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Impacts of COVID-19 on the Garment Sector of Bangladesh

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Abstract

In this study, the principal purpose has been made to investigate the impacts of COVID-19 outbreak on the garment sector of Bangladesh including Bangladesh economy using the modern econometric techniques. For this study, the time series variables GDP, total export values (TEX), sales revenue of the garment sector (REVGS), employment in the garment sector (EMP), remittance inflows (REM) and unemployment rate (UNR) of Bangladesh are used in order to find the impacts of COVID-19 outbreak. In this paper, the impacts of COVID-19 outbreak are predicted using the Holt-Winters' seasonal additive method for all variables individually for the years 2020 and 2021 and then for each and every variable the future values are forecasted. From the predicted results it is found that the loss of GDP, TEX, REVGS, and REM are $31,677.475 million, $6771.5296 million, $6854.089 million and $3941.4486 million in the year 2020 and in the year 2021 it will be $13,544.415 million, $3044.7328 million, $2026.187 million, and $934.513 million respectively for the country wide lockdown due to COVID-19 outbreak. In terms of percentage, the loss of these variables is 13.973%, 13.9726%, 21.789% and 21.650% in the year 2020 and 6.945%, 7.303%, 6.395% and 5.826% in the year 2021 respectively. From the forecasted values the declining trend is found for the variable sales revenue of the garment sector (REVGS) and will be continued for a long period of time. The long-lasting declining trend of REVGS is a red alarming for the garment sector as well as for the Bangladesh economy. Therefore all the stakeholders including BGMEA, BKMEA, and Bangladesh government have to take necessary steps from now to overcome the problem. From the predicted values it is found that in the garment sector the growths of employment are negative by −1.442% and −10.406% in the years 2020 and 2021 respectively. During the period of COVID-19 more than 348 garment factories have shut-down and 0.4 million garment workers lost their jobs. It is found that unemployment rate is upswing by 58.234% in the year 2020 and then will fall back by 18.72% in the year 2021, but from 2022 again increases

returning to moderate levels with an increasing rate of 2.47% and will be continued for a long period of time due to COVID-19 outbreak. The long-lasting increases in unemployment rate will cause adverse effects on socio-economic conditions including the livelihood of the marginal people. During the period of COVID-19, unexpected outcomes such as reported women are being raped and suicide may adversely affect the mental health status of the garment female workers for future. Thus from the predicted values, the following policies should be implemented to tackle the problem of sales revenue, to improve the employment condition in garment sector and also to improve unemployment conditions in Bangladesh. The garment sector should develop and maintain good relationships with the international buyers and related stakeholders and have to negotiate with them regarding the price of the products. Price reduction policy with maintaining the quality of the products should be implemented for which the global demand will be increased as a result sales revenue of the garment sector will be increased. Emphasize should be given to provide tax benefits, to advance livelihoods programming for vulnerable workers, to formalize a centralized government database for the garment sector, to expand social protection programs for all garment workers, including unemployment benefits and housing and to rebuild trust between buyers, employers and workers. Monetary motivation and minimum risk premium policy should be introduced for which the garment workers can work with full enthusiasm. Collaboration between government and garment sector including other sectors should be developed to keep people employed and train them. Well-designed database can be created for matching job seekers and employers. Upskilling or reskilling the individual in conformance with the need of future driven skill trend. Enhancing digital literacy that will help the workers to find job in rapidly changing labor market. Entrepreneurs should be encouraged and different stimulus packages should be allocated and emphasize should be given for proper management of these packages so that there will be no scope of wastage money, as a result money can be used for right purposes. These policies will play significant roles for future development of the garment sector as well as for Bangladesh economy.

Keywords

COVID-19 Outbreak, GDP, Total Export Values, Sales Revenue of the Garment Sector, Remittance Inflows, Employment in the Garment Sector, Unemployment Rate and Econometric Techniques

1. Introduction

1.1. Background of the Study

It is well known to us that any pandemic has multi-dimensional impacts in the world and its effects will be continued for a long period of time. A few pandemics namely: Asian flu (1957-58), Spanish flu (1918-1920), Hong Kong flu (1968-1969), Swine flu (January 2009, August 2010), Ebola virus (1976 Sudan, 1995-

2014 Congo, 2013-2016 West Africa, 2017 Congo, 2018 Equateur Province, 2018-2020 Kivu, 2020 Equateur Province) and Zika virus (2015-2016) have killed a large number of people and damaged the global economy as well. There are adverse effects of US-China trade war and the BREXIT on the global economy. On account of these, the IMF had predicted that the global economic growth will be 3.4 percent. But COVID-19 outbreak changed all types of predictions unexpectedly and damaged the global economy very badly including human lives. COVID-19 has contracted GDP of almost every country in the world. Averagely, the economy of the 33 developed countries[1] contracted by 15.26% in which the US economy contracted by 23.56% and the UK economy contracted by 28.22%, on average, the economy of these nations downgraded for 8.76 years in which the US economy downgraded for 15 years and the UK economy downgraded for 20 years, on an average the economy of the 99 developing countries[2] contracted by 17.38% and downgraded for 7.41 years, on an average the economy of 35 least developed countries[3] contracted by 13.89% and downgraded for 6.51 years. COVID-19 outbreak has downed the European economy's GDP by 12.1% in the second quarter of 2020 by Eurostat in 31 July, 2020. Oxford economics predicts a three-week lockdown and found that 50% - 90% population will cut the consumptions in the next 3 months by 5% - 8%. A six-week and nine-week lockdown reduced the consumption by 9% - 16% and 18% - 32% respectively. It is found that the average loss of GDP of 178 countries is $83,765.17 million, which is statistically significant at any significance level, on an average the economy of these countries will be contracted by 16.04% of the total GDP, which is also statistically significant at any significance level, and averagely, the economy of these countries downgraded for 7.67 years, it is also statistically significant at any significance level. It is also found that in the year 2020, the world GDP is contracted by 17.07% of the total GDP and the world economy downgraded for 7 years due to COVID-19 outbreak. The loss of GDP due to COVID-19 outbreak in 2020 of 178 countries both in million USD and in percentage of total GDP are

[1]Australia, Austria, Bahamas, Belgium, Canada, China, Croatia, Cyprus, Czech R., Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Kuwait, Luxembourg, Netherlands, New Zealand, Norway, Poland, Qatar, Saudi Arabia, Singapore, Spain, Switzerland, Trinidad & T., UAE, UK, USA.

[2]Albania, Algeria, American Sa., Antigua, Argentina, Armenia, Aruba, Azerbaijan, Bahrain, Barbados, Belarus, Belize, Bermuda, Bolivia, Bosnia & H., Botswana, Brazil, Bulgaria, Burundi, Cabo Verde, Cameroon, Cayman, Chile, Colombia, Congo, Rep., Costa Rica, Cote d.I., Cuba, Dominica, Ecuador, Egypt, El Salvador, Equatorial G., Estonia, Eswatini, Fiji, Gabon, Georgia, Ghana, Greenland, Grenada, Guam, Guatemala, Guyana, Honduras, India, Indonesia, Iran, Iraq, Isle of Man, Jamaica, Jordan, Kazakhstan, Kenya, Kosovo, Kyrgyz R., Latvia, Lebanon, Libya, Lithuania, Macao, Malaysia, Mali, Maldives, Malta, Mauritius, Mexico, Micronesia, Moldova, Monaco, Mongolia, Montenegro, Morocco, Namibia, Nauru, Nigeria, North M., Oman, Pakistan, Panama, Papua N.G., Paraguay, Peru, Philippines, Portugal, Puerto Rico, Romania, Russia, Samoa, San Marino, Senegal, Serbia, Seychelles, South Africa, Sri Lanka, St. Kitts & N., St. Lucia, Suriname, Thailand, Tonga, Tunisia, Turkey, Ukraine, Uzbekistan,, Venezuela, Vietnam, West bank G., Zimbabwe.

