	ITC3	Technological changes align with pedagogical objectives.
	ITC4	The use of technology enhances teaching and learning experiences.
Effective Teaching	EOC1	Diverse teaching methods are employed to meet student needs.
	EOC2	Lessons are well organized and engaging for students.
	EOC3	Feedback is regularly provided to students on their performance.
	EOC4	Students are actively engaged in classroom activities.
	EOC5	Assessment practices effectively evaluate student learning.
	EOC6	Technology is effectively utilized in teaching practices.
	EOC7	An inclusive environment is created for all students.
	EOC8	Professional development opportunities are pursued to enhance teaching skills.
	EOC9	Responsiveness to student feedback is prioritized in teaching practices.
	EOC10	Contributions to student success are emphasized in teaching approaches.
	EOC11	There is a continuous effort to improve teaching effectiveness.

The formulation of the scales followed a rigorous process to ensure validity and reliability in measuring the constructs of interest. Initially, a comprehensive literature review identified key dimensions and indicators associated with each variable, including Change Management, Organizational Change, Structural Change, Information Technology Change, and Effective Teaching. Based on these insights, a draft of items was developed, emphasizing clarity and relevance to the context of effective teaching during and after COVID-19 in Bangladesh. Each item was carefully crafted to reflect the nuances of the constructs and was subsequently subjected to expert review to gather feedback on content validity. The refined items were then tested through a pilot study with a sample representative of the target population. This pilot testing allowed for the assessment of the scale's reliability and provided opportunities for further revisions based on participant responses. The final version of the scales incorporated adjustments from the pilot study, ensuring that the items effectively captured the intended constructs and contributed to robust data collection.

In this research work, the Statistical Package for Social Sciences (SPSS), Version 25, was used for the analysis of descriptive quantitative data. The software is an excellent choice for preliminary data analysis, including checking data distributions and missing values. SPSS is also user-friendly and offers a broad range of statistical tests. For the exploration of complex models and the testing of causal interactions, the most appropriate option is Partial Least Squares Structural Equation Modeling (PLS-SEM), as noted by Alshurideh et al. (2020). This approach allows for the simultaneous analysis of both the measurements and structural models, resulting in more accurate estimations of the construct reliability and validity (Deb et al., 2022; Rahman, 2023; Rahman & Akhter, 2021; Rahman et al., 2021). In this study, the two-stage approach recommended by Hair Jr (2006) was used. First, the measurement model was analyzed to test the reliability and validity of different model variables and confirm the outer model's excellence. Second, the structural model was assessed to test the significance of the relationships within the inner model, describe the variance of the endogenous variables, and test the hypotheses.

4 Results

4.1 Measurement model

The measurement model of the present study, which includes all the items, is depicted in Table 2. To meet the first criterion, the square root of each

latent variable's average extracted variance (AVE) was calculated. The measurement model was evaluated based on two criteria: reliability and validity. Reliability was assessed using both item and internal consistency measures, such as Cronbach's alpha (CA) and composite reliability (CR), to ensure that the constructs are reliable. In addition, the validity of the constructs was evaluated using convergent and discriminant validity, ensuring that the constructs measure what they are supposed to measure and are distinct from one another. It is important to consider both reliability and validity measures to ensure that the data collected is of high quality and can be used to test the research hypotheses accurately.

Table 2 displays all items along with their factor loadings. The reliability of the constructs was assessed using Cronbach's alpha (CA) and composite reliability (CR), which were both above the acceptable threshold of 0.80 and 0.70, respectively, as recommended by Hair Jr (2006) and other researchers. The convergent validity (CV) was also established, as each model item had a significant and statistically meaningful standard loading on its target construct, and the average extracted variance (AVE) values of the model constructs ranged from 0.632 to 0.699, which is higher than the recommended threshold of 0.5 set by Fornell and Larcker (1981). Overall, these findings confirm the reliability and validity of the measurement model for the present study.

Table 2: Measurement model summary

Variables	Indicators	Outer Loadings	CA	CR	AVE
Change Management	CM1	0.811	0.772	0.863	0.678
	CM2	(Dropped)			
	CM3	(Dropped)			
	CM4	0.902			
	CM5	(Dropped)			
	CM6	0.751			
Organizational Change	OC1	(Dropped)	0.728	0.837	0.632
	OC2	0.761			
	OC3	(Dropped)			
	OC4	0.756			
	OC5	0.863			
Structural Change	SC1	0.893	0.849	0.892	0.676
	SC 2	0.710			
	SC3	0.809			
	SC4	0.866			

(Contd.)

(Table 2 continued)

Variables	Indicators	Outer Loadings	CA	CR	AVE
Information Technology Change	ITC1	0.870	0.782	0.895	0.661
	ITC2	(Dropped)			
	ITC3	(Dropped)			
	ITC4	0.751			
Effective teaching	EOC1	0.716	0.792	0.865	0.616
	EOC2	0.859			
	EOC3	0.887			
	EOC4	0.832			
	EOC5	0.875			
	EOC6	(Dropped)			
	EOC7	(Dropped)			
	EOC8	(Dropped)			
	EOC9	(Dropped)			
	EOC10	(Dropped)			
	EOC11	(Dropped)			

KMO test=0.935 and BS test=p<0.001

Note: CA indicates Cronbach's Alpha, CR indicates Composite Reliability, AVE indicates Average Variance Extracted, KMO indicates Kaiser–Meyer– Olkin, and BS indicates Bartlett's Sphericity.

According to Khan et al. (2019), "the factor loadings of the measurement instruments should be greater than 0.50". The factor loadings of all the indicators are greater than 0.50 except OC1, ITC2, EOC6, and EOC9. The factor loadings of all OC4, SC1, SC3, SC4, ITC3, CM1 and CM4E are greater than 0.80. The factor loadings of all the following indicators, that is, OC2, OC5, SC2, ITC1, ITC4, EOC1, EOC2, EOC3, EOC4, and EOC5 are greater than 0.70, and all other measures are greater than 0.60. The factor loadings score less than 0.7 have been discarded, and after reducing items having less than 0.70; the measurement model is represented in Table 2.

In addition, the authors follow the requirements of Kline (2015) and Rahman (2023), where all measurement items in the model are statistically significant at $p < 0.01$. According to Hair et al. (2019) and Fornell and Larcker (1981), "The accepted value for AVE, CR, and a is greater than 0.50, 0.70, and 0.70, respectively". This research finds AVE> 0.63, CR > 0.83, and > 0.70 and confirms the convergent validity of the SEM (Table 3). Additionally, it is crucial to assess a measuring model's constructs' discriminant validity (DV). We estimated the DV for all variables using the heterotrait–monotrait correlation ratio (HTMT) criterion. The DV is

the degree to which one construct is distinct from others. HTMT values close to 1 indicate a lack of discriminant validity. Using the HTMT as a criterion involves comparing it to a predefined threshold. If the value of the HTMT is higher than this threshold, one can conclude that there is a lack of discriminant validity. Some authors suggest a threshold of 0.85 (Henseler et al., 2009).

Table 3: HTMT Matrix

	Change Management	Effective teaching	IT Change	Organizational Change	Structural Change
Change Management					
Effective teaching	0.544				
IT Change	0.808	0.414			
Organizational Change	0.747	0.386	0.758		
Structural Change	0.727	0.342	0.738	0.833	

The current study also passed the Fornell-Larker test criterion for discriminant validity (see Table 4). Our analysis revealed that the model had significant discriminant validity. The maximum HTMT score attained was 0.833, supporting the DV of the constructs. Overall, the components of our model demonstrated reliability and validity (Ansari et al., 2022; Rahman et al., 2021).

Table 4: Fornell-Larcker criterion

	Change Management	Effective teaching	IT Change	Organizational Change	Structural Change
Change Management	0.823				
Effective teaching	0.490	0.836			
IT Change	0.479	0.282	0.813		
Organizational Change	0.704	0.340	0.612	0.795	
Structural Change	0.616	0.325	0.464	0.642	0.822

According to cross-loadings in Table 5, a particular item should have higher loadings on its own parent construct in comparison to other constructs in the study. If an item loads well onto another construct in comparison to its own parent construct, then there are issues of discriminant validity. The difference in loading less than .10 also indicates that the item

is cross-loading onto the other construct and hence could be a threat to discriminant validity (Henseler et al., 2009; Sarstedt et al., 2021). Generally, if the cross-loadings of the items of the two constructs are quite high (i.e., around 0.8), indicating problems with discriminant validity. From Table 5, which represents the cross-loading values of the indicators, we found that there is no issue with discriminant validity.

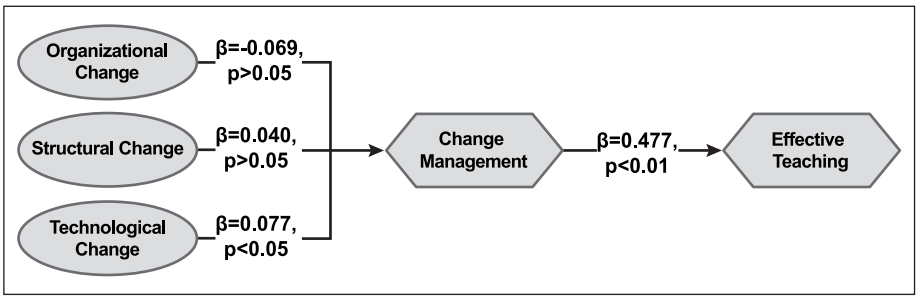
Table 5: Cross-loadings

	Change Management	Effective teaching	IT Change	Organizational Change	Structural Change
CM1	***0.811***	0.306	0.402	0.646	0.639
CM4	***0.902***	0.535	0.373	0.575	0.505
CM6	***0.751***	0.294	0.454	0.559	0.409
EOC1	0.379	***0.716***	0.268	0.432	0.267
EOC2	0.346	***0.859***	0.206	0.207	0.248
EOC3	0.389	***0.887***	0.164	0.236	0.304
EOC4	0.419	***0.832***	0.240	0.246	0.287
EOC5	0.488	***0.875***	0.287	0.302	0.255
ITC1	0.394	0.259	***0.870***	0.417	0.281
ITC4	0.392	0.194	***0.751***	0.614	0.513
OC2	0.479	0.161	0.564	***0.761***	0.512
OC4	0.604	0.231	0.493	***0.756***	0.762
OC5	0.585	0.354	0.463	***0.863***	0.363
SC1	0.617	0.378	0.392	0.613	***0.893***
SC2	0.321	0.115	0.290	0.384	***0.710***
SC3	0.445	0.214	0.365	0.430	***0.809***
SC4	0.531	0.244	0.465	0.606	***0.866***

4.2 Structure model

The data were first examined for potential issues with multicollinearity before evaluating the structural model. The correlation analysis indicated that the highest correlation coefficient between the latent components was 0.495, indicating the absence of multicollinearity. Additionally, the reliability of each variable was assessed using the variance inflation factor (VIF), and all values were well below the maximum threshold of 5.00. Therefore, it was confirmed that there was no multicollinearity in the model, making it suitable for PLS-SEM analysis. To test the proposed hypotheses and evaluate the structural model, we used SmartPLS 3.3.3 software, as shown in Figure 2.

Figure 2: Structure model analysis



Because PLS-SEM does not provide global goodness-of-fit measures, the researchers evaluated the fitness of the model and SEM performance by utilizing several indicators: "Standardized Root Mean Squared Residual" (SRMR), "f-square" (f^2), "Normed Fit Index" (NFI), and "R-square" (R^2). The results can be found in Tables 6 and 7. It is worth noting that the R^2 values for the effective teaching in Table 5 exceeded 0.1.

Table 6: Model evaluation

	R-square	R-square adjusted	f-square
Change Management	0.434	0.429	0.345
Effective Teaching	0.495	0.219	0.442

Table 7: Model fit

	Saturated model	Estimated model
SRMR	0.072	0.072
d_ULS	1.768	1.768
d_G	0.674	0.674
Chi-square	471.330	471.330
NFI	0.639	0.639

To further evaluate the model's fitness, the PLS-SEM SRMR was employed (Table 7). The results showed that the SRMR value was 0.072, which is below the maximum threshold of 0.08. Therefore, based on the findings of Hair et al. (2019), the model demonstrated a good fit.

4.3 Hypothesis testing

According to Table 8, the coefficient for the relationship between Organizational Change and Change Management is -0.069, with a t-statistic of 0.428. The confidence intervals (CI) range from -0.377 to

0.249, which includes zero. Therefore, the hypothesis that Organizational Change positively influences Change Management is not supported. This suggests that in the context of this study, changes within the organization do not significantly impact how change is managed, indicating a potential disconnect between organizational shifts and the effectiveness of change management processes. This hypothesis is not supported because organizational changes often face resistance from employees who may feel uncertain or uninformed about the changes. In many cases, a lack of clear communication and inadequate involvement of staff can lead to confusion, making it difficult for change management initiatives to be effective. This disconnect can prevent organizational changes from being smoothly integrated into existing processes.

Table 8: Path analysis

	Coef.	T-stat.	2.5% CI	97.5% CI	Decision
Organizational Change -> Change Management	-0.069	0.428	-0.377	0.249	H1: Not Supported
Structural Change -> Change Management	0.040	0.357	-0.155	0.286	H2: Not Supported
IT Change -> Change Management	0.077**	0.641	-0.155	0.319	H3: Supported
Change Management -> Effective Teaching	0.477***	4.386	0.248	0.677	H4: Supported

The results for Structural Change and Change Management yield a coefficient of 0.040 and a t-statistic of 0.357. The confidence intervals span from -0.155 to 0.286, again including zero. As a result, H2 is not supported, implying that structural changes within the organization do not have a significant effect on the change management process. This may indicate that simply altering the structure of an organization does not inherently enhance the capability to manage changes effectively. The hypothesis is not supported, as structural changes frequently disrupt established workflows and relationships among staff. In educational institutions, such changes may create uncertainty and anxiety among teachers and administrative staff, leading to a reluctance to embrace new structures. Without adequate support and clarity during these transitions, the potential benefits of structural changes can be lost.

For the relationship between Information Technology Change and Change Management, the coefficient is 0.077 with a t-statistic of 0.641 (H3). The p-value indicates significance, suggesting that the relationship is statistically significant. The confidence intervals range from -0.155 to

0.319, which still includes zero; however, the positive coefficient indicates a trend towards support for this hypothesis. This suggests that changes in information technology have a positive influence on change management processes, reflecting the growing importance of technology in facilitating effective organizational change. This hypothesis is supported because technological changes can enhance communication and streamline processes, making change management more effective. In the context of education, the adoption of new technologies facilitates access to resources and information, helping educators adapt to new teaching methods and collaborate more effectively. Successful integration of technology often empowers teachers to engage in change management more proactively.

The results for Change Management and Effective Teaching show a coefficient of 0.477 and a t-statistic of 4.386, with a confidence interval ranging from 0.248 to 0.677. The p-value is highly significant; thus, H4 is supported. This finding indicates a strong positive relationship, suggesting that effective change management practices significantly enhance teaching effectiveness. In the context of the study, this implies that when change is managed well within educational institutions, it leads to improved outcomes in teaching, highlighting the critical role of effective management strategies in education. This hypothesis is supported, as effective change management practices can lead to improvements in teaching quality. When change is managed well, educators feel supported and are more likely to adopt new instructional methods, ultimately benefiting student learning. In the context of educational institutions, strong change management fosters a positive environment that encourages continuous improvement in teaching practices.

The findings of this study highlight the importance of effective change management in enhancing teaching quality, particularly technological changes within educational institutions. The positive relationship between information technology change and change management suggests that integrating technology is crucial for fostering an adaptable learning environment. This implies that educational leaders must prioritize technology adoption and provide adequate training to educators, ensuring they are equipped to utilize new tools effectively. Furthermore, the significant link between change management and effective teaching indicates that well-managed changes lead to improved teaching practices and student outcomes. Educational institutions should therefore implement structured change management processes that involve continuous communication, staff training, and collaboration among educators.

Conversely, the lack of support for the hypotheses concerning organizational and structural change emphasizes the need for a more nuanced approach to these aspects within the Bangladeshi education system. The findings suggest that merely altering organizational structure or implementing changes without considering the existing culture and individual preferences may not yield the desired improvements in teaching effectiveness. Thus, institutions must engage in thorough assessments of their organizational cultures and structures before implementing changes. Tailoring change initiatives to align with the specific needs and contexts of educators will enhance the likelihood of successful outcomes. Policymakers and educational leaders must consider these dynamics when designing and implementing change initiatives to ensure they positively impact teaching effectiveness and student learning.

5 Conclusions

This study provides valuable insights into the dynamics of change management, organizational structure, and effective teaching within the context of educational institutions in Bangladesh, particularly during and after the COVID-19 pandemic. The findings reveal that while structural and organizational changes do not significantly enhance change management or teaching effectiveness, the integration of information technology plays a pivotal role in facilitating successful change management. This underscores the necessity for educational leaders to prioritize technological advancements and provide comprehensive training for educators to effectively utilize these tools in their teaching practices.

Moreover, the study highlights that effective change management significantly correlates with improved teaching quality, emphasizing the importance of well-structured processes that foster collaboration, communication, and adaptability among staff. It indicates that for educational institutions to thrive in a rapidly changing environment, a focus on change management strategies that resonate with the existing organizational culture and individual preferences is essential. Overall, the research underscores the critical role of technology in shaping educational practices and calls for tailored change initiatives that account for the unique characteristics of the Bangladeshi educational landscape to enhance teaching effectiveness and improve student outcomes.

By examining organizational, structural, and technological changes through the lens of change management theory, this research advances the understanding of how specific types of change influence the

adaptability and effectiveness of teaching practices. Unlike traditional studies that focus on broad organizational changes, this study emphasizes the pivotal role of technological adaptation as a driver of successful change management in educational settings, particularly during periods of disruption. Additionally, the research highlights the mediating role of effective change management in enhancing teaching effectiveness, bridging a gap in existing literature by linking change management strategies directly to pedagogical outcomes. These findings contribute to the theoretical discourse by offering a framework that integrates change management principles with educational theory, providing a foundation for future research to explore context-specific strategies for resilient and adaptive educational practices.