[3]Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Chad, Congo D.R., Dominican R., Eritrea, Gambia, Guinea, Haiti, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Mauritania, Mozambique, Nepal, Niger, Rwanda, Sao T. & P., Sierra Leone, Slovak R., Slovenia, Solomon I., Sudan, Tanzania, Timor-Leste, Togo, Uganda, Yemen, Zambia.

shown below graphically:

Figure 1 shows that in terms of totality the GDP loss is highest for USA and followed by China, UK, Japan, India, Italy, etc. and Figure 2 shows that in terms of percentage the GDP loss is highest for Aruba and followed by Qatar, Chile, Saudi Arabia, Belize Libya, Tonga, Libya, Cyprus, Costa Rica, Montenegro, Panama, etc. and lowest for Solomon Island, and followed by Turkey, Macao, Mongolia, and Jamaica, etc. Due to COVID-19 outbreak, lockdowns and travel restrictions along with the loss of lives may cause a long term economic recession in the world. In March 2020, IMF stated that it expected a global recession that

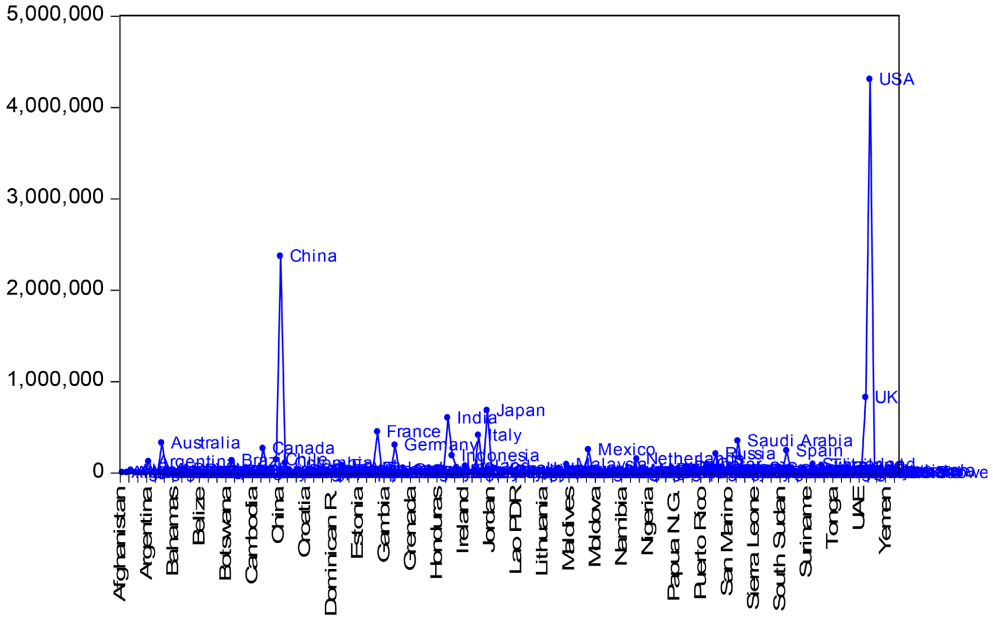

Figure 1. The loss of GDP in million USD (constant 2010$).

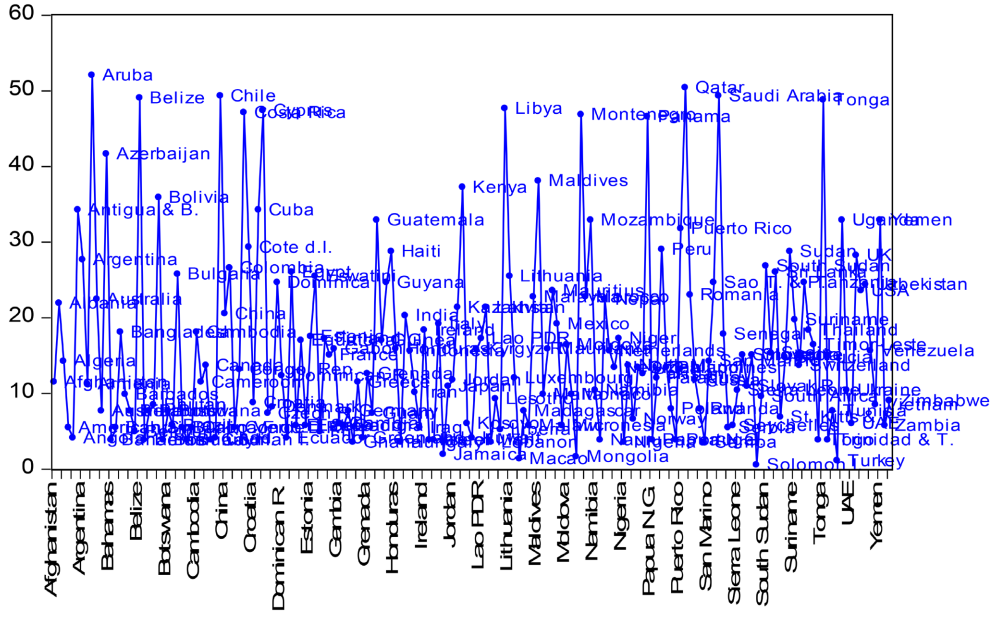

Figure 2. The loss of GDP in percentage of the total GDP (constant 2010$).

would be at least as bad as the 2007-8 global financial crisis followed by a recovery in 2021. But the cause of the 2020 global recession was novel in modern history. The COVID-19 outbreak triggered a new type of recession that was different from the past triggers of a recession. Due to COVID-19 outbreak, from the estimated results it can be said that the world economy will be downgraded and outbreak it's all earlier projections of IMF. Like as other countries in this globe, to save the lives the government of Bangladesh declared lockdown across the nation from March 23 to May 30 in 2020 and from April 5 to April 28 in 2021. As a result, there is a hidden message that the economy is not only transferring back to normal levels but also will exceed that. Thus during the period of COVID-19, the unemployment rate will be increased by 2.44% of the total labor force. Around 164 million people have joined as new poor in the country due to COVID-19 outbreak as per the Bangladesh Institute of Development Studies (BIDS). It was found that during the lockdown (March-May, 2000), 91 percent of sample families regarded themselves to be financially unstable from a survey conducted by the International Centre for Diarrhea Disease Research (ICDDR) in Bangladesh. About 47 percent of people saw their earnings drop below the international poverty line of Tk 160 ($1.90) per person per day, while 70 percent experienced food insecurity and 15 percent either faced a shortage of food or remained hungry or missed meals (FE, August, 27). It is estimated that 80 percent of workers in the informal sector have become unemployed. A large number of workers are not being able to return to their workplace as many businesses are closed. That is clearly reflected by the scenario that in a very large number of people migrating from urban to rural areas. It is noticed that a large portion of these unemployed workers faces the anticipation of permanent job loss. As a result, a very large number of people are already facing it difficult to make ends meet. With the recent impacts of global economy, Bangladesh also experienced severe demand contraction in the global market, as a result, economic crisis is going on in the garment sector of Bangladesh. The readymade garments industry is one of the highest export earning sector in Bangladesh. Nowadays, Bangladesh's economy largely depends on the garment industry for foreign earnings, employment, socio-economic development of the marginal people and women empowerment. The garment industry in Bangladesh contributes 11.75% of the GDP in 2020 which is 5875 times higher than in 1979. It contributes 81.16% of the total export in 2020 which is 901.78 times higher than in 1979. In garment industry, 6.28% of the total labor force are working in 2020 which is 5.28 times higher than in 1979. But due to COVID-19 outbreak, the garment sector in Bangladesh is affected severely. It was estimated that Bangladeshi RMG workers had lost $500 million in wages in four months from March to June. Under the ministry of labor and employment, there were 580,836 factories, among them 8029 factories including 1915 garments factories have shut down due to COVID-19 as a result about 1,710,221 workers have lost their jobs. For example, during the period of COVID-19, the garment sector lost $4.33 billion worth of exports be-

tween March and June, 2020 due to cancellation of foreign orders and delayed payments (The Financial Express, 2020). Due to cancellations of large number of orders (982 million pieces orders) by international buyers and brands 2.28 millions of garment workers are affected directly and indirectly, in which millions of workers-many of them are women fall in financial crises. A report which is published by the Centre of Policy Dialogue (CPD, 2021) 357,450 garment workers were laid-off or terminated during the period of COVID-19 pandemic. A study by Anner (2020), Penn State University's Center for Global Workers Rights and the Worker Rights Consortium reported that more than one million garment workers were fired or furloughed, 72 percent without severance pay but the official statistics differ with this report. The Department of Inspection for Factories and Establishments (DIFE) prepared crisis report which provided information on the number of RMG factories shutdowns and terminated and lay-off workers during the period of COVID-19 pandemic (from mid-March till September 17, 2020). According to the report, 90 thousand workers lost their jobs as a result of order cancellation or delayed payment; among them, 43,049 workers (in 117 factories) have lost their jobs due to factory shutdown, 23,560 workers have been terminated from 75 factories, and 23,523 workers of 26 factories have been laid off[4]. The job lost in the garment sector during the period of COVID-19 outbreak, pushed many workers further into poverty. Thus the COVID-19 pandemic will have long-lasting unprecedented effects on the garment workers especially who are associated with their health, financial hardship and inability to pay for essentials say foods and treatment and future employment and economic crisis for the employers in the garment sector of Bangladesh including nationwide. In the absence of vaccination or effective treatment, Bangladesh government was taken shutdown measures to prevent the rapid spread of contagion from the virus which resulted in huge short-term economic loss of the garment sector of Bangladesh including the Bangladesh economy. After the withdrawal of one-month of lockdown measures, in April 2020 the garment factories are gradually resuming their operations with the condition of implementing a safety precaution guideline[5]. Moreover, this guideline is not followed by the employers, for example, a report which is published by the Guardian in 2020 that a significant number of pregnant workers have been laid off (Guardian, 2020). Reports also found that RMG workers' mental health is also affected, due

[4]Crisis report September 17, prepared by the Department of Inspection for Factories and Establishments (DIFE) in 2020.

[5]This guideline covers workers' health and safety, medical facilities, the establishment of a COVID-19 taskforce, physical distancing in the workplace, and the setting up of suitable quarantine and self-isolation facilities. The BGMEA also issued a general directive to member factories regarding the reopening of factories, which included provisions advising to exclude vulnerable workers or those most at risk, such as pregnant workers and workers over the age of 50, as well as paid leave for those workers. However, these health and safety measures in factories are often insufficient. Though a large number of factories arranged hand wash facilities at the factory entrance, the number is not sufficient when compared against the number of workers and safe distancing was not maintained in most of the factories on the working floor and factory entrances, increasing the risks of COVID infection amongst the workers.

to the tensions of future job insecurity and fear of becoming infected with or dying of COVID-19 Kabir et al. (2020). On March 25, 2020, the Bangladesh government declared a stimulus package of BDT 500 crore ($587.925 million) for export-oriented industries to go towards salaries and funding of two-year loans to factory owners at 2% interest to tackle the problem of COVID-19. The European Union and the German government approved a €113 million grant for around one million Bangladeshi garment workers who had either been laid off or permanently lost their jobs because of the COVID-19 pandemic. But it was very much unfortunate that the owners did not pay the full salary to the workers for the months of March and April 2020 and did not pay their outstanding wages on time, which forced thousands of workers to raise their voices on the street for demanding their wages be paid in full (The Daily Star, 2020a, 2020b). The RMG workers are playing significant roles to earn billions of dollars ($31,456.73 million of exports in 2019-20 financial year) to the factory owners every year (BGMEA, 2021), yet the factory owners are not seen to stand beside them during this critical crisis period. Some workers complained that they had not been paid for 2 months or more. The Bangladesh government has also implemented different programs to protect jobs and wages, such as temporary interest-free loans to pay wages and allowances for workers in enterprises that export at least 80% of their production. Bangladesh Bank has also adopted measures to ease the economic burden, including a moratorium on loan payments that lasted till 30 September 2020 and provisions that ensured the borrower would not be considered to be in default. Thus it can be said that the impacts of COVID-19 outbreak on the garment sector of Bangladesh have been transmitting through the following channels namely: i) contraction domestic demand and supply disruption in the local market, ii) slowdown in global economic activities affecting global trade and international financial flows, iii) lockdown effects and iv) the employment effects on the garment sector of Bangladesh. Therefore it is very much important to know for the people of Bangladesh including Bangladesh government, Bangladesh Bank, BGMEA, BKMEA, BTEXPO, and owners and workers of the garment sector, etc. whether the impacts of COVID-19 pandemic on the garment sector will be long-lasting threat for Bangladesh economy. What are the impacts of COVID-19 outbreak on Bangladesh economy including remittance, export values and unemployment? What situation of COVID-19 pandemic is going on in Bangladesh? Therefore, in this study, the principal purpose has been made to investigate the short-term and long-term impacts of COVID-19 pandemic on the garment sector of Bangladesh including national economy using the econometric techniques based on indicator variables namely GDP, total exports values, sales revenue of the garment sector, employment of the garment sector, remittance inflows, and unemployment rate. Also, another important purpose has been made to investigate the situation of COVID-19 in Bangladesh including different continents in the world. From the findings, appropriate policies should be taken to tackle the problem of COVID-19 pandemic

and for future development of the garment sector as well as for Bangladesh economy.

1.2. The Organizational Structure of the Study

The organization of the paper is outlined as follows: Section II presents a literature review; Section III discusses data sources, including COVID-19 pandemic situation and some fundamental descriptive statistics of some non-economic and economic variables; Section IV discusses econometric methodology including analytical results; Section V presents an overall discussion of the study; and Section VI concludes with a summary of the main findings and policy implications.

2. Review of Literature

2.1. Introduction

Initially, China was the epicenter of the disease and most reported cases were the Chinese people or traveler from China. Since January 2020 few more epicenters have come into forth-Italy, Spain, UK, Western European countries, the USA has become new epicenters from time to time. India is becoming the new epicenter of corona virus with reported cases reaching close to 164,972 cases every day since January 2022. The evolution of deadly COVID-19 disease and associated uncertainty how this disease going to affect the economy, employment generation, education, tourism and other macroeconomic indicators has made it difficult for the policy makers to devise appropriate macroeconomic policies. A number of empirical studies have been conducted regarding impacts of COVID-19 on garment sector of Bangladesh and also on Bangladesh economy see for example: Akter (2020) carried out a study on Covid-19 and Bangladesh: threat of unemployment in the Economy. This study is based on secondary data and found that the impact of COVID-19 as an unemployment problem. The study argued that the recession of the global, as well as local economy, would lead losing of jobs. Due to crisis of COVID-19, the garment, transport, tourism, banking and insurance, education sectors are more vulnerable. The study articulated several key aspects of RMG sectors among others. As the orders from international buyers were shrunk, factories remained shut and workers would be terminated-the study argued. This study highlighted that due to COVID-19 the RMG workers are affected very badly and it cannot demonstrate a range of impacts on RMG workers. Begum et al. (2020) conducted a study on COVID-19 and Bangladesh: Socio-Economic Analysis towards the Future Correspondence. This study identified several socio-economic effects of COVID-19 in Bangladesh. The study explored that several sectors such as banking, dairy farm, poultry, remittance, RMG, etc. are severely affected by the pandemic due to the irruption to the global supply chain. Though the article identified sectoral impacts, it largely overlooked micro-level impact and the pervasive implications of the crisis towards marginal communities such as daily laborers, RMG laborers,

and workers in informal sectors. On 6 March 2020, the Asian Development Bank (ADB) assumed that the impact of Covid-19 on the economy would be laid off by 894,930 workers in Bangladesh. Bhattacharjee (2020) carried out a study on Bangladesh: COVID-19 badly impacts garment industry and found that cancellation of orders will be a big threat for the survival of this sector. Islam (2020) carried out a study on the impact of COVID-19 on garment sector in Bangladesh and this study is based on both primary and secondary data. This study found that due to COVID-19, the orders of 3.18 billion $ are cancelled. This study also found that during COVID-19, the supply chain of raw materials was severely disrupted. This study highlighted in July 2020, the exports of the RMG sector are 11.43% lower compared to the previous year but 72.4% from the previous month. This study also found that the monthly growth rate of the exports of RMG sector was negative in FY 2019-20. Islam et al. (2020) carried out a study on the impact of COVID-19 on RMG industry of Bangladesh. This study is based on secondary data and found that export trends for both woven and knit items are decreasing since the beginning of COVID-19 pandemic but before the pandemic the trends were opposite. This study also found the similar scenario for the total exports of the RMG sector of Bangladesh. Orders cancellation, factories' shut-down, job loss of the RMG workers have been found in this study. This study also recommended to ensure safety measures in the RMG factories and to maintain good relationship with the foreign buyers to tackle the pandemic situation. This paper also recommended to take policy to reduce the price temporarily and announcement of risk premium for the RMG workers. Islam (2020) carried out a study on the impact of COVID-19 on employment in Bangladesh. This study is based on secondary data and found that for COVID-19, the growth rate of economy declined sharply which caused the economic crisis and millions of people lost their jobs. The manufacturing, construction and service sectors are affected very badly due to COVID-19. The urban informal economy is affected seriously due to the lockdowns. This paper also found that 11 million jobs were lost during the period of lockdowns (April-May 2020). This paper also estimated that 3% of the labor force may have lost their jobs in which half a million jobs were lost in manufacturing sector, 1.23 millions of jobs were lost in service sector and in the garment sector, 0.4 million of people may have lost their jobs for COVID-19. Kabir et al. (2020) carried out a study on the impact of COVID-19 on Bangladeshi RMG workers. This study is based on 2675 respondents from nationwide low-income background and found 14% of the respondents had no food reserves at home, whereas 29% only had enough food for 1 - 3 days. This study highlighted that with such shortage of foods and due to lockdown for COVID-19, starvation is a potential outcome for those garment workers who came from vulnerable and low-income areas. This study argued that COVID-19 pandemic will have long-lasting effects on the garment workers specially associated with health issues, financial hardship, and inability to pay for essentials such as food and future employment opportunities. Jebin & Hossain (2020) carried out a study on COVID-19: increasing production cost and its effect on