This study has limitations that may affect the interpretation and generalizability of its findings. Firstly, the relatively small sample size restricts the ability to draw broad conclusions applicable to the entire population of educational institutions in Bangladesh. A larger and more diverse sample would enhance the reliability of the results. Additionally, focusing primarily on organizational and structural changes, along with information technology, may overlook other significant factors such as leadership styles, teacher motivation, and external influences like governmental policies. These factors could play crucial roles in shaping change management and effective teaching dynamics. As a result, the findings may not fully capture the complexities of the educational environment, highlighting the need for further research that includes a wider array of variables and explores different contexts to enhance the robustness of the conclusions drawn.

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Policy Implications of Restructuring Public Debt Portfolio in Bangladesh

Hussain Syed Gowhor[1]

Abstract

Judicious public debt management is a *sine qua non* for a robust economy. The recent catastrophic consequences of debt management failures of some countries are a wake-up call for Bangladesh. As part of precautionary measures, Bangladesh must review its debt portfolio in order to decide whether to rely more on domestic debt than external debt. It should also decide which debt would be economically viable and less risky for Bangladesh. This decision would entail restructuring its debt portfolio between domestic and external debt, among development partners and debt instruments. In this article, such restructuring is done with the help of regression analysis and portfolio analysis. The results are quite striking and have profound implications for policy making.

Keywords: Public debt portfolio, public finance, regression analysis, portfolio analysis, portfolio restructuring, policy implications

1 Introduction

As some economists have forewarned that the debt situation of Bangladesh may slip to the yellow zone that may entail 'another Sri Lanka in the making,' it is high time for the Government of Bangladesh (GoB) to carefully review its debt portfolio with a view to restructuring it so that any catastrophic consequences can be avoided. Restructuring allows for minimizing risk on debt portfolios. Experts in Bangladesh call for structural reforms with respect to public debt for the betterment of the economy (Khatun, 2024). Poor management of public debt restructured results in malicious effects on the economy, such as declines in the growth

1 Vice Principal, Postal Academy, Rajshahi-6203, Bangladesh. E-mail: hussainsyed.gowhor@bdpost.gov.bd

of GDP, investment, bank credit to the private sector and capital flows, to name a few (Asonuma et al., 2024).

As is evident from the Economic Relations Division (ERD) Handbook (ERD, 2023), the present decision-making process on debt portfolio restructuring is quite subjective, which often suffers from numerous biases. As a result, Bangladesh is more prone and susceptible to becoming a vulnerable economy due to poor public debt restructuring decisions. In order to streamline the debt restructuring decision-making process, it is imperative that the Government of Bangladesh (GoB) uses a data-driven decision-making approach. While the data are already available in a suitable form, the only thing that is absent is the use of an appropriate tool to facilitate the decision-making for restructuring the public debt portfolio.

This article demonstrates two innovative approaches of debt restructuring that have not been utilized by the GoB so far. One is the regression analysis, and the other is the portfolio analysis. With the help of the former tool, policymakers will be able to understand the extent of influence of domestic and external debt on Bangladesh's economy and how the macroeconomic situation dictates the amount of external and domestic debt in Bangladesh. With the help of the latter tool, the policy makers will be able to obtain the optimal portfolio structure with respect to both domestic and external debt.

Such types of analysis would help answer several burning questions of the policy makers, such as whether the country should borrow more domestically than externally, how much to borrow from which country in the case of external debt, and how to restructure the domestic debt portfolio according to major instruments. However, ascertaining how much to borrow domestically or externally requires further research and is beyond the scope of this article.

The results of both types of analysis are quite striking and have profound implications for policy making. Such analysis should be conducted periodically, as debt management is a highly dynamic discipline.

2 Review of literature

The literature review is conducted with a view to achieving two purposes. First, it would justify the use of regression analysis and portfolio analysis as appropriate tools for restructuring the public debt portfolio in Bangladesh. Second, it would justify the use of Bangladesh as the unit of analysis for this research.

This paper uses regression analysis and portfolio analysis as appropriate tools for restructuring the public debt portfolio in Bangladesh because they seem to be the most appropriate tools given the current economic features of Bangladesh. Buchheit et al. (2019) argue that no public debt restructuring mechanism is quite like another. Buchheit et al. (2019) show how Greece, Mexico and Uruguay have restructured their public debt, where each country has followed their unique approach given their country's economic conditions and characteristics. Adesola (2015) shows how Nigeria's public debt restructuring was different from that of other countries. It follows that each country's approach would be unique given its economic conditions and features (Chouraqui, Jones & Montador, 1986). The economic conditions and features of Bangladesh are quite different from those of other countries, where budget deficit, current account deficit, and exchange rate depreciation are posing constant challenges in public debt management (Alam & Taib, 2013). As such, it is expected that Bangladesh should also follow a unique restructuring mechanism with respect to its public debt.

Now, in order to decide on which tool to use to restructure the public debt portfolio in Bangladesh, it is imperative that other available methods be reviewed first. Destais, Eidam & Heinemann (2019) argue that there is no single optimal debt restructuring mechanism for public debt, and any design decision on such a mechanism requires judgements on the underlying trade-offs and related assumptions on relative costs. The existing public debt portfolio restructuring mechanisms that use judgment include the practices of intervention (Backus & Kehoe, 1989), coordination (Bi, Chamon & Zettelmeyer, 2016), contractual arrangements (Guzman & Stiglitz, 2016) and negotiation (Kastrop & Ebert, 2012). However, if such judgments are unwarranted and are not based on appropriate economic analysis, debt restructuring efforts may fail and may have disastrous consequences on an economy (Buchheit et al., 2019). The failures of the Stability and Growth Pact (SGP) and the European Stability Mechanism (ESM) are concrete examples of the absence of appropriate economic analyses in restructuring the European public debt portfolios. That is why Nicholas (2014) underscores the need for a credible macroeconomic framework for effective public debt portfolio restructuring. The existing approaches to economic analyses include the cost-at-risk approach (Hahm & Kim, 2003), value-at-risk approach (Adinugrahan & Ridwan, 2015), net present value approach (Beaugrand et al., 2002) and portfolio balance approach (Backus & Kehoe, 1989). Both the cost-at-risk approach and value-at-risk approach are aimed at optimizing the risk on the public

debt portfolio. The cost-at-risk (CaR) approach uses a target benchmark portfolio to optimize the portfolio risk (Hahm & Kim, 2003), whereas the value-at-risk approach uses the probability of default concept to optimize the portfolio risk (Coimbra, 2020). However, both of them are devoid of the basic principles of risk optimization, which requires a portfolio approach as has been suggested by Markowitz (Adinugrahan & Ridwan, 2015). The International Monetary Fund conducted a study in 2002 that delineated the method of choosing between external and domestic debt, which deploys the Net Present Value method (Beaugrand et al., 2002). Although the Net Present Value method is a suitable method for investment decision making, such analysis has little practical usefulness for such restructuring decisions (Emmanuel et al., 2010). The portfolio balance approach uses portfolio theory. However, it ignores the inevitable consequences of government budget constraints (Backus & Kehoe, 1989), which render it a flawed tool for restructuring the public debt portfolio.

Based on the above literature review on the available tools for restructuring public debt portfolios, it can be said that due to the limitations of the above tools, alternative tools should be used for analyzing the public debt portfolio with a view to restructuring it. Portfolio analysis is such an alternative tool that has been used in this study to restructure the public debt portfolio. Elberry, Naert & Goeminne (2023) argue that such portfolio analysis is critical during a debt crisis because it deals with the composition of public debt portfolios. Another tool used in this paper is the regression analysis, which essentially works as a deterministic as well as a heuristic method for understanding the relationship and nature of dependence between debt and macroeconomic variables (Rafindadi & Musa, 2019).

At this stage of the literature review, let us focus on why Bangladesh has been selected as the unit of analysis in the study. Previous studies on public debt management, such as those of the Economic Relations Division, Finance Division and Bangladesh Bank, are mainly descriptive in nature and provide debt-related statistical data of Bangladesh. There are some academic studies on public debt analysis in Bangladesh, which are very superficial in nature and do not conduct any significant, in-depth analysis. For example, Aktar (2023) tried to analyze the impact of external debt on the economy. However, she provided only descriptive statistics. Thus, analytical studies are grossly absent with respect to Bangladesh's debt portfolio. Some studies provide in-depth quantitative analysis of the impact of external debt on a single economic factor. For example, Rahman et al. (2012) analyzed the impact of external debt on GDP only. However,

there is no evidence of previous studies that investigates the influence of the macroeconomic variables on debt. Thus, there exists a considerable knowledge gap with respect to the appropriate method of analysis of Bangladesh's debt portfolio that would assist policymakers in restructuring decisions regarding Bangladesh's debt portfolio. Thus, it may be concluded that the gaps identified from the above literature review justify a study on the debt portfolio of Bangladesh that would examine the impact of the macroeconomic variables on debt and at the same time would allow the application of an appropriate method for restructuring its debt portfolio.

3 Methodology

Regression analysis was done in previous studies to show the impact of debt on an economy. For example, Kabwoya et al. (2024) used regression analysis to examine the relationship between debt levels and economic growth indicators such as GDP. However, it did not study the impact of other economic variables, such as unemployment rate, inflation rate, government's tax and non-tax revenue collection, foreign currency reserve, national export and national import. There is no evidence of a study that uses regression analysis to enable policymakers to dictate how much to borrow domestically and externally, given the performance of the economic indicators. For example, how much can domestic borrowing be if the inflation rate falls by 1%? Portfolio analysis was also done in previous studies. However, those studies used the Structural Vector Auto Regressive model and other empirical analysis, which did not use portfolio theory as the guiding principle for such analyses (Afonso et al., 2024). Thus, these studies are flawed from the viewpoint of portfolio management science. Moreover, these studies were conducted in the context of other countries. Thus, in order to provide a comprehensive restructuring analysis for the public debt portfolio of Bangladesh considering its present economic features, this study uses an innovative approach to regression analysis encompassing all the relevant economic variables and an innovative approach to portfolio analysis incorporating the portfolio theory.

In order to decide if the country should borrow more domestically than externally, the impact of the debt on the economy is ascertained using a multiple regression analysis. This analysis comprises a debt-related variable as the independent variable and the economy-related variables as the dependent variable. In order to ascertain how much to borrow from which country, the article conducts a portfolio analysis on the existing share of the bilateral and multilateral loans according to sources and restructures the external debt portfolio. In order to ascertain how much

to borrow from which instruments in the case of domestic debt, a similar portfolio analysis was also conducted.

3.1 Regression analysis

The regression analysis was done on the external debt and the domestic debt with the aim of determining the most preferred source of financing. In order to conduct the regression analysis, time series data were used on the debt-related and economy-related variables. The most relevant economic variables were selected for inclusion in the analysis. The selected economic variables are gross domestic product (GDP), unemployment rate (UR), inflation rate (IR), government's tax and non-tax revenue collection (RC), foreign currency reserve (FCR), national export (NE) and national import (NI). The other economic variables, such as money supply, interest rate, exchange rate, fiscal policy, monetary policy, wage earner's remittance, foreign direct investment, cost of living index, and stock market indices are also relevant, but to a less extent than the selected economic factors (Aktar, 2023; Junaedi et al., 2022). The relevance is determined by the purpose of borrowing, i.e., why the government borrows domestically and externally. The debt-related variables were the principal amount of the domestic and external debt. Detailed data are given in Appendix 2.

The justifications for including the selected economic variables as the most relevant are given below:

3.1.1 GDP

A government borrows with a view to increasing the GDP (Rahman et al., 2012). Thus, the debt will be deemed to have a positive impact on the economy if GDP increases over time.

3.1.2 Unemployment rate

A government borrows with a view to decreasing the unemployment rate (Cahyadin & Ratwianingsih, 2020). Thus, the debt will be deemed to have a positive impact on the economy if the unemployment rate decreases over time.

3.1.3 Inflation rate

A government borrows with a view to reducing the inflation rate (Karakaplan, 2009). Thus, the debt will be deemed to have a positive impact on the economy if the inflation rate decreases over time.

3.1.4 Revenue collection

A government borrows with a view to increasing its revenue (Mahdavi, 2004). Thus, debt will be deemed to have a positive impact on the economy if the government's revenue collection increases over time.

3.1.5 Foreign currency reserve

A government borrows with a view to increasing the foreign currency reserve (Ayunku & Markjackson, 2020). Thus, the debt will be deemed to have a positive impact on the economy if the foreign currency reserve of the country increases over time.

3.1.6 National export

A government borrows with a view to increasing the national export (Ahmed et al., 2000). Thus, the debt will be deemed to have a positive impact on the economy if the national export of the country increases over time.

3.1.7 National import

A government borrows with a view to decreasing the national import (Looney, 1989). Thus, the debt will be deemed to have a positive impact on the economy if the national import of the country decreases over time.

3.1.8 Data sources

The data for the regression analysis were taken from the Bangladesh Economic Review 2023 of the Ministry of Finance of the Government of Bangladesh and the World Bank. The past twelve years' data on the debt and economy-related variables from 2011–12 to 2022–23 were used in the regression analysis. Details of the data are provided in Appendix 2.

3.1.9 Analysis technique

Two sorts of analysis were conducted. The first analysis involved the examination of the impact of both external and domestic debt on the economy (through the selected economic variables). The second analysis involved examining the macroeconomic drivers of external and domestic debt. As the first step of the analysis, the debt and economy-related variables were transformed to z-scores to equate the variables in the measurement scales using R software. Then, regression analysis was performed using the same software and the regression data were generated.

3.2 Portfolio analysis

Here, both external and domestic debts are analyzed. External debts are analyzed according to countries in order to determine how much to borrow from which country. On the other hand, domestic debts are analyzed according to instruments in order to determine how much to borrow from which instrument.

3.2.1 Data sources

The data for the portfolio analysis were taken from the Flow of External Resources into Bangladesh 2020-2021, Golden Jubilee Special Edition and from a newspaper article published in The Business Standard on 28 May, 2023 (Kashem & Abdullah, 2023). For external debt, debt disbursement and interest payment related data were used for twenty-eight countries and institutions. For domestic debt, interest-related data on five types of debt instruments were used. Details of the data are provided in Appendix 2.

3.2.2 Analysis technique

The portfolio analysis is conducted using the procedures as delineated by Goetzmann et al. (2014). In order to perform the analysis, the following notations are used:

Table 1: Notations used in the portfolio analysis

Sl.	Notations	For External Debt	For Domestic Debt
1.	R_i	Interest paid to each country, detailed data are given in Appendix 1.	Interest paid for each instrument, detailed data are given in Appendix 1.
2.	R_F	Interest on relatively risk-free instrument, i.e., the treasury bonds, which is USD 2,745.98 million or BDT 25,193 crore as on 30 June, 2023 (Kashem & Abdullah, 2023; Ministry of Finance, 2022).	
3.	β_i	The portion of the systematic risk of R_i, which is estimated as 88% as per the risk measurement literature of the Economic Relations Division (ERD) of the Ministry of Finance (ERD, 2022).	
4.	σ^2_i	The portion of the unsystematic risk of Ri, which is the variance of all the R_i	
5.	C_i	Cutoff rate, which is calculated using the following Equation (1): $$C_i = \frac{{\sigma_m}^2 \sum_{i=1}^{n} \frac{(\overline{R_i} - R_F)\beta_i}{{\sigma_i}^2}}{1 + {\sigma_m}^2 \sum_{i=1}^{n} \left(\frac{{\beta_i}^2}{{\sigma_i}^2} \right)}$$	
6.	Z_i	The relative portion of each country/instrument in the portfolio is calculated using the following Equation (2): $$\frac{{\beta_i}^2}{{\sigma_i}^2} \left(\frac{(\overline{R_i} - R_F)}{\beta_i} - C_i \right)$$	

3.3 Limitations of the Methodology

The regression analysis and portfolio analysis are conducive to take restructuring decisions on the current year's economic conditions only. It should not be taken for granted to work for future economic conditions, given the volatility of the economy of the debtor country and the creditor countries and institutions. These analyses could provide a completely different result during economic crises and during economic prosperity. To avoid such limitations, it is recommended that the concerned government officials periodically conduct such analyses in order to determine the optimal composition of the debt portfolio.

4 Result and discussion on the regression analysis

4.1 Regression analysis – 1: Impact of debt on economy

In respect of examining the impact of both external and domestic debt on the economy (through the selected economic variables), two models were used, as can be seen in Figure 1. The first model examined the impact of external debt on the economy, and the second model examined the impact of domestic debt on the economy. The regression results are summarized in Table 2, which are described below.

Table 2: Impact of external and domestic debt on selected economic variables

Predictors	**Model 1**	**Model 2**
	Estimates	***Estimates***
(Intercept)	0.000	0.000
	(0.396)	(0.462)
External debt (ed_z)	5.151***	
	(0.414)	
Domestic debt (dd_z)		5.090***
		(0.483)
Observations	12	12
R^2/ R^2 adjusted	0.939 / 0.933	0.917 / 0.909

*Note: *p<0.05 **p<0.01 ***p<0.001*

4.1.1 Model 1

An individual standard multiple regression was performed to investigate the effects of external debt on the selected economic variables. R for regression was significantly different from zero (R^2 = 0.939, p = 0.001). The adjusted R^2 is 0.933. Therefore, 93% of the variance in the selected economic variables is caused by the external debt.

The regression coefficient (slope) for the external debt is 5.151. This means that external debt has a positive effect on the economy while controlling for the effects of domestic debt. The slope also means that with every increase of one standard deviation in the external debt, the selected economic variables will increase by 5.151 standard deviations, while controlling for the effects of domestic debt. The positive effect of the rate of external debt on the selected economic variables is statistically significant at alpha=0.001.

4.1.2 Model 2

An individual standard multiple regression was performed to investigate the effects of domestic debt on the selected economic variables. R for regression was significantly different from zero (R^2 = 0.917, p = 0.001). The adjusted R^2 is 0.909. Therefore, 91% of the variance in the selected economic variables is caused by the domestic debt.

The regression coefficient (slope) for the domestic debt is 5.090. This means that domestic debt has a positive effect on the economy while controlling for the effects of external debt. The slope also means that with every increase of one standard deviation in the domestic debt, the selected economic variables will increase by 5.090 standard deviations, while controlling for the effects of external debt. The positive effect of the rate of domestic debt on the selected economic variables is statistically significant at alpha=0.001.