RMG sector of Bangladesh. This study found that due to COVID-19, the cost of RMG sector was affected badly. This study highlighted that due to COVID-19, the cancellation of orders the RMG sector lost $3.16 billion which affected 1142 garments and 2.26 million workers, who were working in those garments. This study found that from April-June in 2020 more than 18,000 workers faced layoffs. Rahman et al. (2020) conducted a study on socio-economic impact assessment of COVID-19 and policy implications for Bangladesh. This study is based an ex ante macroeconomic approach in assessing the implications for 2020 against a baseline without any Covid-19 related disruptions. This study focused on various likely scenarios to simulate impacts rather than focusing on just one possibility. This study used the GTAP modelling framework for studying the shock scenarios, a SAM multiplier model for Bangladesh has also been utilized to analyses income and poverty impact at the household level and deriving further policy implications. This paper found that Covid-19 shocks cause output shortfalls in the range 3.5 - 9.3 per cent as against the baseline of the Bangladesh economy portraying an 8 per cent GDP growth. Exports are simulated to fall by around 10 per cent under the low shock scenario and 23 per cent under a high shock scenario. These disruptions are reflected into reduced outputs of various sectors with leather, textile and apparel sectors are picking up largest declines in production in terms of percentage of respective baseline outputs. Processed food, construction and various services sector also experience considerable decline. Simulations from a global migration model show the remittance inflow into Bangladesh to shrink by 3.8 - 7.7 percent. Simulations from a social accounting matrix multiplier model suggest that sectoral output changes to cause household consumption spending to decline by 2.8 - 7 percent. If the earlier simulated likely weaknesses in remittances are added to this, the corresponding household consumption decline further to reach 3.5 - 7.5 percent. This results in the rising poverty incidence by 2.2 - 5.3 percentage points depending on alternative shock scenarios. For the three poverty-prone households of small farmer, daily laborer, and non-farm wage-employed households the average proportion of households in poverty rises by 3.5, 2.5 and 2.4 percentage points due to Covid-19 under the low-shock scenario. The corresponding figures could be as high as 7.5, 6.2 and 6.5 percentage points under the high-shock scenario. In the case of a deeper fall in remittances, household consumption spending would be subject to further deterioration. This study suggested to implement different stimulus packages to solve these problems. Shimanta et al. (2020) have conducted a study on readymade garment sector and COVID-19 in Bangladesh based on the secondary data. This study found that due to increasing lockdown period, the garment sector hitting badly by stopping production and cancellation of orders as a result, some factories are failed to give payments to the workers, some are being shut down which forced the workers of losing their jobs. Therefore during this pandemic the unemployment rate was increasing day-by-day. Siddique & Faruk (2020) from the BRAC Institute of Governance and Development carried out a study on COVID-19's impact on Bangladesh economy based on the sec-

ondary data of major economic and financial indicators of Bangladesh including production, wages, price levels, advances, bills, investment, remittance and foreign trade. This study found that during the period of COVID-19 pandemic, the garments and knitwear products, petroleum, cement and other non-metallic mineral products were declined sharply while the drug and pharmaceutical products were increased. The nominal wage rates in industry and service sector were declined due to COVID-19 pandemic. This paper also highlighted based on point-to-point changes the national inflationary rate was not affected mush by COVID-19. It is also found that bills and investment were comprised but the advances remain unchanged during the period of COVID-19. The export of goods, imports of goods and service payments had fallen sharply during the period of pandemic. From point-to-point estimated results, it is found that the exports of RMG sector had fallen 56.44%. This paper concluded that Bangladesh economy was affected very badly due to COVID-19, as a result, Bangladesh is facing an unprecedented economic challenge like the rest of the world. Sultan et al. (2020) carried out a study on the effect of COVID-19 on RMG sector and trade union efforts to mitigate fall out and found that a great number of garments workers is likely to get affected due to coronavirus pandemic ranging from pay cut to job loss. These issues will impact the socioeconomic condition of the country and to tackle the crisis of the RMG industry the trade leaders along with the government support should formulate proper policies. Genoni et al. (2020) conducted a study on the labor market impacts of COVID-19 in Bangladesh. This study is based on household survey from three vulnerable areas namely: poor areas of Dhaka, Chittagong, and Cox's Bazar cities. This study found the labor-market impacts both at the extensive and intensive margin, with important variation across areas and gender, largely due to the different nature of occupations affected by COVID-19. This study also found that the crisis of COVID-19 causes longer-term consequences of poverty, food-security and future earning by the permanent job losses of the market workers. This study also highlighted that high levels of uncertainty in the job market also generating stress, and anxiety which may cause health and mental problems that are associated with the pandemic. As a result poor workers will not be able to carry out their day-to-day activities in the month. This would be the main problem of the workers. Mohiuddin (2020) has found that per capita daily income of urban slum and rural poor has dropped by 80% due to present countrywide shutdown enforced by the government to halt the spread of Covid-19. 40% - 50% of this population took loans to meet the daily expenses in Bangladesh. Ahmed et al. (2021) carried out a study on the effects of COVID-19 in the garment industries of Bangladesh and ways to overcome its' challenges. This study found that due to COVID-19 a large number of foreign orders are cancelled as a result the garment sector lost 3.15 billion $. This study also highlighted that more than 1 million garment workers have fired during time period of COVID-19 which forced a large number of families back into poverty. Aktar et al. (2021) carried out a study on impacts of COVID-19 pandemic on RMG sector of Bangladesh. They have

found the multiple impacts of COVID-19. In this paper they highlighted due to COVID-19, the total export, import, remittance and economic growth are declined dramatically. This paper highlighted that COVID-19 affects garment sector in terms of two aspects namely: economic status and social status. In respect of economic status due to COVID-19, supply chain of the garment sector affected badly and the export values of the garment sector declined dramatically. In respect of social status, due to COVID-19, women empowerment, gender equity, unemployment, livelihood and health and security of the garment workers are affected badly. Boudreau & Naeem (2021) carried out a study on the economic effects of COVID-19 on the RMG factories on Bangladesh. This study is based on a representative random sample which is collected by a survey from BGME member factories. This study found that order cancellations and renegotiations by buyers were widespread during the pandemic's early stages. This paper found the strong evidence that individual buyers' responses to the pandemic, though, varied substantially. This paper also found that on an average, BGMEA member factories experienced a decline in revenue of almost 17.4% in 2020 compared to 2019. Revenue losses varied widely across factories: those that were smaller, older, less well-managed, and selling to more different buyers experienced larger revenue losses in 2020. Employment declined by 7.4% in the second half of 2020 compared to pre-COVID-19 levels, although it started to recover toward the end of 2020. In terms of capital investment, COVID-19 caused some factories to delay or to decrease planned investment, including in increasing automation. Hansen et al. (2021) from NORC at the University of Chicago conducted a study on RMG sector workers during a global pandemic in order to find the impacts of COVID-19 on the garment industry in Bangladesh and India. This study found that the COVID-19 pandemic is exposing the power imbalance between buyers and suppliers in both countries, COVID-19 pandemic caused the extreme vulnerability of the garment workers particularly women, migrants and informal workers, the risk of forced labor will be increased due to COVID-19. In case of Bangladesh, this paper also recommended to advance livelihoods programming for vulnerable workers, to formalize a centralized government database for the garment sector, to expand social protection programs for all garment workers, including unemployment benefits and housing and to rebuild trust between buyers, employers and workers. Hossain (2021) conducted a study on the impacts of COVID-19 on Bangladesh economy based on the secondary data. He found that due to COVID-19 in Bangladesh the GDP, export volume and remittance will be affected by $40,984.34 million, $6540.97 million and $3941.45 million in the year 2020 respective. In percentage the loss of GDP, export volume and remittance were 18.09%, 18.08% and 19.73% respectively. From the forecasted values this paper also highlighted that in Bangladesh the GDP, exports and remittance downturned for 3 years, 2 years and 2 years from 2019 respectively. This paper also highlighted that the unemployment rate will be increased by 1.38% globally whereas in Bangladesh the unemployment rate will be increased by 2.43%. Finally this paper concluded that due to COVID-19

in Bangladesh except unemployment no economic indicator variables will be unreasonably affected and the post COVID-19 Bangladesh economy will not face undue risk. Hossain & Rahman (2021) carried out a study on the post COVID-19 global economy. This paper is based on time series data of 178 countries of the globe. This paper found that due to COVID-19, in the year 2020 the average loss of GDP of 178 countries was 83,765.17 million $, on an average the economy of these countries would be contracted 16.04% of the total GDP, and on an average the economy of these countries would be downgraded for 7.67 years, and all of these variables were statistically significant at any significance level from their zero means. It was also found that in the year 2020, the world GDP would be contracted 17.07% of the total GDP and the world economy would be downgraded for 7 years due to COVID-19. This paper also highlighted that the world economy would be decline significantly due to COVID-19 and the global recessionary phase would be started. This paper also found that the variables, total confirmed cases, lockdowns, domestic travel restrictions, air travel restriction, unemployment and change of human quality index have negative impacts on economic growth of which the impacts of lockdowns and domestic travel restrictions are statistically significant. This paper also found that on an average the global stock markets erased about 3.08% and on an average, the unemployment rate would be increased by 1.36% in 2020 relative to 2019. This paper concluded that to save the lives and global economy the protective measurements should be implemented rather than lockdowns and restrictions by the governments of these countries. Hossain et al. (2021) carried out a study on the impact of COVID pandemic on the garment workers in Bangladesh. For this study, information is collected through questionnaire from 500 garment workers in which 125 respondents from each of the four areas namely Dhaka, Gazipur, Naraynganj and Chottogram. This study found that 99% workers shared that their factories were closed on average for a period of 41 days during COVID-19 pandemic. This study found that 9% of respondents went back to the villages when the factories were closed. Four in every ten respondents claimed that their factories retrenched workers during the period of COVID-19 pandemic. This study also found that job and retrenchment were more in the first three months of the COVID-19 outbreak in the country and the rate of retrenchment was slightly higher in knit factories. During the period of COVID-19 pandemic, job loss and retrenchment were caused by cancellation of orders, shipments and factory closure. This study also found that the employers did not follow the formal system for retrenchment. This study also found that not all workers received their due wage or overtime allowances after being retrenched. This study found that during the period of pandemic wages of the garment workers were reduced and the lowest average monthly income of the workers was recorded in April 2020 and it was about BDT 5425 but after May 2020 their average income gradually increased but in October 2020 they received their normal salary. This study found that COVID-19 pandemic had significant impacts on the jobs, wages, livelihoods, and well-being of

the garment workers and their families. Shahriar et al (2021) conducted a study on the impact of COVID-19 on Bangladesh's economy. This paper mainly focused on the effects of COVID-19 on graduate employability. This paper highlighted that the COVID-19 has an adverse impact on Bangladesh's economy by affecting millions of people's life and hampering their income sources. This paper found that due to COVID-19, the rate of graduate unemployment rate increased from 47% to 58% in 2020 with an expected annual loss 53 million $. Sharif (2021) carried out a study on the impact of COVID-19 on RMG workers in Bangladesh. This study is based on the primary data in order to find the socio-economic impacts of COVID-19 on RMG workers. This study found that due to COVID-19, health condition, safety, security and social relations of the RMG workers affected badly and they faced their livelihoods crises as their earnings were curtailed.

2.2. Research Gaps from Literature

From the literature review it can be said that there have been many studies in the context of impacts of COVID-19 on the garment sector of Bangladesh and Bangladesh economy. Most of the existing studies on impacts of COVID-19 were survey types and explained in qualitatively. These studies are not sufficient enough to reach any definite conclusion about the impacts of COVID-19 on the garment sector of Bangladesh. According to the knowledge of the authors, still now no one is conducted any study in order to find the impacts of COVID-19 using advanced level of econometric techniques based on temporal behaviors of economic and financial indicator variables of the garment sector of Bangladesh. Hence, any new study will add a value to the review of literature and attempts to fulfill the gap in the literature. By keeping this in our mind, the present study is carried out to investigate the impacts of COVID-19 pandemic on economic and financial indicator variables of the garment sector of Bangladesh using the modern econometric techniques. Thus this study shall fill the gap in the literature by exploring the impact of COVID-19 empirically on the garment sector of Bangladesh using the modern econometric techniques. This study also predicts how COVID-19 will change the shape of the garment sector in future using econometric techniques based on the time series data. We believe, that the findings of this study will throw some light to the policy makers and for the scope of future research. Moreover, the study has used sophisticated econometric approaches to find out linkage between garment sector development and policies mitigating gap in the existing literature.

2.3. Hypotheses Development

For this study the following important hypotheses can be developed:

Hypothesis 1:

H_0: $\mu_i = 0$, (the subscript i is used for the variables day wise total cases, total deaths, total recovered cases, total tests, death ratio to total cases, recovered ratio to total cases and death ratio to recovered cases).

H_1: $\mu_i \neq 0$.

Hypothesis 2:

H_0: $\rho_i = 0$ (the subscript i is used for different pairs among the variables total cases, total deaths, total recovered cases and total tests).

H_1: $\rho_i \neq 0$.

Hypothesis 3:

H_0: There is no impact of COVID-19 pandemic on the garment sector of Bangladesh.

H_1: There is a negative impact of COVID-19 pandemic on garment sector of Bangladesh.

Hypothesis 4:

H_0: There is no long-lasting impact of COVID-19 pandemic on the garment sector of Bangladesh.

H_1: There is a long-lasting negative impact of COVID-19 pandemic on garment sector of Bangladesh.

Hypothesis 5:

H_0: There is no impact of COVID-19 pandemic on Bangladesh economy.

H_1: There is a negative impact of COVID-19 pandemic on Bangladesh economy.

Hypothesis 6:

H_0: There is no impact of COVID-19 pandemic on remittance.

H_1: There is a negative impact of COVID-19 pandemic on remittance.

Hypothesis 7:

H_0: There is no impact of COVID-19 pandemic on unemployment rate.

H_1: There is a positive impact of COVID-19 pandemic on unemployment rate.

Hypothesis 8:

H_0: There is no long-lasting effect of COVID-19 pandemic on unemployment rate.

H_1: There is a long-lasting positive effect of COVID-19 pandemic on unemployment rate.

3. Data Collection, COVID-19 Situation and Some Fundamental Descriptive Statistics

For this study data of different variables are collected from different sources. Annual time series data for GDP (constant 2010 $) from 1971-2019, total export values from 1971-2019, unemployment rate from 1991-2019 are collected from the WDI, the data of remittance inflows from 1979-2019 is collected from the Bangladesh Bank, the sales revenue of the garment sector of Bangladesh from 1978-2019 and the data of employment of the garment sector of Bangladesh from 1979-2019 are collected from BGMEA publications in order to find the impacts of COVID-19 on these variables and to forecast these variables for future time period. The time series data day wise cumulative total of infected cases, deaths, and

recovered cases for Bangladesh and also for different regions are collected from https://www.worldometers.info/coronavirus/, https://flevy.com/coronavirus, in order to find the growth rate and also to find the rate of change of average death with respect to total cases of Bangladesh. Data of lockdown for Bangladesh is collected from different government website, newspaper and https://en.wikipedia.org/wiki/COVID-19pandemiclockdowns. Due to non-availability of information, there is no consistency of the number of years of different variables.