4.2 Discussion on the first kind of regression analysis

The regression coefficient (slope) as well as the adjusted R2 for the external debt is higher than those of the domestic debt. This means that external debt is more aligned with the selected economic variables than domestic debt. As such, the government should be more inclined towards external debt than domestic debt from an economic point of view. It is interesting that Bangladesh borrows more from domestic sources while the external sources are cheap in terms of interest rate. Let us demonstrate this with

the help of an example. Suppose Bangladesh borrows USD 100, both domestically and externally. If the exchange rate is BDT 100 per US dollar and the foreign borrowing rate is 1% per annum, then Bangladesh has to pay $1 annually as interest, which is equivalent to BDT 100. On the other hand, if the interest rate on domestic borrowing is 12% per annum, then Bangladesh has to repay BDT 1200 as interest. Thus, domestic borrowing is more costly than external borrowing. However, the government deems it less risky than external borrowing (Ministry of Finance, 2022).

4.3 Regression analysis – 2: Macroeconomic determinants of debt

In order to know how much the macroeconomic situation dictates the amount of external and domestic debt in Bangladesh, a regression analysis was conducted. The regression results are summarized in Table 3, which are described below.

Table 3: Macroeconomic determinants of external and domestic debt of Bangladesh

Predictors	**External Debt**	**Domestic Debt**
	Estimates	***Estimates***
(Intercept)	0.000	0.000
	(0.018)	(0.063)
Gross Domestic Product (gdp_z)	1.079**	0.613
	(0.215)	(0.731)
Unemployment Rate (ur_z)	0.273*	0.094
	(0.062)	(0.211)
Inflation Rate (ir_z)	-0.040	0.225
	(0.062)	(0.212)
Tax and Non-tax Revenue Collection (rc_z)	0.035	0.130
	(0.157)	(0.535)
Foreign Currency Reserve (fcr_z)	-0.439*	0.290
	(0.138)	(0.469)
National Export (ne_z)	-0.569**	0.014
	(0.121)	(0.412)
National Import (ni_z)	0.588**	0.062
	(0.118)	(0.402)
Observations	12	12
R^2/ R^2 adjusted	0.999 / 0.996	0.983 / 0.952

*Note: *p<0.05 **p<0.01 ***p<0.001*

4.4 Discussion on the second kind of regression analysis

The effects of all the macroeconomic determinants on external debt, except inflation rate and revenue collection, are statistically significant. However, the effects of all the macroeconomic determinants on domestic debt are not statistically significant.

These selected macroeconomic factors can explain 99.9% of the variations in the external debt and 98.3% of the variations in the domestic debt.

For every 1 billion taka increase in GDP, the government can borrow 1.079 billion taka of external debt and 0.613 billion taka of domestic debt while controlling for the effects of the other economic factors.

For every 1% rise in unemployment rate, the government can increase the external borrowing by 27.3% and domestic borrowing by 9.4% while controlling for the effects of the other economic factors.

For every 1% rise in inflation rate, the government should decrease the external borrowing by 4% and instead should increase the domestic borrowing by 22.5% while controlling for the effects of the other economic factors.

For every 1 billion taka increase in the government's tax and non-tax revenue collection, the government can borrow 0.035 billion taka of external debt and 0.130 billion taka of domestic debt while controlling for the effects of the other economic factors.

For every 1 million USD increase in the foreign currency reserve of the country, the government should decrease external borrowing by 0.439 million USD of external debt and should increase domestic borrowing by 0.290 million USD while controlling for the effects of the other economic factors.

For every 1 billion taka increase in national export, the government should decrease external debt by 0.569 billion taka and should increase domestic debt by 0.014 billion taka while controlling for the effects of the other economic factors.

For every 1 billion taka increase in national import, the government should increase external debt by 0.588 billion taka and should decrease domestic debt by 0.062 billion taka while controlling for the effects of the other economic factors.

5 Result and discussion on the portfolio analysis

5.1 Restructuring the external debt portfolio

The result of the external debt portfolio analysis is shown in Table 4 below.

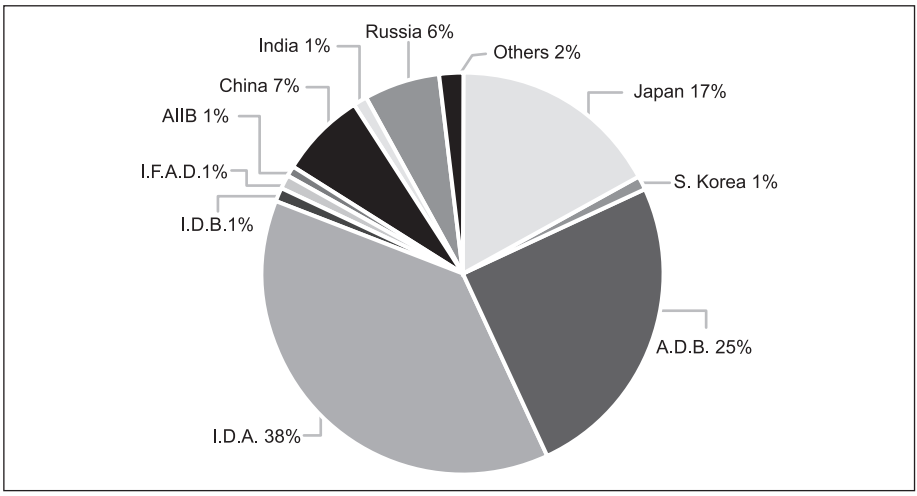
Table 4: Portfolio analysis of the external debt (figures are rounded)

Name of the Country	$\frac{(\bar{R}_i - R_F)}{\beta_i}$	$\frac{(\bar{R}_i - R_F)\beta_i}{{\sigma_i}^2}$	$\frac{{\beta_i}^2}{{\sigma_i}^2}$	$\sum_{i=1}^{n}\frac{(\bar{R}_i - R_F)\beta_i}{{\sigma_i}^2}$	$\sum_{i=1}^{n}\frac{{\beta_i}^2}{{\sigma_i}^2}$	C_i	z_i	$\frac{z_i}{\sum z_i}$
ADB	(7)	(60)	0	350,073	7	51,452	(1,306)	0.00
AIIB	(111)	(5)	0	350,073	7	51,452	(91)	0.00
BELARUS	(1,246)	(0)	0	350,073	7	51,452	(8)	0.00
BELGIUM	(3,119)	(0)	0	350,073	7	51,452	(3)	0.00
CHINA	(2)	(104)	0	350,073	7	51,452	(2,848)	0.01
DENMARK	(640)	(1)	0	350,073	7	51,452	(16)	0.00
E.E.C	(1,202)	(0)	0	350,073	7	51,452	(9)	0.00
EIB	(372)	(1)	0	350,073	7	51,452	(27)	0.00
FRANCE	(149)	(4)	0	350,073	7	51,452	(68)	0.00
GERMANY	(20)	(24)	0	350,073	7	51,452	(479)	0.00
I.D.A	(41)	(12)	0	350,073	7	51,452	(239)	0.00
I.D.B	(97)	(5)	0	350,073	7	51,452	(104)	0.00
I.F.A.D	(824)	(1)	0	350,073	7	51,452	(13)	0.00
INDIA	(67)	(8)	0	350,073	7	51,452	(149)	0.00
ITFC	(1,856)	(0)	0	350,073	7	51,452	(6)	0.00
JAPAN	1	248,635	4	350,073	7	51,452	(208,609)	0.60
KUWAIT	(580)	(1)	0	350,073	7	51,452	(18)	0.00
NDF	(6,159)	(0)	0	350,073	7	51,452	(2)	0.00
O.P.E.C	(216)	(2)	0	350,073	7	51,452	(47)	0.00
PAKISTAN	(9,294)	(0)	0	350,073	7	51,452	(1)	0.00
RUSSIA	(12)	(37)	0	350,073	7	51,452	(768)	0.00
SAUDI ARABIA	(84)	(6)	0	350,073	7	51,452	(120)	0.00
SOUTH KOREA	1	101,714	3	350,073	7	51,452	(135,083)	0.39
SPAIN	(8,093)	(0)	0	350,073	7	51,452	(1)	0.00
SWITZERLAND	(5,673)	(0)	0	350,073	7	51,452	(2)	0.00
U.A.E.	(237)	(2)	0	350,073	7	51,452	(43)	0.00

As can be seen in the last column of Table 2, the external debt portfolio is restructured in such a way that 60% of the external debt should be sourced from Japan, 39% should be sourced from South Korea, and the remaining 1% from China. All other bilateral and multilateral sources should be avoided in order to have a positive impact on the economy. In order to understand the restructuring effect of the external debt portfolio

analysis, it is imperative that we have a look at the existing structure of the external debt portfolio, which is as follows:

Figure 1: Existing structure of the external debt portfolio



Source: Ministry of Finance, 2022.

From Figure 1 and Table 4, we can see that the structure of the portfolio has shifted dominantly from multilateral sources, such as IDA and IDB and the new structure has leaned more towards bilateral sources, i.e., Japan and South Korea.

5.2 Restructuring the domestic debt portfolio

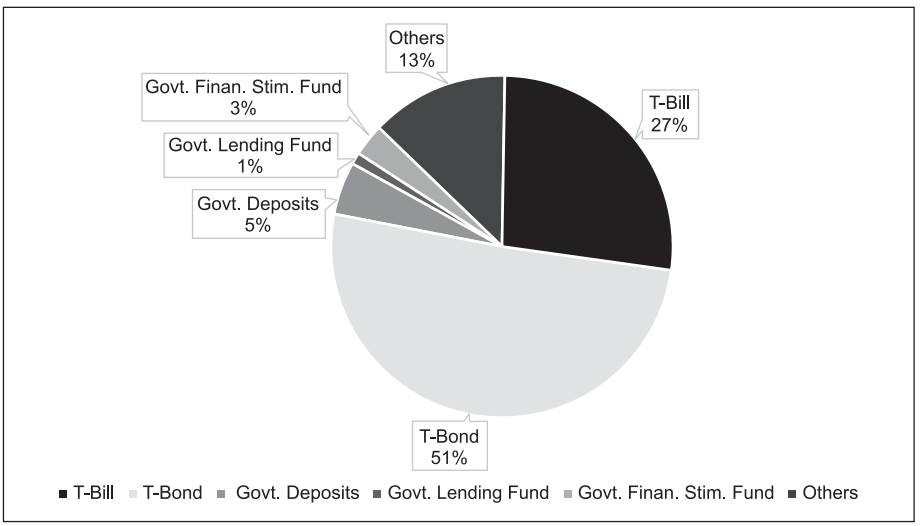
The result of the domestic debt portfolio analysis is shown in Table 3 below.

Table 5: Portfolio analysis of the domestic debt (figures are rounded)

Name of the Instruments	$\frac{(\overline{R}_i - R_F)}{\beta_i}$	$\frac{(\overline{R}_i - R_F)\beta_i}{{\sigma_i}^2}$	$\frac{{\beta_i}^2}{{\sigma_i}^2}$	$\sum_{i=1}^{n}\frac{(\overline{R}_i - R_F)\beta_i}{{\sigma_i}^2}$	$\sum_{i=1}^{n}\frac{{\beta_i}^2}{{\sigma_i}^2}$	C_i	z_i	$\frac{z_i}{\sum z_i}$
Savings Scheme	1	46,503	2	36,608	4	8,852	(20,676)	0.56
Provident Fund	(3)	(6,099)	0	36,608	4	8,852	(2,844)	0.08
Ways and Means Advances	(2,862)	(13)	0	36,608	4	8,852	(6)	0.00
Treasury bonds	-	-	1	36,608	4	8,852	(11,551)	0.32
Treasury bills	(7)	(3,782)	0	36,608	4	8,852	(1,534)	0.04

As can be seen in the last column of the Table 3, the domestic debt portfolio is restructured in such a way that 56% of the domestic debt should be sourced from the national savings schemes, 8% from provident fund, 32% from treasury bonds, and the remaining 4% from treasury bills. In order to understand the restructuring effect of the domestic debt portfolio analysis, it is imperative that we have a look at the existing structure of the domestic debt portfolio, which is as follows:

Figure 2: Existing structure of the domestic debt portfolio



Source: Ministry of Finance, 2022.

From Figure 2 and Table 5, we can see that the structure of the portfolio has shifted dominantly from treasury bills and treasury bonds and the new structure has leaned more towards national savings schemes and treasury bonds.

5.3 Discussion on portfolio analysis

5.3.1 External debt

It is very interesting to note that while the portfolio theory suggests portfolio diversification in order to minimize risk, the portfolio analysis we have conducted has paved the way for portfolio concentration. The explanation is that portfolio diversification is the strategy in the case of personal finance. However, public finance differs in a diametrically opposite way to personal finance (Rosen, 1992). For example, in the case

of personal budgeting, we cut our coat according to our cloth. That is, a person first ascertains his or her income limit and then spends judiciously and rationally to keep his or her budget within his or her income limit. But, in the case of public finance, the government first estimates its expenditure and then looks for ways and means to increase its income to cover the expenditure. In the same way, while portfolio diversification is the strategy for personal finance, portfolio concentration is the strategy for public finance that holds true for both domestic and public debt.

Debt is a financial product that every country and international lending agencies want to sell to the countries in need of it in order to make some profit on it. They would rationally want to sell more of their debt to the needy countries. If Bangladesh diversifies its external debt portfolio, it will mean that lending countries and organizations would try to convince or compel Bangladesh to subscribe to more credit. Thus, at one stage, Bangladesh would be heavily indebted to those lending countries and organizations. In case Bangladesh defaults on its loan due to economic failure, the lending countries and organizations would create pressure on repaying its debt at the cost of gold and foreign currency reserves. That is why portfolio diversification in the case of external debt is detrimental for a country.

5.3.2 Domestic debt

Whereas T-bills and T-bonds benefit the institutions, they do not directly benefit the public. Instead, if the government uses a national savings scheme, it will create a social safety net for the vulnerable groups of society, particularly women, retired and aged people.

6 Analysis and reflection on the nexus between the results and the existing literature

The results of the analysis are strikingly different from those of the existing literature on debt structure. For example, some of the existing literature provides only descriptive statistics relating to public debt, such as the debt-to-GDP ratio and the relative structure of domestic and external debt (Khatun, 2024). In respect of regression analysis, academic studies, such as those of Rahman et al. (2012) and Islam and Hossain (2024), regressed the debt variable (external debt only) only on a single economy-related variable (gross domestic product). Their findings are that debt and GDP have a significant positive relationship. The results and findings of this study go further than those of the previous studies. In addition to GDP,

this study examines the relationship between debt (both domestic and external) and all the relevant economic variables. While the previous studies were concerned with the direction of the relationship between debt and economic variables, the results of this study inform policymakers about the vector and the magnitude of the relationship. With respect to the portfolio analysis, previous studies, such as that of Patwary (2021), provide only a cursory analysis of descriptive statistics on public debt (both domestic and international) without suggesting the optimal portfolio structure. On the other hand, this study shows how to find the optimal portfolio structure for both domestic and external debt.

7 Implications of the research

7.1 Policy Implications

There are several policy implications that can be derived from the research. First, for domestic debt, the GoB should refrain from using some of its debt instruments for public interest. Second, for external debt, the GoB should concentrate its debt portfolio by choosing one or two selective bilateral or multilateral sources. Again, such selection would depend on the terms and conditions of the borrowing agreement. Third, the GoB should ensure flexibility in its portfolio mix through various tools, such as swaps, hedging, forwards, futures and other financial derivatives. Fourth, the GoB should not consider its domestic debt as a fiscal instrument. Instead, it should be considered as an instrument for the social safety net. Fifth, the optimal portfolio mix with respect to both external and domestic debt would depend on the economic circumstances of the country.

7.2 Societal impact of restructuring

In terms of external debt restructuring, no significant societal impact will be visible. However, the Bangladeshi diaspora living in a country that does not lend to Bangladesh will feel honored. Moreover, the bilateral relations between Bangladesh and the non-lending countries will improve, which will help Bangladeshi people immigrate and work in those countries. The societal impact of restructuring the domestic debt is that the people of Bangladesh will lead happy lives due to increased savings.

7.3 Influence of the Findings on Policy and Practice

The findings of this research have several potential influences on policy and practice. First, the nature of the work of the employees in the National

Savings Directorate, the Internal Resources Division, and the Economic Relations Division will change. Second, the existing debt portfolio composition will be changed drastically. Third, the existing practices of determining the portfolio composition will be changed drastically. Fourth, bilateral and multilateral diplomatic and economic relations will be changed. Fifth, in the case of domestic debt, more reliance on Savings Schemes may become a political issue and can be used in the election manifesto of the political parties.

8 Conclusions and recommendations

8.1 Conclusions

Experts in the field of public debt management have emphasized judicious public debt management through restructuring the debt portfolio in order to avoid adverse effects of debt on the economy. While the current practices of debt management are subjective and suffer from biases, it is imperative that the GoB engages in a data-driven decision-making approach with respect to domestic and external debt restructuring. To this end, this paper demonstrates and performs two innovative quantitative analyses with a view to restructuring the public debt portfolio of Bangladesh. One is the regression analysis, and the other is the portfolio analysis. Existing literature on regression analysis provides only a cursory idea about the impact of debt on the economy, taking into account only one variable, such as GDP. This article analyses the impact of debt on the economy as well as the impact of each economic variable on debt. In respect of portfolio analysis, the existing literature is concerned with descriptive statistics on public debt (both domestic and international) without suggesting the optimal portfolio structure. This article uses portfolio analysis in the light of portfolio theory and comes up with the optimal portfolio structure given the current economic condition of the country. If the debt portfolio is restructured using these two types of analysis, it is expected that Bangladesh will have a balanced composition of the debt portfolio that will help it achieve autarky.

This paper presents research because the previous studies on the public debt management of Bangladesh have shed little light on its restructuring mechanism. Similar studies for other countries are also parochial because they address only one economic variable (GDP). This study opens up a new vista of research by incorporating all the relevant economic variables and by offering an optimal portfolio mix for both domestic and external

debt. Further research can be conducted on issues, such as ascertaining how much to borrow domestically or externally and the optimal public debt portfolio structure during different phases of the economic life cycle of a country, to name a few.

Debts go in tandem with national economic situations. Thus, debts are highly dynamic. One should not presume that the structure of the portfolio would remain the same in the next years or even in the next six months. Thus, the debt portfolio needs to be constantly reviewed, monitored and updated, at least on an annual basis, using the formula shown in this article. A software can be used that can provide policymakers with a decision on the structure once the inputs are provided.