3.1. The COVID-19 Situation in Bangladesh

Bangladesh has now entered the 24th month of the COVID-19 pandemic situation. It has been observed that health care system or medical crisis has caused into a multi-system game changer which will pose significant challenges for Bangladesh. It has also been observed that economic crisis is going on and unfolding unemployment crisis is increasing very sharply in Bangladesh. The first report of a disease caused by COVID-19 was in Wuhan, China, in December 2019. The World Health Organization (WHO) declared the COVID-19 outbreak a Public Health Emergency of International Concern on January 30, 2020 and a pandemic on 11 March 2020. Since the COVID-19 pandemic has been continuing for two years, as of February 11, 2022, the highest number of confirm cases is in the U.S.A. with 19.46% followed by India, Brazil, France, UK, Russia, Turkey, Italy, Germany, and Spain, with 10.469%, 6.676%, 5.260%, 4.470%, 3.330%, 3.114%, 2.935%, 2.928% and 2.598% of the world total infected cases respectively but globally the position of Bangladesh is 40 among 225 countries in respect of total confirmed cases with 0.466% of the world total confirm cases, it is also observed that the highest number of deaths is in the U.S.A. with 16.175% followed by Brazil, India, Russia, Mexico, Peru, UK, Italy, Indonesia, and Colombia with 10.953%, 8.733%, 5.821%, 5.349%, 3.573%, 2.740%, 2.587%, 2.494%, and 2.352% of the global total deaths respectively but in respect of the total number of deaths the position of Bangladesh is 32 with 0.495% of the global total deaths. It is also found that as of February 11, 2022, the highest number of recovered cases is in the USA with 15.159% followed by India, Brazil, France, UK, Turkey, Russia, Italy, Germany, and Argentina, with 12.674%, 7.190%, 4.866%, 4.808%, 3.605%, 3.345%, 3.054%, 2.602%, and 2.553% of the world total number of recovered cases respectively but in respect of total recovered cases globally the position of Bangladesh is 36 with 0.504%. It is also observed that the highest number of death rate with respect to total infected cases is in Sudan with 6.331% followed by Peru, Mexico, Syria, Egypt, Somalia, Ecuador, Afghanistan, Taiwan (China), China, and Bosnia and Herzegovina with 6.108%, 5.983%, 5.766%, 5.167%, 5.114%, 4.460%, 4.413%, 4.392%, 4.346% and 4.136% respectively but the position of Bangladesh is 79 based on death rate with respect to total confirmed cases among 225 countries. It is also observed that as of February 11, 2022, the highest number of death per million people is in Peru with 6156 cases followed by Bul-

garia, Bosnia and Herzegovina, Hungary, Montenegro, North Macedonia, Georgia, Croatia, Czechia, and Slovakia with 4986 cases, 4599 cases, 4393 cases, 4177 cases, 4169 cases, 3873 cases, 3525 cases, 3509 cases and 3302 cases respectively but the position of Bangladesh is 153 in respect of total deaths per million people with 172 cases. In respect of tests per million people the position of Bangladesh is 168 with 77,082 tests in which Denmark is in the 1st position with 21,030,737 tests, Austria is the 2nd position with 16,441,641 tests and Faeroe Islands is in the 3rd position with 15,520,117 tests respectively in respect of total doses the position of Bangladesh is 16 globally with 102.11 million doses in which China's position is one with 2.55 billion doses, India's position is second with 1.28 billion doses, and USA's position is 3 with 470.30 million doses respectively. As of data February 11, 2022, in respect of fully vaccinated per 100 people the position of Bangladesh is 150 globally with 38.074% in which the position of Gibraltar is one with 120.928%, Palau is the 2nd position with 94.229% and Brunei Darussalam is the 3rd Position with 92.207% (WHO, 2020). As of February 11, 2022, more than 406.31 million cases of COVID-19 have been reported in over 225 countries resulting 5.81 million deaths. In Bangladesh 1.89 million cases of COVID-19 have been reported and resulting 0.0287 million deaths. From the reported values it can be said that the COVID-19 situation of Bangladesh is not so bad relative to other countries in the world but in respect of total tests per million people and vaccinated people per 100 people the position of Bangladesh is very poor relative to other countries. In order understand the scenario of COVID-19 in Bangladesh the day wise cumulative total confirmed cases, total deaths and the total recovered cases from March 8, 2020 to February 11, 2022 are shown below in **Figure 3**.

From the **Figure 3**, it can be said that from January 22 in Bangladesh the COVID-19 infected cases are increasing rapidly as a result the no. of death is higher relative to previous time period. Also to know the situation of COVID-19 and the impacts of lockdown on spreading, the day wise number of infected cases, number of deaths and the number of recovered cases are presented below in **Figure 4**:

From the **Figure 4**, it is very clear to us that there are four waves of COVID-19 pandemic in Bangladesh, the first wave was from March-September 2020, the second wave was from February-May 2021, the third wave was May-September 2021 and the fourth wave is started from January 22 and it is continuing. Among them the third and fourth waves were very dangerous. From the **Figure 4**, it is very clear that during the lockdown periods 23 March-May 30 in 2020, and 5 April-28 April in 2021 the spreading rate was relatively smaller than other time periods. Thus it can be said that in Bangladesh lockdowns were playing significant role to prevent spreading COVID-19 virus from human to human. Also to know the situation of COVID-19 in different continents, as of February 11, 2022, the total infected cases, total deaths, and total recovered cases in million, also in percentage of these variables for each continent with respect to

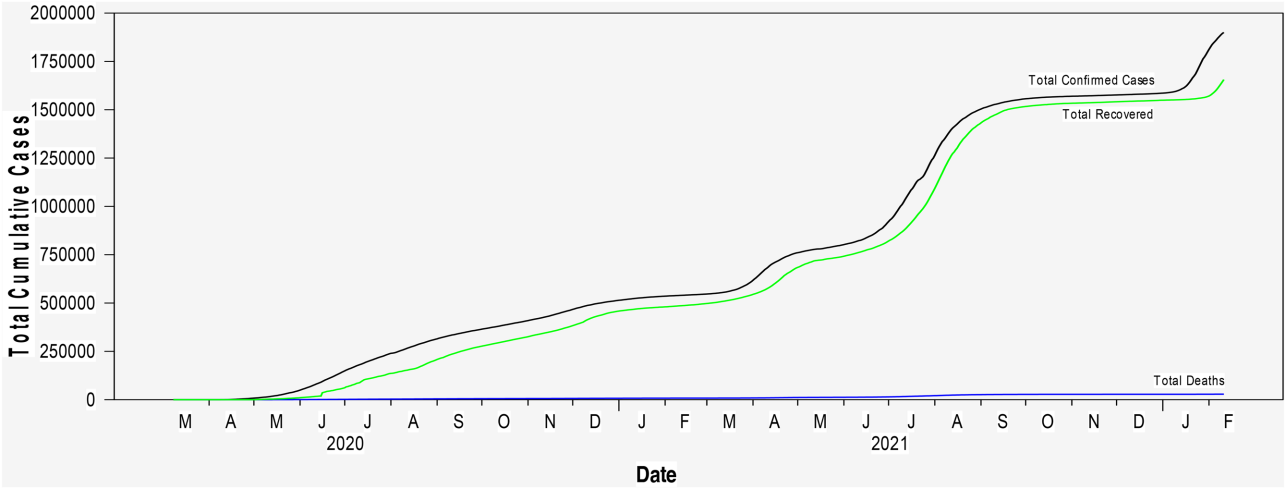

Figure 3. Day wise cumulative total confirmed cases, total deaths and total recovered cases.

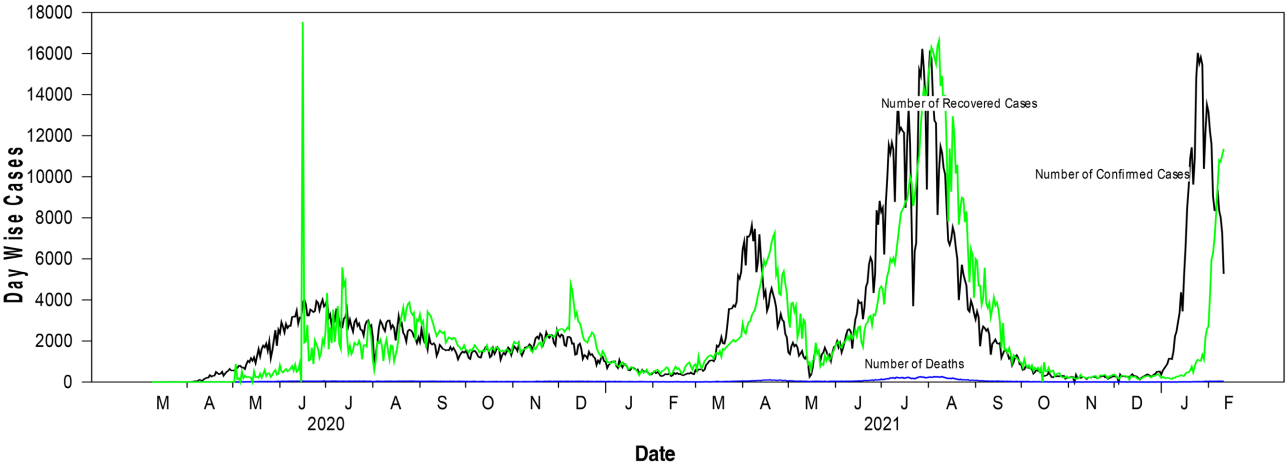

Figure 4. Day wise no. of confirmed cases, no. of deaths and no. of recovered cases.

global total are presented below in Table 1. Death ratio to total cases (DRTC), recovered ratio to total cases (RRTC) and death ratio to total recovered cases for each continent are presented below in Table 1 as percentage.

As of February 11, 2022, Table 1 shows that Europe has the highest number of infected cases with 34.855%, Asia is in the second highest position with 26.240% followed by North America, South America, Africa and Oceania with 22.741%, 12.640%, 2.772% and 0.7538% of the total infected cases respectively. Europe has the highest number of deaths with 28.471% followed by North America, Asia, South America, Africa and Oceania with 23.361%, 22.622%, 21.211%, 4.198%, and 0.1187% of the total deaths respectively. The Europe has the highest number of recovered cases with 33.647% followed by Asia, North America, South America, Africa and Oceania with 30.247%, 18.662%, 13.468%, 3.122%, and 0.855% of the total recovered cases respectively. South America has the highest deaths ratio to total cases with 2.393% followed by Africa, North America, Europe, Asia, and Oceania with 2.160%, 1.465%, 1.165%, 1.299% and 0.2245% respectively. Asia has the highest recovered ratio to total cases with 92.667% followed by Oceania

Table 1. Continent wise covid-19 statistics as of February 11, 2022.

	Africa	Asia	Europe	North America	South America	Oceania	World
Total Cases	11.298	106.966	142.085	92.702	51.527	3.073	407.652
Total Deaths	0.244	1.315	1.655	1.358	1.233	0.0069	5.813
Total Recovered	10.231	99.122	110.264	61.156	44.135	2.802	327.711
TC in % of the World	2.772	26.240	34.855	22.741	12.640	0.7538	100.00
TD in % of the World	4.198	22.622	28.471	23.361	21.211	0.1187	100.00
TR in % of the World	3.122	30.247	33.647	18.662	13.468	0.855	100.00
DRTC (in%)	2.160	1.229	1.165	1.465	2.393	0.2245	1.426
RRTC (in%)	90.555	92.667	77.604	65.971	85.654	91.181	80.390
DRTR (in%)	2.385	1.327	1.501	2.221	2.794	0.2463	1.774

Source: https://www.worldometers.info.[6]

Africa, South America, Europe, and North America, and with 91.181%, 90.555%, and 85.654%, 77.604% and 65.971% respectively. South America has the highest death ratio to total recovered cases with 2.794% followed by Africa, North America, Europe, Asia, and Oceania with 2.385%, 2.221%, 1.501%, 1.327% and 0.246% respectively. Thus from analytical results it can be said that the situation of the continent Oceania is good in respect of total infected cases, total deaths, and death ratio to total infected relative to other continents but the situation of the continent South America is worst in respect of death ratio to total cases and death ratio to total recovered cases.

Empirical Models

Also to observe the COVID-19 situation of Bangladesh including different continents, in this section we also estimated the growth rate of total infected cases, total deaths, total recovered cases and also the rate of change of total deaths with respect to total cases using the data as of February 11, 2022. The growth rates of day wise cumulative total confirmed cases (GRTC), total deaths (GRTD) and recovered cases (GRTR) of Bangladesh including different continents are obtained using the following growth model:

$$Y_t = C_0 (1+r)^t \, e^{\varepsilon_t}, \quad t = 1, 2, \cdots, T \tag{1}$$

where, Y is the observed variable for which the growth rate will be calculated, r is the growth rate of the variable Y, ε_t is the random error term corresponding to the tth set of observation which satisfies all the usual assumptions. The estimated value of r is given by:

$$\hat{r} = \exp\left(\hat{\beta}\right) - 1, \text{ where } \beta = \ln(1+r) \tag{2}$$

[6]Own Calculations, TC: indicates total cases, TD: indicates total deaths, TR: indicates total recovered, DRTC: indicates death ratio to total cases, RRTC: recovered ratio to total cases, DRTR: indicates death ratio to total cases.

The rate of change of the day wise deaths with respect to confirmed cases is obtained using the simple linear regression equation of the type:

$$TD_t = \beta_0 + \beta_1 TC_t + u_t, \quad t = 1, 2, \cdots, T \tag{3}$$

where TD_t is the day wise cumulative total deaths at time t and TC_t is the day wise cumulative total confirmed cases at time t, u_t is the random error term corresponding to the tth set of observation that satisfies all the usual assumptions. Based on the diagnostic test results the appropriate methods are applied to estimate the death rate with respect to confirmed cases. The growth rate of day wise cumulative total confirmed cases, deaths and recovered cases are estimated based on the data as of February 11, 2022, for Bangladesh and also for different continents using the software RATS which are reported below in Table 2.

As of data February 11, 2022, from the analytical results it is found that in Bangladesh the growth rates of day wise cumulative total cases, total deaths and total recovered cases are 0.9074%, 0.7733% and 1.0698% respectively. Also it is found that the rate of change of average death with respect to total confirmed cases is 1.7713% in Bangladesh which is statistically significant at any significance level. As a continent wise, from the estimated results it can be said that the growth rate of total infected cases is highest for South Asia with 1.4763% followed by South East Asia, North America, Europe, European Union, Africa, South America, World, Oceania and East Asia with 1.4763%, 1.2675%, 1.2345%, 1.181%, 1.1777%, 1.1256%, 1.0301%, 0.9823%, 0.9727%, 0.9655%, and 0.634% respectively. It is also found that the growth rate of deaths is highest for South

Table 2. Growth rate of total cases, total deaths, total recovered cases and the rate of change of total death with respect to total cases.

	GRTC (in %)	GRTD (in %)	GRTR (in %)	$\hat{\beta}_1$ (in %)	t-value for β_1
Bangladesh	0.9074	0.7733	1.0698	1.7713	318.583*
Africa	1.1256	0.8395	1.7555	2.4468	288.181*
Asia	0.9655	0.8392	1.5678	1.4041	335.602*
East Asia	0.6340	0.4133	0.8415	0.8475	73.2671*
South Asia	1.4763	0.9262	2.3931	1.3560	312.175*
South East Asia	1.2675	1.1736	1.8960	1.9786	421.537*
Europe	1.1810	0.7639	1.6833	1.5490	92.659*
European Union	1.1777	0.6943	1.5859	1.4200	73.748*
North America	1.2345	0.6002	1.5590	1.7500	123.752*
South America	1.0301	0.8660	1.3337	2.9092	226.793*
Oceania	0.9727	0.6850	1.1072	0.2318	34.4527*
World	0.9823	0.8338	1.1332	1.7640	150.555*

Sources: https://www.worldometers.info/coronavirus; https://flevy.com/coronavirus; https://github.com/owid/covid-19-data; Own calculations; * indicates significant at 1% significance level.

East Asia with 1.1736% followed by South Asia, South America, Africa, Asia, World, Europe, European Union, Oceania, North America and East Asia with 0.9262%, 0.866%, 0.8395%, 0.8392%, 0.8338%, 0.7639%, 0.6943%, 0.685%, 0.6002%, and 0.4133 respectively. The growth rate of total recovered cases is highest for South Asia with 2.3931% followed by South East Asia, Africa, Europe, European Union, Asia, North America, South America, World, Oceania, and East Asia with 1.896%, 1.7555%, 1.6833%, 1.5859%, 1.5678%, 1.5590%, 1.3337%, 1.1332%, 1.1072%, and 0.8415% respectively. The rate of change of average death with respect to total confirmed cases is highest for South America 2.9092% followed by Africa, South East Asia, World, North America, Europe, European Union, Asia, South Asia, East Asia and Oceania, with 2.4468%, 1.9786%, 1.764%, 1.7500%, 1.549%, 1.420%, 1.4041%, 1.356%, 0.8475%, and 0.2318% respectively and for all continents it is statistically significant at any significance level. The estimated growth rates and the rate of change of average deaths with respect to total confirmed cases of different regions including Bangladesh are presented below in Figure 5.

From the analytical results and also from in Figure 5, it is found that the growth rate of infected people are higher for those regions which are economically developed and having developed health care system. Thus it can be said due to less connection with epicenter of corona virus, testing difference, demographic characteristics of the regions can be the reasons of higher growth rate of infected cases. Also it is found that the growth rate of deaths are higher for those regions which are economically not developed and health care systems are very poor. Thus it can be said that poor health care system is one of the main factor to increase the death due to COVID-19.