8.2 Recommendations

After restructuring the public debt portfolio using the above two analyses, it is recommended that GoB take a number of initiatives to manage its debt more judiciously so that it can contribute significantly towards sustaining the positive impact of public debt on the economy. First, the GoB should try to secure external debts from bilateral sources instead of multilateral sources because they can be sourced and serviced easily. Moreover, the terms and conditions of the debt and the interest rate are more favorable in the case of bilateral debts. Another reason is that there is no trading relationship with multilateral agencies. Thus, debt cannot be serviced efficiently without a trading relationship. Second, the GoB should service its debt through international barter rather than with cash because of its pressure on foreign exchange reserves. Third, the GoB should try to facilitate the way and should provide a guarantee for other private sector external debt. Fourth. the GoB should carefully review its debt utilization strategy. At present, debts are utilized in the inefficient and unproductive sectors that do not have strong debt servicing capacity. Thus, the government should utilize the proceeds in directly productive activities. Fifth, the GoB should also review its debt servicing strategy carefully. Although its debt portfolio in terms of countries are concentrated, it should not concentrate its debt currencies. At present, most of the debt liabilities are met in the USD, Euro or SDR. These currencies fluctuate wildly in the international market. Thus, if the GoB diversifies its debt currencies, it will be able to minimize the exchange rate risk. As the external debt portfolio is concentrated and has shifted towards Japan and South Korea, the GoB can opt for using those currencies, which are relatively stable in the international market. Sixth, the GoB should utilize the proceeds in a

more intelligent way to minimize the pressure on foreign exchange. This could be done by lending the proceeds from external debt to the local development financial institutions, who will, in turn, lend the money to the exporters of the country. Thus, the government can use the proceeds, along with the interest earned, to service its own debt. Seventh, the GoB should apply the techniques of financial derivatives for risk minimization of international debt service obligations. Swaps, options, etc. should be practiced in the international market to help minimize the risk of interest rate and exchange rate fluctuations.

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Appendix 1

Detailed Data on Debt Disbursement and Interest Paid on External and Domestic Debt

Table A1: External Debt

(in million USD)

Sl.	Country / Organization	Total Disbursed	Interest Rate (%)	Total Interest
1	ADB	6,556.48	2%	$400.97
2	AIIB	433.363	2.50%	$27.80
3	BELARUS	49.999	0.01%	$2.50
4	BELGIUM	2.478	0%	$1.00
5	CHINA	14,301.60	2%	$874.64
6	DENMARK	95.291	0.20%	$4.87
7	E.E.C	48	0.75%	$2.59
8	EIB	143.4	1.50%	$8.35
9	FRANCE	340.555	2.00%	$20.83
10	GERMANY	59.075	2.49	$147.10
11	I.D.A	1,359.77	0.75%	$73.47
12	I.D.B	497.23	2.50%	$31.90
13	I.F.A.D	68.255	1%	$3.78
14	INDIA	824.151	1%	$45.67
15	ITFC	25	3%	$1.68
16	JAPAN	1,156,153.12	1%	$64,068.59
17	KUWAIT	101.945	0.50%	$5.37
18	NDF	9.376	0.75%	$0.51
19	O.P.E.C	246.399	1.50%	$14.35
20	PAKISTAN	5.489	2%	$0.34
21	RUSSIA	4,048.05	1.50%	$235.78
22	SAUDI ARABIA	599.468	2%	$36.66
23	SOUTH KOREA	748,658.29	1%	$41,487.13
24	SPAIN	6.957	1%	$0.39
25	SWITZERLAND	10.179	0.75%	$0.55
26	U.A.E.	225.346	1.50%	$13.13
27	U.S.A.	9.719	2%	$0.59
28	YUGOSLAVIA	40.764	3%	$2.74

Source: Flow of External Resources into Bangladesh 2020-2021, Golden Jubilee Special Edition https://erd.portal.gov.bd/site/page/7f192f96-1442-48b4-a947-2e09ce30ec54/Flow-of-External-Resources-2020-21

Table A2: Domestic Debt

Sl.	Instruments	Total Interest (Crore Taka)
1	Savings Scheme	$45,100.00
2	Provident Fund	$6,200.00
3	Ways and Means Advances	$10.00
4	Treasury bonds	$25,193.00
5	Treasury bills	$3,342.00

Source: Kashem, A & Abdullah, S, 2023, Govt's domestic debt up by Tk65,000cr in FY23, The Business Standard, 28 May, 2023, https://www.tbsnews.net/economy/govts-borrowing-treasury-bills-tk73167cr-fy23-639738

Appendix 2

Table A3: Debt and Economy Related Variables used in Regression Analysis

FY	Billion Tk.	Billion Tk.	Billion Tk.	%	%	Billion Tk.	Milion USD	Billion Tk.	Billion Tk.
	External Debt Principal	Domestic Debt Principal	GDP	Unemployment Rate	Inflation Rate	Revenue Collection	Foreign Reserve	National Export	National Import
2011-12	140.4	344.7	10552	3.8	8.69	1148.9	10364	2101.4	2634.6
2012-13	199.5	324.7	11989.2	4.1	6.78	1396.7	15315	2123.6	2683.8
2013-14	186.8	409.8	13436.7	4.4	7.35	1566.7	21508	2314.3	2842.4
2014-15	238.7	547.1	15158	4.4	6.41	1633.7	25020	2384.4	2925.4
2015-16	270.47	621.75	20758	4.4	5.92	1774	30168	2617.2	3122.8
2016-17	315.87	699.03	23243	4.3	5.44	2185	33493	2691.6	3441
2017-18	510.4	660.17	26392	4.4	5.78	2594.54	32943	2972.5	4471.5
2018-19	538.83	787.45	29514	4.4	5.48	3166.12	32717	3327.6	4658
2019-20	636.59	973.45	31705	4.4	5.65	3480.7	36037	2783.5	4297.6
2020-21	809.54	1150.52	35302	5.2	5.56	3515.3	46391	3130	5146.1
2021-22	918.12	1242.88	39717	5.1	6.15	3890	41827	4789.6	8023.5
2022-23	1017.69	1406.25	44393	4.7	8.78	4330	32267	3400.8	4745.7

Sources: 1. *Bangladesh Economic Review 2023, Ministry of Finance, https://mof.portal.gov.bd/site/page/28ba57f5-59ff-4426-970a-bf014242179e/Bangladesh-Economic-Review-2023*

2. *World Bank. https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=BD*

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Analyzing the Evolving Trade Dynamics of Bangladesh with India and China: An Empirical Study

Md.Yousuf[1], *Nasrin Akter Lubna*[2],
Dr. Md. Salim Al Mamun[3], *Dr. Md. Ezazul Islam*[4]

Abstract

This study uses annual time series data to investigate the trade dynamics between Bangladesh and its two primary trading partners, India and China. Our analysis employs various metrics, including export and import intensity indices, intra-industry trade index, Export Specialization Index, and the revealed comparative advantages (RCA) approach. Finally, we use the ARDL approach to examine the long-run relationship between the structural transformation of the economy and trade dynamics. The trade intensity indices reveal a nuanced pattern in Bangladesh's trade relationship with India and China. The Export Specialization Index indicates that Bangladesh exhibits significant export specialization in commodity groups such as animal or vegetable fats and oils and their cleavage products with India, and live animals and animal products, as well as raw hides and skins-leather and articles thereof with China. Furthermore, our examination of the impact of changes in the structure of the Bangladeshi economy on trade dynamics underscores a notable shift. As Bangladesh undergoes industrialization, China emerges as a prominent trade partner, supplying capital machinery and related products, thereby replacing India's role as a source of primary goods and food items. The comprehensive analysis of these indices underscores the need to enhance intra-industry trade levels with major partners. Additionally, there is

1 Joint Director, Governor Office, Bangladesh Bank. E-mail: md.yousuf@bb.org.bd

2 Joint Director, Chief Economist's Unit, Bangladesh Bank. E-mail: nasrin.lubna@bb.org.bd

3 Director, Chief Economist's Unit, Bangladesh Bank. E-mail: salim.mamun@bb.org.bd

4 Executive Director, Monetary Policy Department. Bangladesh Bank. E-mail: ezazul.islam@bb.org.bd

a call for emphasis on sectors with high specialization that possess the potential to reduce the trade deficit. Diversifying Bangladesh's export baskets is also crucial for achieving a more favorable trade balance. The study provides a comprehensive understanding of the trade dynamics of Bangladesh with India and China, aiming to inform policy decisions, facilitate business strategies, and contribute to a broader understanding of economic interactions in the region.

Key Words: Trade Indices, Revealed Comparative Advantage, Exports, and Imports.

1 Introduction

Over the past few decades, the trade dynamics of Bangladesh have undergone a remarkable transformation, marked by a shifting focus from its traditional trading partner, India, to a burgeoning economic relationship with China. This shift has redefined the contours of Bangladesh's international trade and has had profound implications for the country's economic growth, industrialization, and geopolitical standing in the South Asian region. The analysis of this shift in trade dynamics explores the multifaceted factors that have driven Bangladesh to pivot its trade strategies towards China and the consequent impacts on its economy and diplomatic engagements.

Historically, Bangladesh has shared strong trade ties with India, which were shaped by geographical proximity, shared culture, and historical factors. Those realities gave rise to intricate trade relationships that India predominantly influenced for a long time. However, as the world entered the 21st century, Bangladesh began reorienting its trade policies and priorities, seeking new avenues for economic expansion and development. Nonetheless, Bangladesh's robust economic growth, particularly in the ready-made garments (RMG) industry, pharmaceuticals, and agriculture, has made it an attractive trading partner for India and China.

With the progress of the Bangladesh economy, the structure of the economy changes, which leads to changes in the foreign trade. In the last two decades, the service sector has led the economy with more than 50 percent of the share. Moreover, the industry sector becomes the second largest contributor. Industrialization of the economy results in growth in the imports of capital machinery and other related goods. As a result, the country's import basket changed, which contributed to the change in major trade partners.

Since 2004, China has increasingly become a significant participant in Bangladesh's shifting trade dynamics. Its swift economic advancement and the amplification of the Belt and Road Initiative (BRI) have opened up new avenues for Bangladesh in terms of trade, investments, and infrastructure development. Consequently, China has surpassed India in Bangladesh's foreign trade, mainly due to a substantial increase in imports of industrial goods from China and a decline in imports of similar goods from India. China's competitive edge lies in its reasonable pricing, streamlined trade procedures, and swift shipment of goods, granting it a comparative advantage over India in Bangladesh's import market.

This research investigates Bangladesh's changing trade dynamics with India and China, focusing on a detailed analysis of comparative advantages across different commodity groups. Additionally, the study delves into the factors driving the significant shift in Bangladesh's major trade partnership from India to China. The exploration extends to identifying challenges and opportunities arising from this transition, encompassing issues such as trade imbalances, non-tariff barriers, trade diversification, and the potential for increased regional cooperation.

This study has been structured around the following sections. The following section will discuss the study's related literature. Sections 3 and 4 contain the methodology and empirical results, respectively. Finally, we conclude the analysis in the last section.

2 Rationale of the study

Trade plays a significant role in the economic development of countries. Analyzing how trade patterns evolve between Bangladesh, India, and China can provide significant insights into economic trends, opportunities, and challenges for Bangladesh. Side-by-side studying the trade dynamics among these neighboring countries can shed light on the prospects for regional economic integration and cooperation. Governments formulate trade policies based on various factors, including trade relations with neighboring countries. By empirically studying the trade dynamics, policymakers can make informed decisions to enhance trade relations, address trade imbalances, and promote economic growth. The study delves into specific commodities that are significant contributors to the trade between these countries. Analyzing commodity-wise trade dynamics can help identify opportunities for specialization, cooperation, and competitiveness. Besides, investigating the evolving

trade relationships can provide insights into the effectiveness and impact of bilateral and multilateral agreements.

Overall, this research aims to provide a comprehensive understanding of the evolving trade dynamics between Bangladesh, India, and China, which is essential for policymakers, economists, and businesses operating in the region.

3 Bangladesh's foreign trade with china and india: an overview

China stands as Bangladesh's primary trading partner, making a significant contribution of USD 17.8 billion in FY23 (26.0 percent of total imports), which was 12.1 billion in FY20, with imports accounting for USD 11.5 billion. This import-heavy trade relationship, constituting 25.2 percent of imports in FY20, primarily involves capital machinery, nuclear machinery, cotton, man-made staple fibers, and knitted or crocheted fabrics. India follows as the second-largest trading partner, with a trade volume of USD 9.5 billion in FY23 (13.9 percent of total imports), which was 6.9 billion in FY20, of which USD 5.8 billion was attributed to imports, forming 12.7 percent of the total in FY20. India's exports mainly consist of food items, consumer goods, and intermediate goods.

While exports to China and India have seen incremental growth, their overall share remains modest, at 1.89 percent and 3.18 percent, respectively. Bangladesh's trade balance with these nations is heavily tilted towards imports, warranting attention towards enhancing bilateral trade agreements, particularly in the export of ready-made garments to these significant partners.

Over the past decade, Bangladesh has executed 46 projects under India's three line of credit schemes, with 14 completed projects, primarily focused on buses, trucks, and other vehicles. Simultaneously, China has played a pivotal role in Bangladesh's infrastructure development through various bilateral cooperation agreements and its Belt and Road Initiatives (BRI) strategy. The Padma Bridge Rail Link project, backed by the Chinese government's preferential loan, is the most expensive initiative with a cost of USD 3.14 billion, exemplifying China's substantial involvement. Additionally, China has contributed to other noteworthy projects, including the Bangabandhu International Conference Center, Payra Power Plant, Karnaphuli Multi-Channel Project, and the IV Tier National Data Center.

Figure 1: Exports as percentage of GDP

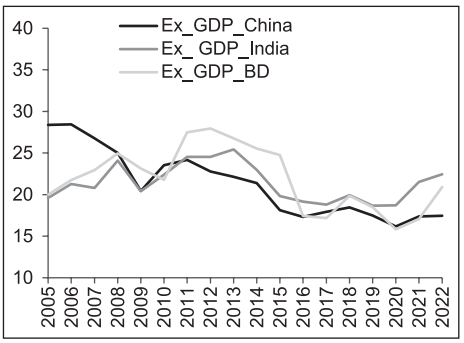
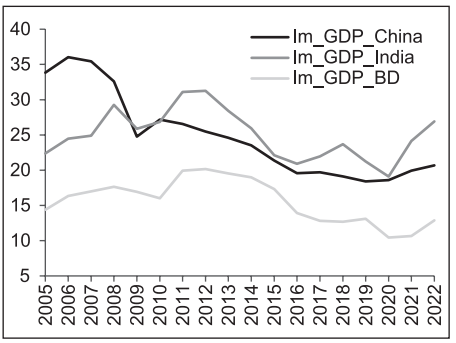


Figure 2: Imports as percentage of GDP



Source: Authors' calculation based on Bangladesh Bank data.

The exports and imports (as a percentage of GDP) of Bangladesh, along with its major trade partners China and India, are shown in the above figure. The chart shows that very recently, the foreign trade of the countries has been decreasing following the China-US trade war, together with the outbreak of the COVID-19 pandemic.

4 Review of literature

Several studies have delved into Bangladesh's foreign trade relations with India and China, with a particular focus on understanding the shifts in trade dynamics from India to China. For instance, Alam et al. (2009) conducted research on the impact of changes in price levels on the exchange rate, employing purchasing power parity (PPP) as the analytical framework. Their study encompassed an examination of Bangladesh's trade patterns with both India and China. However, the study fell short of providing a comprehensive justification for the causes behind the observed changes in the trade pattern.

In a separate investigation, Datta (2021) explored trilateral cooperation among Bangladesh, India, and China. The analysis primarily centered on various trade-related series. Notably, this study placed a greater emphasis on institutional and diplomatic factors rather than delving deeply into economic factors as key determinants of the observed trade dynamics.

Basu and Datta (2007) utilized various trade-related indices to investigate the persistent bilateral trade deficit between Bangladesh and India. Their study revealed similarities in the exports of both countries, highlighting a competitive environment with a random nature of exports. Additionally, the research identified remittance inflows and exchange rates as significant

factors influencing exports. In a separate analysis spanning from 1995 to 2018, Hossain (2021) scrutinized the structure and trends of the bilateral trade deficit between Bangladesh and China. The findings underscored the importance of enhancing intra-industry trade between the two nations, suggesting diversification of Bangladesh's export basket to China.

Examining bilateral trade between Bangladesh and India, Islam (2019) employed aggregated and disaggregated data, utilizing the Revealed Comparative Advantage (RCA) for different commodity groups to explain inter-industry trade. The results indicated that India possessed a comparative advantage in a greater number of product groups compared to Bangladesh. Kabir (2017) delved into the bilateral trade between Bangladesh and China, using various trade indicators for the period of 2012-2015 and offering insights into the trade relationship. Prabir et al. (2012) employed trade-related indices and the Gravity model in both static and dynamic frameworks to examine trade relations between India and Bangladesh. Their findings suggested mutually beneficial trade opportunities by opening markets to each other.

Sahoo (2013) analyzed parameters influencing the increasing merchandize trade of China and the declining trend with India in Bangladesh. Results revealed that China had overtaken many industries from India in Bangladesh's foreign trade, and the author proposed policies to address the imbalance in India's position.

However, none of the aforementioned studies analyzed trade dynamics at the commodity group level; instead, they focused on overall trade. Additionally, the causes behind these trade dynamics were not explored. The current study aims to contribute to existing literature by analyzing the comparative advantage of Bangladesh with India and China, focusing specifically on the commodity group level, which will guide policy decisions and support business. Furthermore, the analysis seeks to uncover the reasons behind China's growing trade with Bangladesh in comparison to India.

5 Methodology

This study relies on secondary data from the Bangladesh Bank. By utilizing data spanning from FY07 to FY22, various indices related to trade were computed to scrutinize trade dynamics. The decision to limit the data until FY20 is driven by the intention to mitigate the influence of the COVID-19 pandemic on trade patterns. It's noteworthy that FY20 data incorporates

information until June 2020, thereby allowing for the exclusion of the COVID-19 impact through the chosen sample period ending at FY20.

Trade Intensity Index: The trade intensity index, a widely utilized metric for assessing bilateral trade (Brown, 1949; Komija, 1964), offers a means of gauging trade relations without the influence of comparative trade size biases. The index comprises two distinct segments: export and import intensity indices. With values either exceeding or falling below one, a reading greater than one signifies trade surpassing expected levels, while a value less than one suggests trade is relatively weaker or below anticipated levels.

Export intensity index: The export intensity index is calculated as the ratio of a trading partner's share in a country's total exports to the share of world exports directed to that trading partner. The calculation is performed using the following formula:

$$\text{MXII} = \frac{\frac{X_{bj}}{X_b}}{\frac{M_j}{(M_w - M_b)}} \quad (1)$$

where $\boldsymbol{X_{bj}}$ is Bangladesh's Export to *j* country. Here, *j* indicates two major trade partners (China & India) of Bangladesh. $\boldsymbol{X_b}$ is the total export of Bangladesh, $\boldsymbol{M_j}$ is the total import of *j* country, $\boldsymbol{M_b}$ is the total import of Bangladesh, and $\boldsymbol{M_w}$ is the global import.

Import intensity index: It can be measured by the ratio of a trading partner's share to a country's total imports to the share of world imports to the trading partner. It is calculated by using the formula given below:

$$\text{IMII} = \frac{\frac{M_{bj}}{M_b}}{\frac{X_j}{(X_w - X_b)}} \quad (2)$$

where $\boldsymbol{M_{bj}}$ is Bangladesh's Import from *j* country. Here, *j* indicates two major trade partners (China & India) of Bangladesh. $\boldsymbol{M_b}$ is the total import of Bangladesh, $\boldsymbol{X_j}$ is the total export of *j* country, $\boldsymbol{X_b}$ is the total export of Bangladesh and $\boldsymbol{X_W}$ is the global export.

Intra-Industry Trade: Intra-Industry Trade (IIT) takes place when a country is involved in both importing and exporting similar types of products within a specific industry or sector. This strategy allows a country to streamline its production of similar goods, taking advantage of economies of scale. Elevated IIT ratios signify effective utilization of these potential gains. The IIT index quantifies the extent of overlap between a

country's imports and exports within the same commodity category. A value of 1 (one) denotes pure intra-industry trade while a value of 0 (zero) signifies pure inter-industry trade, reflecting the exchange of goods across different industries between countries. Intra-industry trade of a particular industry 'j' can be measured by the formula given below:

$$ITT_j = 1 - [\|X_{bj} - M_{bj}\| / (X_{bj} + M_{bj})] \quad (3)$$

$\boldsymbol{M_{bj}}$ is the Import of commodity group j by Bangladesh and $\boldsymbol{X_{bj}}$is the export of commodity group *j* by Bangladesh.

Export specialization index: It can be measured by the ratio of the share of the product in a country's total exports to that of its total imports of that country. It is calculated as

$$EXSI = \frac{\frac{X_{bj}}{X_{bt}}}{\frac{M_{ij}}{M_{it}}} \quad (4)$$

where $\boldsymbol{X_{bj}}$ is the export value of product *j* in Bangladesh and $\boldsymbol{X_{bt}}$ is the total export of Bangladesh. $\boldsymbol{M_{ij}}$ is the total export of country *i*, indicating two major trade partners (China & India) of product j, $\boldsymbol{X_{it}}$ is the total export of i countries (China and India). The value of the index can be from zero to one, where zero indicates no comparative advantage in the specific market and one indicates full specialization in the market.

RCA type index: The revealed comparative advantage of a particular product 'j' can be measured as the trade gap of the product divided by the total exports and imports of that product. Positive value indicates a comparative advantage, and negative value indicates a comparative disadvantage.

$$RCA_j = (X_j - M_j)/(X_j + M_j) \quad (5)$$

where $\boldsymbol{X_j}$ is the export values of Bangladesh in product j and $\boldsymbol{M_j}$ is the total import of the country Bangladesh in product *j*. The value of the index can be positive or negative, where a positive value indicates a comparative advantage in the specific product group and a negative value indicates a comparative disadvantage in the specific product group.

Visvizi-Wosiek RCA index: To overcome the limitations of the RCA index, Visvizi and Wosiek (2021) modified the index by using the formula given below.

$$VWRCA = \frac{EX_i^j}{IM_i^j} : \frac{\sum_{i=1}^{n} EX_i^j}{\sum_{i=1}^{n} IM_i^j} \quad (6)$$

EX_i^j are the exports of a j group of products of the economy **i** and IM_i^j is the imports of a j group of products of the economy i. The larger the value of the index, the greater the comparative advantage.

6 Influence of economic structure on trade dynamics

To explore the impact of economic transformation on the trade dynamics, we conduct a regression analysis, regressing the ratio of share of imports from China to India on the ratio of the industry's share in GDP to the share of agriculture in GDP, controlling for other macroeconomic variables. A positive relationship in the regression results would imply that as Bangladesh's economy undergoes industrialization, there is an increase in imports from China compared to India. The study uses time series data for Bangladesh's Economy covering 1989-2022. Data were collected from the World Development Indicators (WDI) data set of the World Bank and Bangladesh Bank (BB).

For the reliability of the result, we use both ADF and PP tests to check the unit root. Then we use the autoregressive distributed lag (ARDL) bound test method originated by Pesaran and Shin (1999) and expanded by Pesaran, Shin, and Smith (2001) to look at the long-term relationship. We shall calculate the effect of structural transformation on trade dynamics while accounting for some macroeconomic factors.

If the bound test shows that a long-term relationship exists, we can estimate that relationship using the below.

$$Chi\_Ind_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\ Chi\_Ind_{t-i} + \sum_{i=0}^{k} \beta_{1i}\ Ratio_{t-i} + \sum_{i=0}^{q} \gamma_{1i}\, LEx_{t-i} + \sum_{i=0}^{l} \theta_{1i}\, Lopen_{t-i} + \sum_{i=0}^{j} \varphi_{1i}\, Tariff_{t-i} + \varepsilon_{1t} \quad (7)$$

Here, p, k, q, l, and j are the optimal lags of the respective variables.

where,

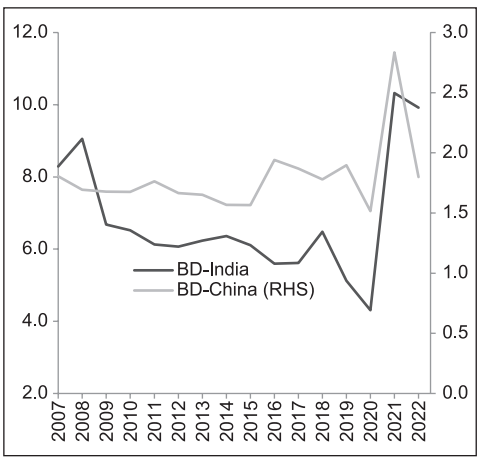
Variable	Definition	Source
Chi_Ind	The Ratio of Import from China to Import from India	WDI
LEx	Log of Exchange Rate BDT per USD	WDI
LFDI	Log of FDI net inflow from China	Bangladesh Bank
Lopen	Log of Trade openness	WDI
Ratio	Ratio of the share of industry on GDP to share of agriculture on GDP	WDI
Tariff	Tariff Rate (simple mean)	WDI

7 Empirical results

This section presented the empirical findings of the study. Initially, we discussed various trade-related indices, including export and import intensity indices, including export and import intensity indices, export specialization index, and intra-industry trade indices. We then explored the analysis of revealed comparative advantage based on commodity groups. Finally, we examined the impact of economic transformation on trade dynamics using a standard regression model.

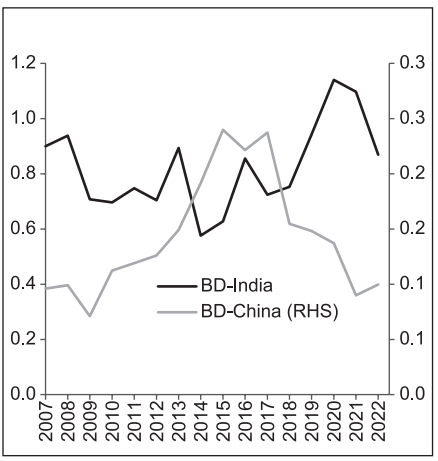
The data presented in Table 1 showed the export and import intensity between Bangladesh and two of its key trading partners, India and China, for the period 2007-2022. Bangladesh's export intensity to India gradually decreased and reached a minimum in 2014, after which it began to increase and became its highest in 2020. During the sample period, BD exports to India were below the expected level except for 2020 and 2021 (during the pandemic period).

Figure 3: Import intensity



Source: Author's Calculation.

Figure 4: Export intensity



Source: Author's Calculation.

The export intensity value of Bangladesh to China is notably low, indicating that Bangladesh's export level to China lags behind China's global market share. Bangladesh's export intensity to China peaked in 2015 but has since declined, reaching 0.10 in 2022. This declining trend suggests a failure on Bangladesh's part to diversify its exports to the Chinese market.

On the other hand, the import intensity of Bangladesh from India has gradually decreased, hitting a minimum in 2020. Throughout the

observation period, Bangladesh's imports from India exceeded the expected level, with values greater than one. This indicates that Bangladesh's imports from India have gradually decreased, evidenced by a decline in the share of total imports from 15.65% in 2008 to 11.90% in 2020.

Meanwhile, the import intensity of Bangladesh from China surpasses one, indicating that Bangladesh's import level from China exceeds China's global market share. Bangladesh's import intensity from China has gradually increased, peaking in 2021 with a mixed trend over the sample period. The upward trend suggests a gradual increase in Bangladesh's imports from China, reflected in the rise in the share of total imports from 17.79% in 2007 to 25.6% in 2022. This trend implies that China is diversifying its exports to the Bangladesh market.

8 Commodity-wise analysis

Bangladesh has Intra-industry trade with India among the following groups of commodities: live animals and animal Products, wood and articles of wood, raw hides and skins—leather and articles thereof, footwear, headgear, umbrellas, and parts thereof, textiles and textile articles. Among them, the intensity of intra-industry trade of commodity groups, such as live animals and animal products, and wood and articles of wood, has decreased, and the intensity of other commodity groups has increased.

In bilateral trade with India, Bangladesh has high export specialization on Animal or Vegetable fats and Oils and their cleavage products and low specialization on commodity groups live animals and animal products, raw hides and skins—leather and articles thereof, footwear, headgear, umbrellas, and parts thereof.

Bangladesh has a comparative advantage in the two product groups, animal or vegetable fats and oils and their cleavage products, as well as footwear, headgear, umbrellas, and parts thereof, in the trade with India. Moreover, the comparative disadvantage of some product groups has decreased. These product groups are prepared foodstuffs, plastics & rubber articles, textiles & textile articles, and pulp of wood or other fibrous cellulosic material.

Bangladesh has intra-industry trade with China in the three groups of commodities, such as animal or vegetable fats and oils and their cleavage products, wood and articles of wood, raw hides and skins, and leather and articles thereof. Among them, the intensity of intra-

industry trade of commodity groups live animals and animal products, base metals and articles of base metals, and plastics and rubber articles thereof has decreased and that of the others commodity groups, such as textiles and textile articles and footwear, headgear, umbrellas, and parts thereof has increased.

In bilateral trade with China, Bangladesh has high export specialization on live animals and animal products and low specialization on commodity groups animal or vegetable fats and oils and their cleavage products, raw hides and skins—leather and articles thereof, textiles & textile articles, and wood and articles of wood.

Bangladesh has a comparative advantage in the product groups Live Animals and animal Products. moreover, the comparative disadvantage of some product groups has been decreased. these product groups are animal or vegetable fats and oils and their cleavage products, wood and articles of wood, and footwear, headgear, umbrellas, and parts thereof.

9 Relationship of trade dynamics with the changing structure of the economy

In the empirical analysis, we use time series data. First, we describe the basic characteristics of the data. Table 1 shows the descriptive statistics of each variable.

Table 1: Descriptive statistics

	CHI-IND	RATIOA-I	LEX	LNFDI	LOPEN	TARIFF
Mean	1.163	1.465	1.774	0.716	1.465	32.643
Median	1.242	1.295	1.822	0.424	1.469	15.290
Maximum	1.983	3.023	1.962	3.064	1.673	105.36
Minimum	0.172	0.647	1.508	-0.959	1.216	11.670
Std. Dev.	0.425	0.699	0.135	1.040	0.126	31.569
Skewness	-0.275	0.902	-0.443	0.641	-0.303	1.389
Kurtosis	2.418	2.637	1.831	2.370	2.386	3.239
Jarque-Bera	0.910	4.802	3.050	2.892	1.053	11.027
Probability	0.634	0.091	0.217	0.235	0.591	0.004
Observations	34	34	34	34	34	34

Before running the regression model, we have to check the stationarity of the time series data. We use the Augmented Dicky-Fuller (ADF) and Phillips-Parron (PP) tests to check the unit root.

Table 1 (Appendix) represents the result of the unit root tests. Among the six variables, the ADF test shows that two variables, Chi_Ind and Tariff, are stationary at a level that is integrated of order zero I(0). The remaining four variables, LEx, LFDI, Lopen, Ratio and Tariff, are stationary at the first difference, which is integrated into order one I (1). The results of the PP test also provide the same integration level of the variables.

Since some variables are I(0) and others are I(1), the appropriate econometric model to find the long-run relationship is the ARDL bound test approach. Table 3 (Appendix) reports the result of the bound test. The estimated value of the F-statistic is 7.55, which is larger than the Upper bound value at any significance level. The result indicates the existence of a long-run relationship among the variables.

Table 2: ARDL long run relationship

Variables	Coefficients	Standard Errors
LEx	13.9908	9.771
LFDI	0.596	0.478
Lopen	**7.375@**	**2.841**
Ratio	**3.888@**	**1.555**
Tariff	-0.004	0.007
Constant	-30.213	17.236
Trend	**-0.567***	**0.288**
ECT	**-0.955#**	**0.207**
Adjusted R2	**0.727**	

*Note: # indicate significant at 1 percent, @ indicates significant at 5 percent l and * indicates significant at 10 percent.*

The estimates of the long-run ARDL model with robust standard errors are reported in Table 4. The findings indicate that the structural transformation of the Bangladesh economy, measured by the ratio of the share of industry to the share of agriculture in GDP, resulted in a divergence of imports from India toward China. More specifically, an increase in the ratio of the share of industry to share of agriculture in GDP, on average, significantly increases the import from China compared to India by 3.9 percentage points.

In addition, trade openness promotes Bangladesh's import from China by 7.4 percentage points and is statistically significant at 5%. The coefficient of the time trend is also significant at even 1%. The coefficient of the Error correction term is -0.96 and statistically significant at 1% significance level.

That is, any short-run disequilibrium will be corrected within almost one year. The effects of other variables are not significant. The value of the adjusted R2 is 0.727, which indicates that 73 percent of the variation in the dependent variable can be explained by the regression model.

To check the reliability of the result, we use different diagnostic tests, and the results are shown in Table 5. The tests of heteroskedasticity and serial correlation indicate that both models are free from the problems of heteroskedasticity and autocorrelation at 5 percent level. Finally, the Ramsey RESET test results are statistically insignificant, which means the model is correctly specified.

10 Policy implications

Given the declining intensity of intra-industry trade in commodity groups such as Live Animals and animal Products, and Wood and Articles of Wood, Bangladesh needs to prioritize diversifying its export portfolio. Policies should encourage a broader range of products to reduce reliance on specific commodities. Notably, Bangladesh shows strong export specialization in Animal or Vegetable fats and Oils and their cleavage products in trade with India, and Live Animals and animal Products in its dealings with China. Strengthening this specialization requires targeted government support, including investment incentives, infrastructure development, and improved market access. While comparative disadvantages have lessened in some product categories over time, efforts should persist in addressing remaining weaknesses, particularly in Textiles & textile Articles and Wood and Articles of wood. Policies should promote collaboration within industries to enhance competitiveness and productivity. Moreover, measures to streamline trade procedures, reduce tariffs, and upgrade logistics infrastructure are crucial to capitalize on increasing intra-industry trade intensity. Diversifying export destinations beyond India and China is essential to mitigate risks associated with market dependence, with exploration of opportunities in emerging markets and bolstering trade agreements with other nations being key strategies. Through these policy measures, Bangladesh can optimize its trade relations, bolster export competitiveness, and drive sustainable economic growth.

11 Conclusion

Bangladesh's trade dynamics with India and China have undergone significant evolution, influenced by factors such as economic growth, infrastructure development, policy reforms, and geopolitical

considerations. Understanding these changes is crucial for policymakers to seize opportunities and tackle challenges in the evolving regional trade landscape. The empirical analysis revealed a shifting pattern of trade dynamics, with Bangladesh's exports to India gradually increasing over the sample period, albeit below expected levels, while exports to China peaked in 2017 before declining. Meanwhile, imports from India decreased gradually, reaching a minimum in 2020, whereas imports from China showed a steady increase, indicating China's growing export diversification into the Bangladeshi market. Export specialization indices highlighted Bangladesh's strengths in specific product groups with each country, reflecting comparative advantages in sectors like Animal or Vegetable fats and Oils and their cleavage products, as well as Live Animals and animal Products. The study also underscored the positive impact of structural changes in Bangladesh's economy on the shift from India to China as the leading trade partner. As Bangladesh strives to enhance its role in regional trade, emphasis on bilateral agreements with India and China, particularly in light of recent tariff exemptions, is crucial for further export growth. Positioned as a pivotal player in South Asia's evolving trade dynamics, Bangladesh's strategic realignment in trade relationships underscores its growing significance in regional and global affairs, making it imperative for stakeholders to grasp the reasons and consequences of this transformative shift.

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Appendix

Table A1: Unit Root Test

	ADF Test			PP Test		
Variables	**Level (constant & trend)**	**First difference (constant & trend)**	**Decision**	**Level (constant & trend)**	**First difference (constant & trend)**	**Decision**
Chi_Ind	-3.966**		I (0)	-3.740***		I (0)
LEx	-1.632	-4.626***	I (1)	-1.579	-5.029***	I (1)
LFDI	-3.051	-6.538***	I (1)	-2.921	-22.285***	I (1)
Lopen	-1.287	-5.813***	I (1)	-1.287	-5.891***	I (1)
Ratio	-0.259	-5.407***	I (1)	-0.284	-5.401***	I (1)
Tariff	-37.160***		I (0)	-2.911*		I (0)

Table A2: Diagnostic Tests

	Test Statistic	**Baseline**
Serial Correlation LM test	F-statistic	3.84 (0.0514)
Heteroskedasticity	F-statistic	1.593 (0.192)
Ramsey RESET Test	F-statistic	1.157 (0.302)

Table A3: Cointegration/Bound Test for Long Run Relationship

Test Statistic	**Baseline**	**Significance Level**	**Lower Bound I (0)**	**Upper Bound I (1)**
F-test	7.55	10%	2.75	3.79
		5%	3.12	4.25
		1%	3.93	5.23

Table A4: Trade Intensity

	Export Intensity		Import Intensity	
Year	**BD-India**	**BD-China**	**BD-India**	**BD-China**
2007	0.90	0.10	8.29	1.80
2008	0.94	0.10	9.05	1.69
2009	0.71	0.07	6.68	1.68
2010	0.70	0.11	6.52	1.67
2011	0.75	0.12	6.13	1.76
2012	0.70	0.13	6.07	1.67
2013	0.89	0.15	6.24	1.65
2014	0.58	0.19	6.36	1.57
2015	0.63	0.24	6.11	1.57
2016	0.85	0.22	5.59	1.94
2017	0.72	0.24	5.61	1.87
2018	0.75	0.15	6.48	1.78
2019	0.94	0.15	5.12	1.90
2020	1.14	0.14	4.31	1.52
2021	1.10	0.09	10.32	2.83
2022	0.87	0.10	9.92	1.80

Table A5: Commodity Group Wise Analysis

BD-INDIA	**Intra-Industry Trade**			**ESI**			**VWRCA-INDIA**			**RCA**		
	FY22	FY20	FY10	FY22	FY20	FY10	FY22	FY20	FY10	FY22	FY20	FY10
Live Animals and animal Products	0.62	0.76	0.87	0.12	0.14	0.17	0.64	1.14	1.23	-0.38	-0.24	-0.13
Animal or Vegetable fats and Oils and their cleavage products	1.98	0.02	0.00	22.05	24.04	0.00	121.8	202.1	0.00	0.98	0.98	-1.00
Prepared foodstuffs	0.25	0.29	0.08	0.04	0.04	0.01	0.20	0.31	0.06	-0.75	-0.71	-0.92
Mineral Products	0.06	0.11	0.24	0.01	0.01	0.03	0.05	0.11	0.22	-0.94	-0.89	-0.76
Products of the Chemical or Allied Industries	0.15	0.08	0.06	0.02	0.01	0.01	0.11	0.08	0.05	-0.85	-0.92	-0.94
Plastics & Rubber Articles Thereof	0.12	0.09	0.03	0.02	0.01	0.00	0.09	0.09	0.03	-0.88	-0.91	-0.97

(Contd.)

(Table A5 continued)

BD-INDIA	Intra-Industry Trade			ESI			VWRCA-INDIA			RCA		
	FY22	FY20	FY10	FY22	FY20	FY10	FY22	FY20	FY10	FY22	FY20	FY10
Wood and Articles of wood; wood charcoal; cork and articles of cork	0.44	0.24	0.52	0.07	0.03	0.08	0.41	0.25	0.56	-0.56	-0.76	-0.48
Pulp of wood or of other fibrous cellulosic material;	0.09	0.18	0.01	0.01	0.02	0.00	0.07	0.19	0.01		-0.82	-0.99
Textiles & textile Articles	0.28	0.50	0.35	0.05	0.07	0.05	0.24	0.61	0.34	-0.91	-0.50	-0.65
Footwear, Headgear, Umbrellas, and parts thereof	1.44	0.97	0.13	0.67	0.23	0.01	3.70	1.96	0.11	0.44	0.03	-0.87
Articles of stone, plaster, cement, Asbestos, mica or similar materials,	0.63	0.15	0.45	0.12	0.02	0.06	0.66	0.15	0.47	-0.37	-0.85	-0.55
Natural or Cultured pearls, Precious or semiprecious stones, and articles thereof,	00	0.03	0.07	0.00	0.00	0.01	0.00	0.03	0.06	-1.0	-0.97	-0.93
Base Metals & Articles of Base Metals	0.18	0.15	0.19	0.03	0.02	0.02	0.14	0.15	0.17	-0.82	-0.85	-0.81
Machinery and Mechanical appliances; electrical equipment; parts thereof;	0.06	0.01	0.02	0.01	0.00	0.00	0.04	0.01	0.02	-0.94	-0.99	-0.98

Table A6: Commodity Group Wise Analysis

BD-CHIN	Intra-Industry Trade			ESI			VWRCA			RCA		
	FY22	FY20	FY10	FY22	FY20	FY10	FY22	FY20	FY10	FY22	FY20	FY10
Live Animals and animal Products	0.36	0.12	0.81	1.68	6.77	0.38	6.58	28.69	2.36	0.64	0.88	0.19
Vegetable Products	0.06	0.07	0.06	0.01	0.01	0.01	0.05	0.06	0.05	-0.94	-0.94	-0.94
Animal or Vegetable fats and Oils and their cleavage products	0.03	0.47	0.00	0.01	0.13	0.00	0.03	0.57	0.00	-0.97	-0.53	-1.00
Prepared foodstuffs	0.01	0.02	0.04	0.00	0.00	0.01	0.04	0.02	0.03	-0.94	-0.98	-0.96
Mineral Products	0.05	0.01	0.11	0.01	0.00	0.02	0.04	0.01	0.10	-0.95	-0.99	-0.89
Products of the Chemical or Allied Industries	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.02	0.00	-0.99	-0.98	-1.00
Plastics & Rubber Articles Thereof	0.02	0.03	0.26	00	0.01	0.04	0.02	0.02	0.24	-0.98	-0.98	-0.75
Raw hides and Skins, Leather and articles thereof	0.98	0.74	0.63	0.35	0.26	0.56	1.38	1.09	3.51	-0.02	-0.26	0.37
Wood and Articles of wood; wood charcoal; cork and articles of cork	0.47	0.47	0.03	0.11	0.14	0.00	0.01	0.57	0.03	-0.54	-0.53	-0.97
Pulp of wood or of other fibrous cellulosic material;	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	-0.989	-1.00	-0.99
Footwear, Headgear, Umbrellas, and parts thereof	0.40	0.13	0.04	0.09	0.03	0.01	0.36	0.12	0.03	-0.601	-0.875	-0.960
Articles of stone, plaster, cement, Asbestos, mica or similar materials,	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.02	0.01	-1.0	-0.982	-0.985
Base Metals & Articles of Base Metals	0.08	0.00	0.11	0.02	0.00	0.02	0.06	0.00	0.09	-0.919	-0.998	-0.889

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Budget Deficit and Economic Growth: A Fiscal Policy Evaluation of Bangladesh[1]

Dr Nazneen Kawshar Chowdhury[2]

Abstract

This study examines the relationship between budget deficit and economic growth and evaluates whether budget deficit creates 'crowding-in' effects in private sector investment. This study uses the demand for goods model of the Keynesian framework. Using secondary data for the period 2006-2019, this study shows a positive, but insignificant, relation between budget deficit and economic growth, indicating that monetary policy, fiscal policy, external economic conditions, and various structural factors are influencing both the budget deficit and economic growth independently. On the other hand, the study shows a positive and significant relationship between investment and economic growth, indicating that there is a 'crowding-in' effect on investment, suggesting that encouraging investment can be a strategy to promote the economic growth of Bangladesh. Finally, the study shows a negative, but insignificant, relation between debt and economic growth, reflecting that increasing debt does not directly cause economic growth to decline. Other factors, such as economic policies, external shocks, and structural issues, are influencing both debt levels and economic growth independently.

Key words: fiscal policy, budget deficit, economic growth, Bangladesh

1 This research has been carried out by the author in 2023 for the 'Research and Policy Evaluation' Module of the Senior Staff Course held in the Public Administration Training Center, Dhaka, Bangladesh. During that time the author worked as an Executive Director of the Insurance Development and Regulatory Authority (IDRA) of the Financial Institution Division under Ministry of Finance, Dhaka, Bangladesh.

2 Additional Secretary, Ministry of Commerce. E-mail: nazneenkbd@yahoo.com

1 Introduction

1.1 Background

Bangladesh's economy has been going through a continuous budget deficit since the early 2000s. To finance this deficit, the Government of Bangladesh (GoB) has been borrowing largely from both foreign and domestic sources. During the period of budget deficit, though the economy had been growing consistently high over a decade, crossing the 7.0 percent milestone in FY 2015-16 and the 8.0 percent milestone in FY 2018-19 (MoF 2023a), this growth was less than its potential.

To alleviate poverty and to accelerate the rate of economic growth, Bangladesh has been managing its fiscal policies since 1971. Currently, Bangladesh is considered an emerging economy. The country has made incredible socio-economic progress and has risen to an enviable level compared to its competitors. The average GDP growth during the last fourteen years was more than 6.7 percent. However, the COVID-19 pandemic reduced the growth rate to 3.45 percent in FY 2019-20. Bangladesh successfully managed the COVID-19 pandemic and returned to a high growth trajectory. A record published in June 2023 by the Ministry of Finance (MoF) of Bangladesh shows that in FY 2020-21, Bangladesh achieved the GDP growth of 6.94 percent and 7.10 percent in FY 2021-22. To remain a bit conservative, considering the global sluggish economic condition, the GDP growth rate is expected to be 6.03 percent in FY 2022-23, 1.07 percentage points lower than the previous FY 2021-22. Medium-term forecasts for GDP growth rates are 7.5 percent in FY 2023-24, 7.8 percent in FY 2024-25 and 8.0 percent in FY 2025-26 (MoF 2023a).

World Bank (WB) report (2023) shows that even in times of heightened global uncertainty, Bangladesh has a strong track record of growth and development. This achievement is attainable due to several factors, namely, a robust demographic dividend (WB 2023), strong ready-made garment (RMG) exports, resilient remittance inflows (Rana & Wahid 2017; WB 2023) and stable macroeconomic conditions (WB 2023). Today, Bangladesh is considered a role model to be followed by other nations that are aspiring for development. Since January 2015, Bangladesh has graduated to a lower middle-income country according to the standard of the World Bank. Bangladesh has received the final endorsement from the United Nations to graduate from a least developed country in 2026.

A successful economy is one that combines high output growth, i.e., high GDP growth, low unemployment, and low inflation (Blanchard, 2017).

Macro-economic performance of a country normally depends on judicious formulation, effective implementation and management of national fiscal policies (Rana & Wahid, 2017). To mobilize adequate resources that expedite economic growth and to alleviate poverty, Bangladesh has been pursuing an expansionary fiscal policy. To manage expansionary fiscal policy, government expenditure has exceeded the revenue earnings, and therefore, Bangladesh has experienced a sustainable trend in its budget deficit. In recent years, the volume of the deficit has increased. A report (2021) published by the Economic Relations Division (ERD) of Bangladesh shows that despite the revenue mobilization challenge, Bangladesh performed well in fiscal management by keeping the budget deficit within a reasonable limit of five percent of the nominal GDP.

The relationship between economic growth and budget deficits can be analyzed in terms of how fiscal policies influenced growth and whether deficits helped or hindered economic expansion. The trend of the budget deficit during 2006-2019 shows that the budget deficit remained below five per cent of GDP, a manageable level for a developing economy and higher government spending (especially on infrastructure) correlated with higher GDP growth after 2015. However, a few challenges of a budget deficit on economic growth, such as a low tax-to-GDP ratio, concerns on debt sustainability and inflationary pressures. Low tax-to-GDP ratio (below ten percent) limited the government's ability to finance projects, and heavy reliance on domestic borrowing could crowd out private investment. While external debt remained low, rising domestic borrowing could increase interest burdens. If deficits were to rise beyond five to six percent of GDP, inflation and financial instability risks could increase. In addition, excessive government borrowing could lead to higher inflation, reducing purchasing power.

According to the Ministry of Finance of Bangladesh (2023b), during 2006-2019, the economic growth of Bangladesh remained robust despite moderate budget deficits. The government increased spending on roads, bridges and power plants. Public spending on infrastructure facilitated industrial expansion (especially the garment sector) and led to job creation, boosting demand and private investment. Trends in budget deficit and private investment during 2006-2019 show that private investment as a percentage of GDP increased from 18.4% (2006) to 23.8% (2019). On the other hand, the budget deficit remained below 5% of GDP, suggesting it did not excessively crowd out private investment. Growth in infrastructure spending likely enhanced business opportunities, supporting the

crowding-in effect. Although the budget deficit mostly supported private sector investment, some risks of crowding out existed, such as domestic borrowing pressures, tax revenue constraints, and public-private competition for resources. Government borrowing from domestic banks could limit credit availability for the private sector. Interest rates were kept relatively low, but if deficits had increased further, borrowing costs might have risen. Bangladesh had a low tax-to-GDP ratio (~10%), meaning deficit financing relied on borrowing rather than revenue generation. If revenue collection does not improve, future deficits could put pressure on private investment. Some sectors, such as construction and real estate, saw government projects competing for labor and materials, increasing costs for private investors.

1.2 Objective

The main objectives of this study are —

i. to examine the relationship between budget deficit and economic growth, and
ii. to evaluate whether budget deficit creates 'crowding-in' effects in private sector investment.

1.3 Justification

The relationship between budget deficit and economic growth is a complex and debated topic in economics and varies across developing countries. While budget deficits can contribute to growth under certain conditions, their impact is intertwined with a host of other economic and structural factors. Sound fiscal management, effective governance, and a holistic understanding of a country's economic landscape are crucial for achieving sustainable economic growth despite budget deficits. However, the debate about the effects of government budget deficit on economic growth remains unsettled. On the one hand, a budget deficit does not necessarily cause low economic growth. Other factors, such as private sector activities, exports, and global economic conditions, also play significant roles. Van and Sudhipongpracha (2015) argued that deficit spending is assumed to complement business investment and stimulate economic productivity.

On the other hand, a deficit is believed to trigger high tax rates, which can decrease productivity and deter private investment. In addition, a persistent and significantly high budget deficit over time, that is, in the long run could potentially lead to concerns such as inflation,

increased borrowing costs, and reduced investor confidence, which might negatively impact on economic growth. Rana & Wahid (2017) show that an increased budget deficit may create an adverse impact on the macro-economic performance of the country and result in a negative impact on the acceleration of the rate of economic growth. However, a lower budget deficit might contribute to more stable economic growth, but it's not a definitive rule. Other structural and external factors can influence growth as well. While budget deficits can contribute to economic growth by stimulating demand, funding public investments, and reducing poverty, their impact is contingent on factors such as the quality of spending, crowding-out effects, external influences, and overall fiscal sustainability.

This study uses the demand for goods model of the Keynesian framework. Using secondary data for the period 2006-2019, this study shows a positive, but insignificant, relation between budget deficit and economic growth, indicating that monetary policy, fiscal policy, external economic conditions, and various structural factors are influencing both the budget deficit and economic growth independently. On the other hand, the study shows a positive and significant relationship between investment and economic growth, indicating that there is a 'crowding-in' effect on investment, suggesting that encouraging investment can be a strategy to promote the economic growth of Bangladesh. Finally, the study shows a negative, but insignificant, relation between debt and economic growth, reflecting that increasing debt does not directly cause economic growth to decline. Other factors, such as economic policies, external shocks, and structural issues, are influencing both debt levels and economic growth independently.

The remainder of this paper is divided into four sections. Section 2 reviews the literature. Section 3 describes the research design and methodology. Data, variables and findings are presented in Section 4. Finally, Section 5 offers a conclusion.

2 Literature review

The relationship between budget deficit and economic growth is one of the most debatable issues among economists and policymakers in both developing and developed countries. In a developing country, the issue is more important as it pursues growth in its development policy. Researchers and economists have conducted various empirical studies to understand how budget deficits affect the country's economic performance. Budget deficit occurs when the government's total expenditures exceed its total

revenues (Alt & Chrystal 1983). But a large deficit does not always indicate imprudent fiscal behavior. It is widely said that to cope with wartime situations and economic downturns, a government may choose to incur a deficit as a strategy (Shaviro 1997). In addition, the government uses a variety of fiscal instruments to achieve social stability and promote economic growth. Each choice of fiscal instrument has a different impact on a country's economic performance. One of the fiscal measures commonly used by governments to intervene in the economic sphere is their own expenditures (Thoa et al, 2013).

Economic literature shows three major theoretical frameworks, which describe a positive or negative relationship or neutrality between budget deficit and economic growth (Ahmad 2013). One of these is Keynesian theory, which shows a positive relationship between budget deficit and economic growth. Keynesian theory describes how governments' expenditures affect economic productivity. Keynesian economists argued for an 'expansionary fiscal policy' or a 'crowding-in' effect of budget deficit, which is due to an increase in domestic production and private investment (Modigliani 1977 & Seccareccia 1994). Government budget deficit can lead to an increase in aggregate demand. This eventually stimulates saving and private investment (Eisner 1989). The argument shows that budget deficits have a positive influence on economic productivity (Coggington 1976). However, these crowding-in effects occur only when a deficit results in more public infrastructure, such as roads, airports, railway networks, and public utilities (Aschauer 1989 & Carlsson et al 2013). Similarly, by reducing social conflict and by developing human and technological capital for future economic activities, social welfare and education programs can enhance growth (Kelly 1997).

The second one is neo-classical theory, which explains the opposite relationship between budget deficit and economic growth. Neoclassical economists argue that crowding-in effects only exist in the short run (Elmendorf & Mankiw 1998). It is also argued that by choosing budget deficits, the government shifts tax burdens to the future generation (Bernheim 1989). As a result, personal savings are likely to decline, even though current private consumption is bound to increase. In this scenario, interest rates are expected to rise in order to restore equilibrium in the capital market. The rise in interest rates would, in turn, trigger a decline in private investments (Plosser 1982). These negative consequences reduce the ability of the Government to influence economic activities. Neoclassical economists refer to these fiscal measures as the 'financial crowding-out'

effects of a budget deficit (Buiter 1977, and Buiter & Patel 1992). Apart from the financial effects, through a government's budget deficit, the 'resource crowding-out' effects can also be caused. When the government sector expands through deficit spending, the costs of essential economic resources, such as skilled labor and raw materials, will also increase. As a result, it would be difficult for the private sector to flourish (Yellen 1989).

The third theory is known as the Ricardian theory, which shows that there is no relationship between budget deficit and economic growth. While Keynesian economists and neoclassical economists have contradicting views about the relationship between deficit and growth, Barro (1989) proposes the 'Ricardian equivalence' theorem, which puts forward that the relationship is neutral. It is said that an increase in budget deficits today must be compensated by an increase in future taxes, which in turn, leaves the interest rates and private consumption unaffected (Cunningham & Vilasuso 1994). This theorem, assessed by Barro (1990), examines the effects of government deficits on investment and growth in 98 countries from 1960 to 1985. Findings show that government spending programs in those countries had no direct relationship with economic productivity. Rather, a key factor influencing the deficit-growth relationship is the type of government services and programs. Another study done by Barro (1991) shows that spending on public infrastructure is likely to have a more positive impact on a country's economic progress compared to welfare programs and agricultural subsidies. Similarly, another study on 30 developing countries between 1970 and 1980, argues that government budget deficits in the education sector have 'long-lasting effects on economic prosperity' (Bose et al, 2007). Based on these studies, public investments in public infrastructure and education are regarded as 'growth-enhancing' government expenditures.

A few studies such as, studies done on Bangladesh for the period 1975-2015 (Abdullah et al 2018) and 1981-2017 (Biplob 2019), study on Liberia (Onwioduokit & Inam 2018) supported Keynesian hypothesis, that is, these studies found a positive correlation between budget deficits and economic growth. Other studies focus on the deficit-growth relationship in developed countries, as well as the nature of public services and programs that precipitate budget deficits. Aschauer (1989) found that infrastructure investments by the American federal government facilitated private capital accumulation in the United States from 1953 to 1986, which is consistent with the research findings by Bahmani-Oskooee (1999). This study shows that government budget deficits related to infrastructure and

capital projects cause 'crowding-in' rather than 'crowding-out' (Bahmani-Oskooee 1999). A similar argument is shown in Argimon et al. (1997). Using data from 14 OECD countries between 1978 and 1989, the study shows that government expenditures have significant crowding-in effects on private investment, through the positive impact of infrastructure on economic productivity. Apart from infrastructure and government capital projects, social security policy and social safety net programs are also considered to be growth-promoting expenditures (Kelly, 1997). This suggests that countries may simultaneously pursue growth-oriented and social welfare policies.

However, several studies challenge the 'crowding-in' hypothesis of Keynesian economics. In 17 developed countries between 1949 and 1981, Guess & Koford (1986) find that government budget deficits did not affect inflation, economic productivity, and private investment. Landau (1983) and Kormendi & Meguire (1985) conducted similar studies that examined the relationship between government expenditures and economic growth rates in more than 50 countries. No significant relationship between deficit and growth was found in these two studies. A large number of single-country studies also defy the Keynesian assumption. For instance, a study on Pakistan's economy between 1978 and 2009 (Fatima et al, 2012) and a study on Bangladesh's economy between 1981 and 2011 (Rana & Wahid, 2017) reveal a negative relationship between budget deficit and economic growth. A similar result was also found in Namibia (Amwaama 2018) and Nigeria between 1980 and 2011 (Awe & Funlayo 2014), which shows that budget deficit negatively affects growth rates both in the short run and in the long run. Study shows both in the short and long run, government budget deficits did not appear to affect economic productivity in three Middle Eastern countries such as, in Saudi Arabia from 1960 to 1996 (Ghali 1997), the United Arab Emirates between 1973 and 1995 (Ghali & Al-Shamsi 1997), and Tunisia from 1963 to 1993 (Ghali 1998) as well.

Empirical studies reviewed in this section show mixed results about the effects of government budget deficits on economic growth. However, it is important to note that different components of government expenditures have different economic effects. In research works that highlight the positive relationship between deficits and economic productivity, government spending on public infrastructure is commonly found to promote growth. Not only does a country's infrastructure capacity enhance the private sector's productivity, but it also attracts foreign investments into the country (Cheng & Kwan, 2000; Asiedu, 2002 & Kirkpatrick et al., 2006).

3 Research design and methodology

The Keynesian framework is used in this study to see whether a positive relationship exists between budget deficit and economic growth. In addition to that, using this framework, the study will see whether budget deficit creates 'crowding-in' effects in private sector investment. All these assessments are done using both qualitative and quantitative methods. For quantitative analysis, the Ordinary Least Squares (OLS) method is applied, and the solver macro of the Microsoft Office Excel 2007 software is used. A qualitative method, such as an analytical framework, is also used in this study to see the relationship between budget deficit and economic growth and 'crowding-out' effects in private sector investment.

3.1 Theoretical framework

To evaluate the fiscal policy, this study uses the Keynesian framework following Amwaama (2018), Onwioduokit & Bassey (2014) and Osoro (2016). The Keynesian framework considers demand for goods models to analyze the relationship between budget deficit and economic growth and budget deficit and the 'crowding-in' effect. These models include three types of equations, such as identities, behavioral equations and equilibrium conditions.

In an open economy, the demand for goods is the sum of consumption, investment, government spending and net exports (Blanchard, 2017). The identity of demand for goods,

$$Z \equiv C + I + G$$

(A) For goods market equilibrium, *Production = Demand for goods, i.e.,*

$$Y = Z = C + I + G + NX \tag{1}$$

where,

$Y = Production$

$Z = Demand\ \ for\ goods$

$C = Consumption = c_0 + c_1 Y_D = c_0 + c_1(Y - T)$

$c_0 > 0, 0 < c_1 < 1, Y_D = disposable\ income\ and\ \ T = tax$

$I = \ Investment = \delta + \gamma i\ , \gamma < 0$

$i = nominal\ interest\ rate$

$G = \ \ Government\ Expenditure$

$$NX = \ Trade\ Balance = X - M$$

$$X = Export = s + \sigma\varepsilon\ ,\ \sigma > 0$$

$$\varepsilon = real\ exchange\ rate = \frac{EP}{P^*}$$

$$E = nominal\ exchange\ rate$$

$$P = domestic\ price\ for\ domestic\ goods$$

$$P^* = foreign\ price\ for\ domestic\ goods$$

$$M = Import = m + \mu Y_D = m + \mu(Y - T), \mu > 0$$

Replacing all behavioral equations in Equation 1 and solving and rearranging gives

$$Y = \frac{A}{\theta} + \frac{1}{\theta}[\gamma i + \sigma\varepsilon + BD) \tag{2}$$

where,

$$\theta = 1 - c_1 + \mu;\ A = c_0 + \delta + s - m\ \ and\ BD = G - (c_1 - \mu)T$$

(B) For financial/money market equilibrium, *Demand for money = Supply of money*, i.e.,

$$M^D = M^S$$

where,

$$M^D = Demand\ for\ money = kY + \lambda i$$

$$k > 0, \lambda < 0$$

$$M^S = m_1\frac{B}{P} + m_2 i$$

$$m_1, m_2 > 0\ and\ B = International\ reserve\ held\ by\ the\ Central\ Bank$$

Replacing M^D and M^S, gives

$$i = \psi\frac{B}{P} + \varphi Y \tag{3}$$

where, $\psi = \frac{m_1}{\lambda - m_2}\ and\ \varphi = -\frac{k}{\lambda - m_2}$

Replacing Equation 3 into Equation 2 and solving & rearranging gives

$$Y = \alpha_1 + \alpha_2\frac{B}{P} + \alpha_3\varepsilon + \alpha_4 BD \tag{4}$$

(C) For external sector equilibrium or the Balance of Payment (BoP),

$$B = A_2 - \theta_0 Y + \theta_1 \varepsilon + \theta_2 i$$

Replacing BoP into Equation 4 gives

$$Y = \delta_0 + \delta_1 \varepsilon + \delta_2 i + \delta_3 BD \tag{5}$$

where,

$$\delta_0 = \frac{P\alpha_1 + A_2\alpha_2}{P + \theta_0\alpha_2};\ \delta_1 = \frac{P\alpha_3 + \theta_1\alpha_2}{P + \theta_0\alpha_2};\ \delta_2 = \frac{\theta_2\alpha_2}{P + \theta_0\alpha_2}\ and\ \delta_3 = \frac{P\alpha_4}{P + \theta_0\alpha_2}$$

Replacing $i = r + \pi$ into Equation 5, gives

$$Y = \delta_0 + \delta_1 \varepsilon + \delta_2 (r + \pi) + \delta_3 BD \tag{6}$$

where, $r = Real\ interest\ rate\ and\ \pi = Rate\ of\ inflation$

Equation 6 shows the relationship between budget deficit and aggregate output of the economy. Using Equation 6, the change in growth rate of GDP can be measured.

5.3.2 Model specification

Following Amwaama (2018), the empirical model for GDP, Y, of this study is

$$Y = F(Debt, Budget\ Deficit, Investment) \tag{7}$$

The long-run relationship between budget deficit and economic growth can be specified as,

$$Y_t = \beta_0 + \beta_1 Debt_t + \beta_2 Budget\ defict_t + \beta_3 Investment_t + \varepsilon_t \tag{8}$$

The long-run relationship between budget deficit and economic growth can be specified as,

In Equation 8, β_0 is constant, $\beta_1 < 0, \beta_2 < 0, \beta_3 > 0$ are the coefficients of the independent variables $Debt$, $Budget\ defict$ and $Investment$, respectively. The stochastic error is ε_t and t is the time trend over the period of analysis.

Variable '*Debt*' is expected to negatively affect economic growth as it is used to finance a deficit, which leads to either an increase in taxes or a reduction in government expenditure, which eventually reduces output. Variable 'Budget deficit' is expected to negatively affect economic growth as deficit finance can either be debt-financed or through the collection of taxes. Variable 'investment' is expected to positively affect economic

growth, because an increase in government expenditure (budget deficit) directed towards investment stimulates economic growth.

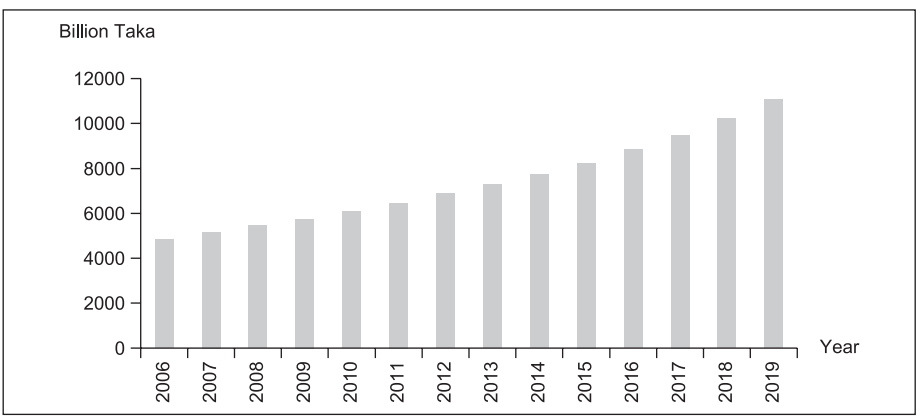
4 Data, variables and findings

All data used in this study were collected from secondary sources, mainly from various issues of the Bangladesh Economic Review (BER) published by the Finance Division of the Ministry of Finance, Bangladesh. In addition to that, different documents, such as books, journals, government circulars, acts, rules and regulations, various reports, newspapers, and research papers, are also used as secondary data. The data range of this study is 14 years from 2006 to 2019. The year used here is the Fiscal Year (FY), where FY 2005–06 is expressed as 2006 and so on. This study uses three independent variables, such as debt, Budget deficit and investment, and where dependent variable is GDP.

4.1 Qualitative analysis

This study uses GDP at constant price (real GDP) as the dependent variable of the model, which is drawn from BER (MoF 2023a) and measured in billion Taka. The GDP is calculated using the base year 2006. Data shows that between the period 2006 and 2019, the average GDP at constant price is Taka 7394.1 billion per year, and the standard deviation is Taka 1952.6 billion. The GDP at constant price during 2006-2019 is shown in Figure 1. The yearly data in Figure 1 shows an increasing trend of GDP in Bangladesh during 2006-2019.

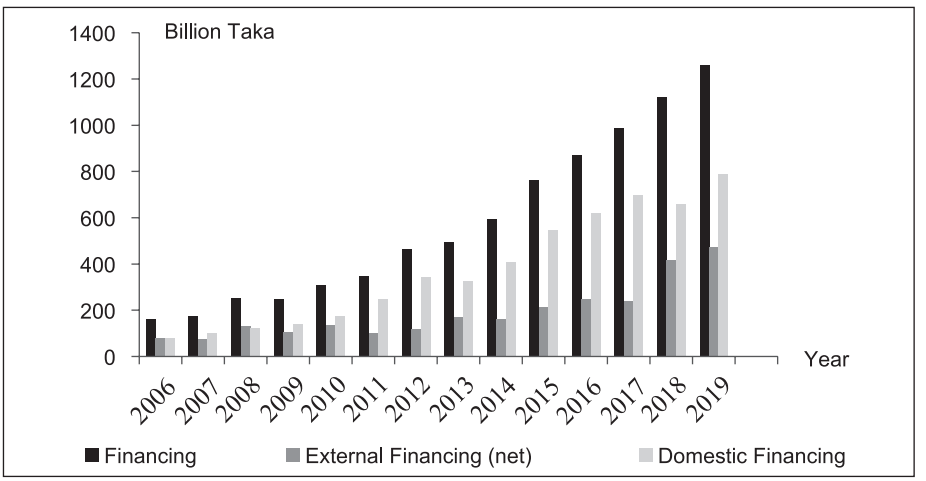
Figure 1: GDP at constant price (2006-2019)



Source: Author's calculation.

Total borrowing of the government that is total financing (excluding grant) is used for *Debt* variable, which is a sum of external financing (loan and repayment) & domestic financing (bank loan and non-bank loan) and drawn from the BER (MoF 2023a). Data shows that between the period 2006 and 2019, the average borrowing of the government is Taka 523.8 billion per year and the standard deviation is Taka 353.0 billion. Total financing, external financing and domestic financing during 2006-2019 are shown in Figure 2.

Figure 2: Total financing, external financing and domestic financing (2006-2019)



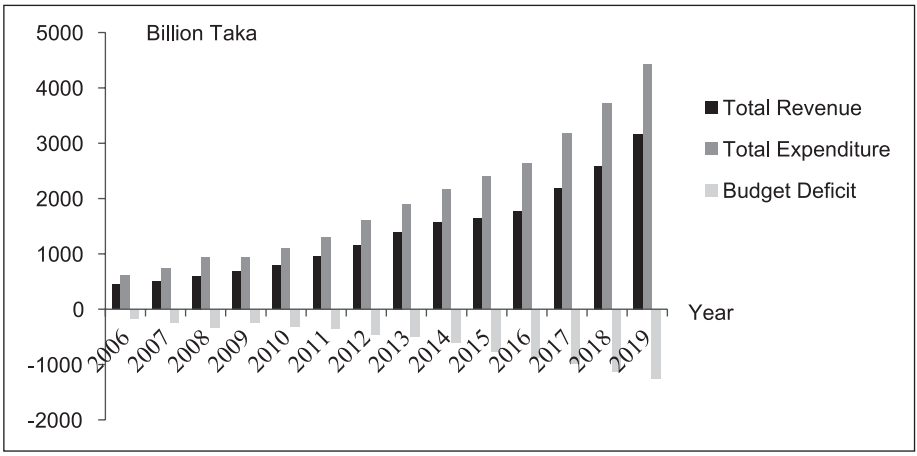
Source: Author's calculation.

The yearly data in Figure 2 show an increasing trend of total borrowing in Bangladesh during 2006–2019. Figure 2 also shows there is a sharp increase in total borrowing during 2013–2019. It shows that in 2006, the domestic and external borrowing were almost equal. But, from 2007, there has been an increasing trend of domestic borrowing and fluctuations in external borrowing. The most notable thing is that during 2009-2019, domestic borrowing was much higher than external borrowing.

The difference between total revenue and total expenditure of the government is used for the *Budget defict* variable. Total revenue uses in this variable are the sum of tax revenue that includes both National Board of Revenue (NBR) & non-NBR tax revenue and non-tax revenue. On the other hand, total expenditure uses here is the sum of revenue expenditure that is, non-development revenue expenditure (currently known as 'operating expenditure'), Annual Development Program (ADP) expenditure and other expenditure that includes expenditure on food, capital and development (except ADP) and all are drawn from the BER (MoF 2023a). Data shows that between the period 2006 and 2019, the average budget deficit of the

government is Taka 586.1 billion per year, and the standard deviation is Taka 355.3 billion. Total revenue, total expenditure and budget deficit during 2006-2019 are shown in Figure 3.

Figure 3: Total expenditure, total revenue and budget deficit (2006-2019)



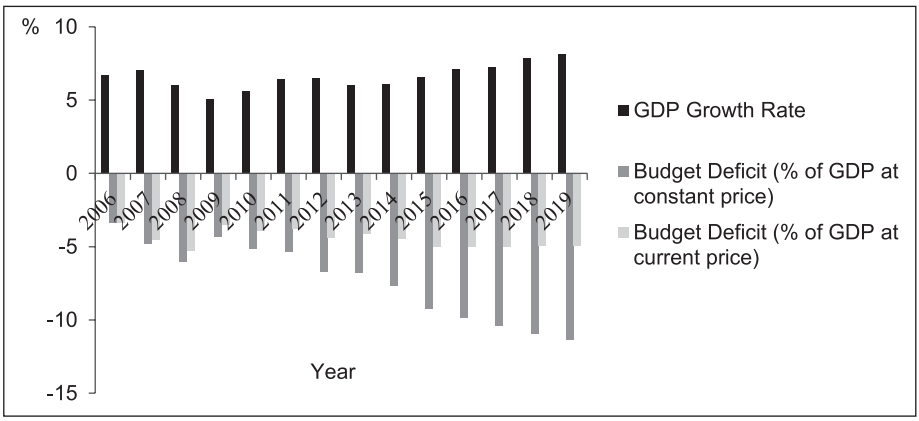
Source: Author's calculation.

Figure 3 shows that during 2006–2019 there is an increasing trend of total revenue, total expenditure and budget deficit in Bangladesh. It shows that during 2006–2011, both total revenue and total expenditure were almost the same; as a result, the budget deficit was almost the same in these years. But, a sharp increase is seen in both total revenue & total expenditure during 2012–2019, resulting in a sharp increase in budget deficit. The widening of total revenue is due to tax reform policy and budget deficits due to an increase in total expenditure of the GoB that aimed at stimulating economic growth of Bangladesh. It would be noted that due to expansionary fiscal policies during 2012-2019, total expenditure of the GoB has significantly increased to stimulate economic activities and growth, particularly in infrastructure development, social safety net programs, and public services by keeping the budget deficit within a reasonable limit of 5 percent of the nominal GDP. In terms of real GDP, the budget deficit of Bangladesh varies from 7 per cent to 11 per cent (MoF 2023a), which indicates that the economic health of Bangladesh needs to increase as the better indicator of the economic health of a country depends on real GDP compared to nominal GDP.

The GDP Growth Rate and Budget deficit, both in percentage of GDP at constant price (real GDP) and percentage of GDP at current price (nominal GDP) during 2006–2019 are shown in Figure 4. An increasing trend of both GDP growth rate and budget deficit in Figure 4 shows the

relationship between economic growth and budget deficit during 2013–2019, which supports the Keynesian Framework.

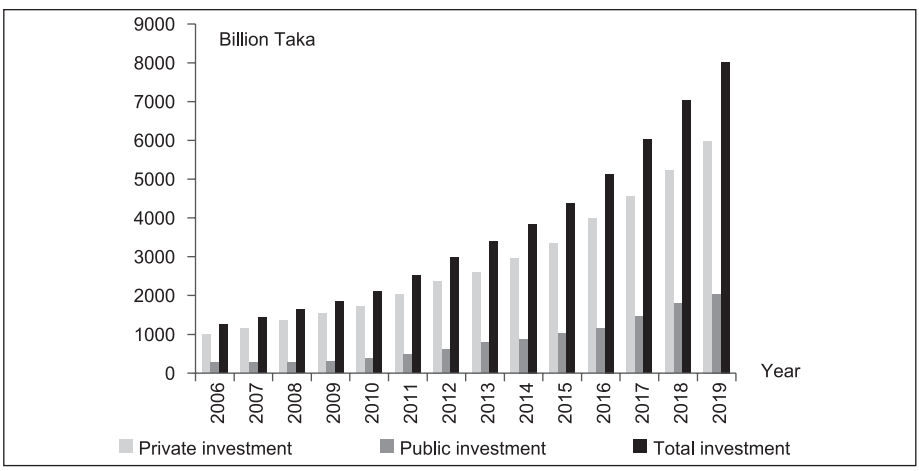
Figure 4: GDP growth rate, Budget deficit both in percentage of GDP at constant price and percentage of GDP at current price (2006-2019)



Source: Author's calculation.

Total investment of the economy is used for *Investment* variable in the model, which is a sum of public investment & private investment and drawn from the BER (MoF 2023a). Data shows that during 2006–2019, the average total investment is Taka 3684.5 billion per year and the standard deviation is Taka 2171.4 billion. Total investment, public investment and private investment during 2006–2019 are shown in Figure 5.

Figure 5: Total investment, public investment and private investment (2006-2019)



Source: Author's calculation.

Figure 5 shows an increasing trend in total investment, public and private investment. It shows a sharp increase in total investment during 2010–2019, which is due to a sharp increase in private sector investment. The public sector investment shows a sharp increase during 2016-2019, and it's mainly due to a few mega projects (such as the Padma multi-purpose project) taken by the GoB during that period. The increasing trend of private sector investment in Figure 5 supports the 'crowding-in' hypothesis of the Keynesian Framework.

The summary statistics of the variables and 14 years (2006–2019) data used in this study are shown in Table 1.

Table 1: Summary statistics of the variables (2006-2019)

Variable	Unit	Average	Maximum	Minimum	Standard Deviation
GDP at constant price	Billion Taka	7394.1	11057.9	4823.4	1952.6
Debt	Billion Taka	523.8	1221.4	137.1	353.0
Budget Deficit	Billion Taka	586.1	1259.3	161.9	355.3
Investment	Billion Taka	3684.5	8026.7	1216.1	2171.4

Source: Author's calculation.

4.2 Quantitative analysis

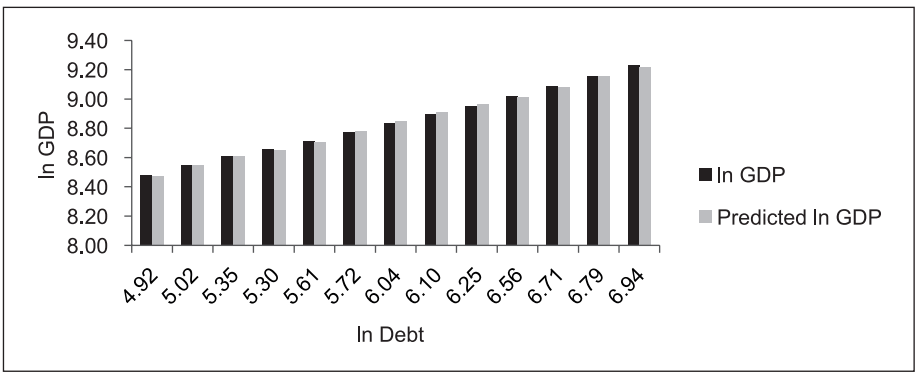
The qualitative analysis in Section 4.1 supports the Keynesian Framework for both the relationship between budget deficit & economic growth and the budget deficit & 'crowding-in' effect in the private sector investment. To see the consistency of this result, a quantitative analysis was done for this study. For quantitative analysis, the data set is converted into the natural 'log' form so that any presence of outliers in the data can be removed. Using the OLS procedure, a 'linear regression plot' between GDP & Debt, GDP & Budget deficit and GDP & Investment is derived and presented in Figure 6. All relationships derived through the OLS procedure in Figure 6 show the relationships between GDP & Debt, GDP & Budget deficit and GDP & Investment are 'best-fit' and show a strong positive correlation with an increasing trend over time. The correlation between dependent and independent variables is shown in Table 2.

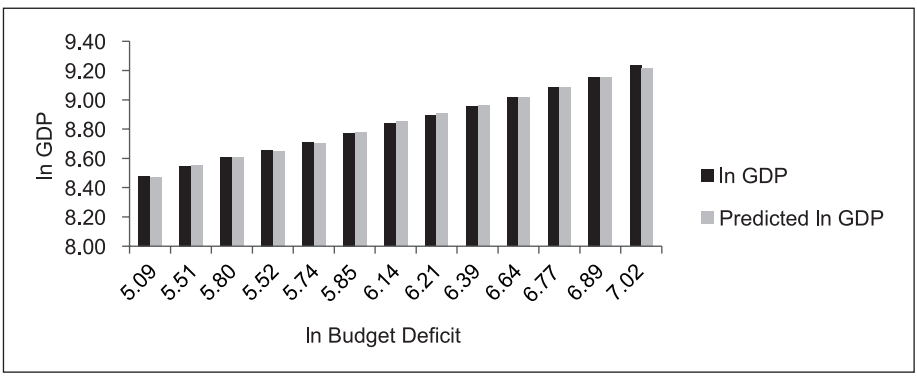
Table 2: Correlation between dependent and independent variables

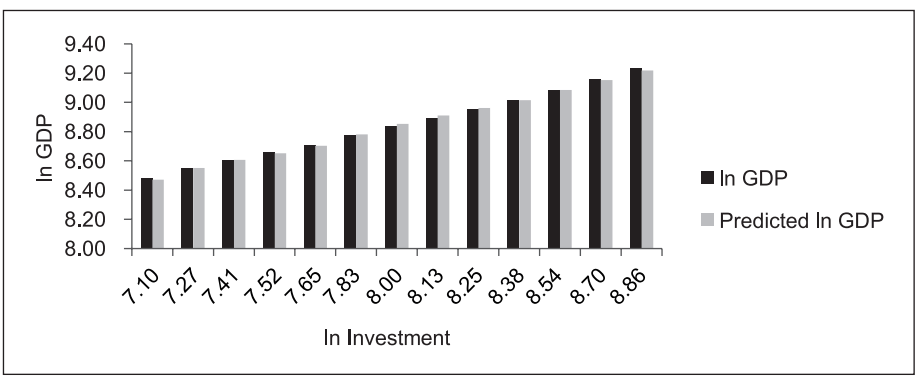
	ln GDP	*ln Debt*	*ln Budget Deficit*	*ln Investment*
ln GDP	1			
ln Debt	0.993	1		
ln Budget Deficit	0.982	0.986	1	
ln Investment	0.999	0.994	0.982	1

Source: Author's calculation.

Figure 6: Linear regression plot between GDP & Debt, GDP & Budget deficit and GDP & Investment







Source: Author's calculation.

The OLS results of the demand for goods model are obtained from the solver-macro of the Microsoft Office Excel 2007 software, which are presented in Table 3.

Table 3: Result: demand for goods model

lnY_t	$= 5.419 - 0.027lnDebt_t + 0.023lnBudget\ deficit_t + 0.432lnInvestment_t$				
se	:	(0.158)	(0.047)	(0.030)	(0.050)
$P\ value$	:	0.000	0.577	0.469	0.000
$t\ Stat$	:	34.249	−0.579	0.755	8.621
$Multiple\ R$	:	0.999			
R^2	:	0.999			
$Adjusted\ R^2$	:	0.998			
$DW\ test$	:	0.769			
$F\ test$	:	2120.224	$(P - value: 0.000)$		

Note: 'se' denotes standard error.

Source: Author's calculation.

The highly significant constant term of the model suggests that the model is better at explaining variations in the quantity demanded of goods. This term captures the total factor productivity of the economy, which shows the effects of fiscal policy, monetary policy and the influence of the external sector, which are mentioned in the theoretical framework. Coefficients of the variables 'Debt' and variable 'Investment' have expected signs. The result shows that a negative effect of 'Debt' on economic growth, but not significant, implying that the relationship between debt and economic growth is not robust in this model.

On the other hand, the result shows a highly significant positive effect of 'Investment' on economic growth, suggesting a 'crowding-in' effect, which supports data (projected in Figure 5) that shows a sharp increase in private sector investment. The finding suggests that encouraging investment can be a strategy to promote growth. The result shows the opposite to the expected sign for 'Budget Deficit.' It shows a positive but insignificant effect on economic growth. Though insignificant, the positive relation between budget deficits and economic growth derived from quantitative analysis is also supported by the Keynesian hypothesis. However, an insignificant effect of budget deficit on economic growth suggests that other factors, such as monetary policy, fiscal policy, external economic conditions, and various structural factors, may be influencing both the budget deficit and economic growth independently.

The residual output (predicted GDP) derived from the OLS procedures in Table 4 shows that during 2009–2017, actual GDP is higher than predicted GDP. But, during 2006–2008 and 2018–2019, there exists an output gap where the actual GDP is lower than the predicted GDP, which confirms the presence of inefficiency during 2006–2008 and 2018–2019.

Table 4: Residual output

(in billion Taka)

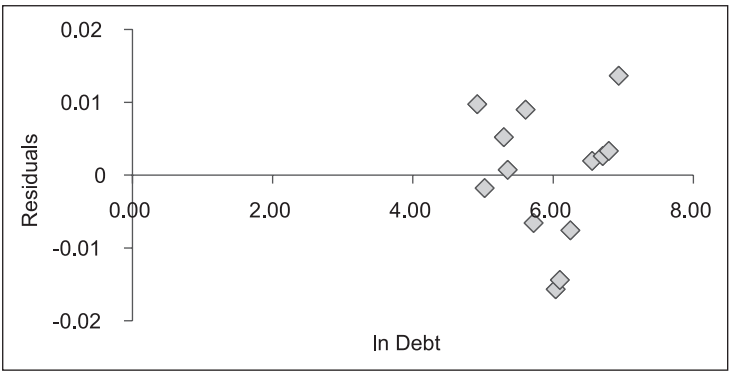
Year	Predicted GDP	Actual GDP	Output Gap
2006	5215.30	4823.4	-391.90
2007	5357.96	5163.8	-194.16
2008	5554.71	5474.4	-80.31
2009	5732.61	5750.6	17.99
2010	5988.47	6071.0	82.53
2011	6329.20	6463.4	134.20
2012	6782.57	6884.9	102.33
2013	7116.70	7299.0	182.30
2014	7496.40	7741.4	245.00
2015	8081.72	8248.6	166.88
2016	8758.68	8835.4	76.72
2017	9466.85	9479.0	12.15
2018	10344.70	10224.4	-120.30
2019	11291.32	11057.9	-233.42

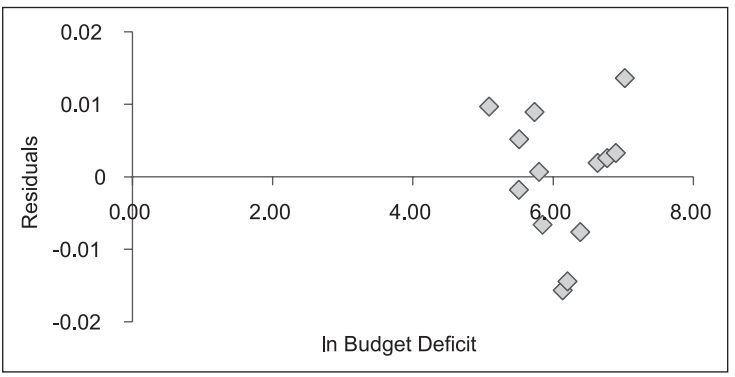
Source: Author's calculation.

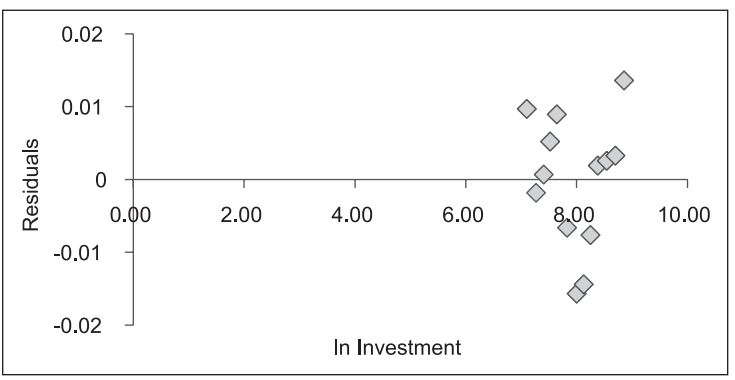
To see whether all these findings of quantitative analysis are logical, diagnostic tests of the model have been done. First, the standard errors of the model are low, indicating that there is no multicollinearity. An overall $F\ test$ test shows that the sample data used in this study provides sufficient evidence to conclude that the regression model fits the data better. A good fit of the time series data is also confirmed by $Multiple\ R,\ R^2\ and\ Adjusted\ R^2$. The Durbin-Watson test for autocorrelation confirms there is no correlation among residuals. Residual plots of independent variables (debt, budget deficit and investment) in Figure 7 show an accuracy of the specified model, which provides that the OLS estimators are unbiased and confirms the absence of heteroscedasticity and outliers of the data set.

In brief, it can be concluded that results of quantitative analysis are consistent with qualitative analysis and support the Keynesian Framework for both the relationship between budget deficit & economic growth and the budget deficit & 'crowding-in' effect in the private sector investment.

Figure 7: Residual plot of Debt, Budget deficit and Investment







Source: Author's calculation.

5 Conclusion and recommendation

Bangladesh has been pursuing an expansionary fiscal policy to mobilize adequate resources that expedite economic growth and to alleviate poverty. To manage expansionary fiscal policy, government expenditure has exceeded the revenue earnings, and therefore, Bangladesh has experienced a sustainable trend in its budget deficit. In recent years, the volume of the deficit has increased. Some argue that the sustainable trend of budget deficit in Bangladesh results from inflationary pressure on the economy. Others argued that the large budget deficit due to widened government expenditure is crowding-in effect in the private investment in Bangladesh and adversely affecting economic growth. The relationship between budget deficit and economic growth is a complex and debated topic in economics and varies across developing countries. The debate about the effects of government budget deficit on economic growth, however, remains unsettled.

This study investigates the relationship between budget deficit and economic growth, in addition to examining whether budget deficit creates 'crowding-in' effects in private sector investment. To examine whether a positive relationship exists between budget deficit & economic growth, this study uses the Keynesian framework. Using this framework, the study also explains whether budget deficit creates 'crowding-in' effects in private sector investment. All these assessments are done using both qualitative and quantitative methods. The Ordinary Least Squares (OLS) method is applied, and the solver macro of the Microsoft Office EXCEL 2007 software is used for quantitative analysis. To see the relationship between budget deficit & economic growth and 'crowding-in' effects, a qualitative analysis is used in this study.

Using secondary data during the period 2006–2019, the study shows that a positive, but insignificant, relation between budget deficit and economic growth indicating other factors, such as monetary policy, fiscal policy, external economic conditions, and various structural factors, may be influencing both the budget deficit and economic growth independently. On the other hand, this study shows a positive and significant relation between investment and economic growth. It implies that increasing investment is likely to have a positive and measurable impact on Bangladesh's economic performance and indicates that there is a 'crowding-in' effect on investment. This result has a few implications. First, in the last few years, the GoB has been encouraging Small and Medium Entrepreneurs (SMEs), promoting investment investment-friendly environment so that it can lead to the creation of new businesses and expansion of existing ones, which,

in turn, generates more employment opportunities and income for the population. Second, increased investment in research and development in Bangladesh fosters innovation and technological progress, making the economy more productive and competitive. Third, initiatives have been taken to invest in infrastructure projects (such as transportation & communication networks), which enhances the overall efficiency of the economy, making it more attractive for businesses to operate and invest. Fourth, higher levels of investment stimulate aggregate demand, leading to increased production and economic growth. Finally, GoB has been considering the positive and significant relation between investment and economic growth when crafting economic policies. Moreover, GoB has been implementing a common strategy to promote economic development and job creation by encouraging and facilitating investment, both from domestic and foreign sources, though foreign sources are still limited.

However, the study shows a negative, but insignificant, relation between debt and economic growth. It reflects that increasing debt directly does not cause economic growth to decline, indicating other factors, such as economic policies, external shocks, or structural issues, may be at play and could be influencing both debt levels and economic growth independently.

The empirical results of this study suggest that encouraging investment can be a strategy to promote the economic growth of Bangladesh. Second, though the budget deficit does not directly cause economic growth to rise, monetary policy, fiscal policy, external economic conditions, and various structural factors are influencing both the budget deficit and economic growth independently. Similarly, increasing debt directly does not cause economic growth to decline in Bangladesh. Rather, economic policies, external shocks, and structural issues are influencing both debt levels and economic growth independently.

In conclusion, the relationship between budget deficit and economic growth in Bangladesh is influenced by multifaceted factors. While a high budget deficit may not necessarily hinder economic growth, the effectiveness of deficit-financed expenditures, macroeconomic stability, and supportive policies is crucial. Prudent fiscal discipline is necessary to maintain a balanced approach to fiscal management, aiming to reduce the budget deficit over time. This could involve rationalizing expenditures, enhancing revenue collection through tax reforms, and improving the efficiency of public spending. To ensure long-term fiscal sustainability, debt sustainability is also important, and hence, careful management of public debt is needed. Finally, it is important to prioritize investments that align with development goals so that they can generate high economic returns.

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