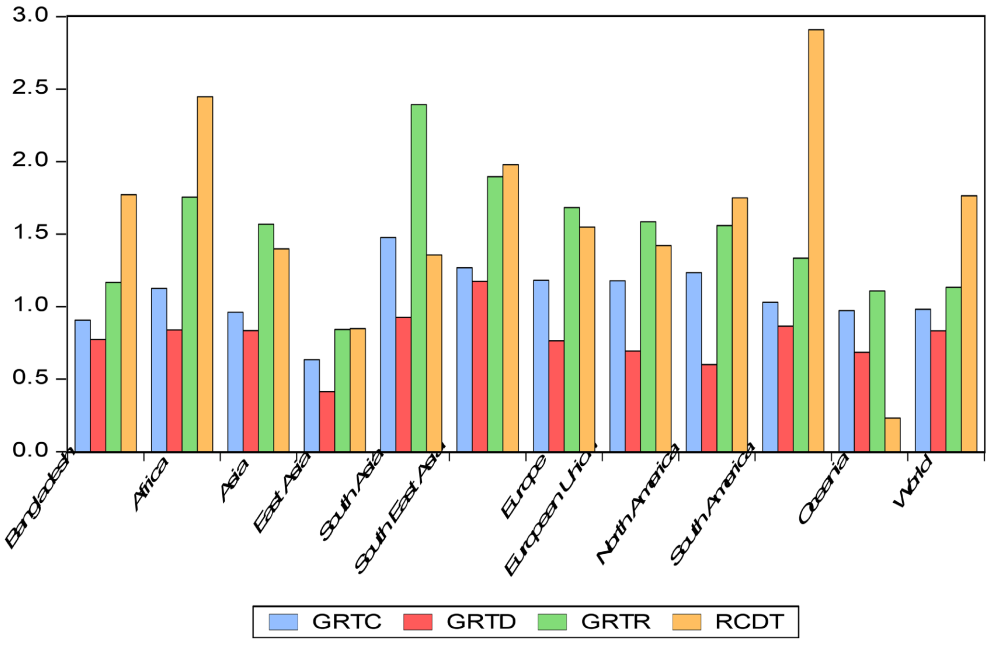

Figure 5. Growth rate of total cases, total deaths, total recovered cases and the rate of change of total deaths with respect to total cases.

3.2. Descriptive Statistics of Some Non-Economic and Economic Variables

Some fundamental descriptive statistics say mean, median, standard deviation (Std. Dev), coefficient of variation (CV), skewness, kurtosis, t-test value for zero mean, interval estimation for population mean, maximum (max.), minimum (min) and range of the non-economic variables say day wise total confirmed cases (DTC), total deaths (DTD), total recovered cases (DTR), total tests (TT), death ratio to total confirmed cases (DRTC), recovered ratio to total confirmed cases (RRTC), and death ratio to recovered cases (DRRC), and also for considered economic variables say real gross domestic product in million $ (GDP), total export values in million $ (TEX), sales revenue of the garment sector of Bangladesh in million $ (REVGS), remittance inflows in million $ (REM), national unemployment rate (UNR), and employment of the garment sector (EMP) of Bangladesh are estimated and recorded below in Table 3 and Table 4 in order to know the behaviors of these variables individually.

From the estimated results in Table 3, it is found that in Bangladesh averagely per day 2698 people are infected by COVID-19 virus of which averagely per day 41.36 people died and 2385 people are recovered. It is also found that averagely per day 18,400.39 cases are tested. From the analytical results it is found that for increasing per 100 confirmed cases averagely 1.8452 people have died and 74.9007 people recovered and for per 100 recovered cases averagely 7.1773

Table 3. Fundamental descriptive statistics of non-economic variables.

	DTC	DTD	DTR	TT	DRTC (in%)	RRTC (in %)	DRRC (in %)
Mean	2698.00	41.36	2385.10	18400.39	1.8452	74.9007	7.1773
Median	1603.00	26.00	1532.00	15672.00	1.5336	87.5587	1.8166
Std. Dev	3296.45	52.87	3078.59	10600.36	1.5155	27.6989	20.9306
CV	122.18	127.83	129.08	57.6094	82.132	36.9808	291.622
Skew.	2.16	2.50	2.51	0.9433	4.9258	-1.4239	4.5098
Kurt.	7.41	8.99	9.73	3.98	27.9502	3.7475	22.8284
t-Value	21.75*	20.64*	20.47*	46.15*	32.37*	71.9006*	9.0660*
Interval Estimation	[2454.89, 2941.21]	[37.43, 45.29]	[2156.71, 5613.49]	[17619.0, 19181.79]	[1.7335, 1.9569]	[72.8589, 76.9425]	[5.6256, 8.7290]
Min	0.00	0.0	0.0	10.0	0.0	0.0	0.0
Max	16230.0	264	17533.0	53462	12.8205	97.7793	130.4348
Range	16230.0	264	17533	53452	12.8205	97.7793	130.4348
Obs.	706	696	698	707	707	707	699

Note: All the predictions are based on the information of COVID-19 up to February 11, 2022.

Table 4. Fundamental descriptive statistics of some economic variables.

Descriptive Statistics	GDP (in m $)	TEX (in m $)	REVGS (in m $)	REM (in m $	UNR	EMP
Mean	76,414.04	11,201.03	9965.856	5584.414	3.7682	2,167,678
Median	55,327.79	4507.555	4583.75	1915.71	3.9640	1,976,783
Std. Dev	54,958.85	14,130.74	11,431.09	6065.729	1.0107	1,214,866
CV	71.9225	126.1557	114.7025	108.6189	26.8218	56.0446
Skew.	1.0271	1.2496	0.9329	0.7968	0.4011	0.3208
Kurt.	2.8515	3.1013	2.3279	1.9638	3.4225	1.9766
t-Value	9.9293*	5.6608*	5.7169*	5.9665*	20.758*	11.7040*
Interval Estimation	[61,330.32 91,497.77]	[7322.78, 15,079.28]	[6549.14, 13,382.58]	[3749.93, 7418.90]	[3.412, 4.124]	[1,804,557.96, 2,530,798.04]
Min	21,475.76	356.841	0.672	171.141	2.2000	391,958
Max	209,974.3	46,363.74	34,133.27	18,205.01	6.6300	4,290,282
Range	188,498.54	46,006.899	34,132.598	18,033.869	4.4300	3,898,324
Obs.	51	51	43	42	31	43

people have died. From the estimated result it is found that the coefficient of variation (CV) is highest for the variable DRRC followed by DTR, DTD, DTC, DRTC, TT and RRTC respectively. Except the variable RRTC all the variables are positively skewed and the curves of all the variables are leptokurtic. The population means of the variables DTC, DTD, DTR, TT, DRTC, RRTC and DRRC are statistically significant individually at any significance level with their 95% confidence interval estimations are [2454.89, 2941.21], [37.43, 45.29], [2156.71, 5613.49], [17619.0, 19181.79], [1.7335, 1.9569], [72.8589, 76.9425], and [5.6256, 8.7290] respectively.

From the reported values in Table 4, it is found that the variability is highest for the variable TEX followed by REVGS, REM, GDP, EMP, UNR respectively. The results also support that all the variables are positively skewed. The results also support that the curves of the variables TEX and UNR are leptokurtic and the curves of the variables GDP, REVGS, REM and EMP are platykurtic. It is also found that population means of all the variables are statistically significant individually from their zero means at any significance level with their interval estimations are [61,330.32, 91,497.77], [7322.78, 15,079.28], [6549.14, 13,382.58], [3749.93, 7418.90], [3.412, 4.124], and [1,804,557.96, 2,530,798.04] respectively.

3.3. Correlation Matrix of Non-Economic Variables

In order to detect the association between different pairs of variables the correlation coefficients are estimated and presented below in Table 5.

From the estimated results in Table 5, it is found that total cases are highly associated with total deaths, total recovered cases and total tests. The total deaths

Table 5. Correlation matrix.

Variable	TC	TD	TR	TT
TC	1.0000	0.9965 [3841.219] (0.0000)	0.9969 [4247.387] (0.0000)	0.6928 [35.376] (0.0000)
TD	0.9965 [3841.219] (0.0000)	1.0000	0.9986 [9622.708] (0.0000)	0.6569 [30.681] (0.0000)
TR	0.9969 [4247.387] (0.0000)	0.9986 [9622.708] (0.0000)	1.0000	0.6505 [29.947] (0.0000)
TT	0.6928 [35.376] (0.0000)	0.6569 [30.681] (0.0000)	0.6505 [29.947] (0.0000)	1.0000

Values within third brackets are the t-test values and in the parentheses are the p-values.

are also highly associated with total recovered cases and total tests, and the total recovered cases is highly associated with total tests. It is also found that all the associations are statistically significant individually from their zero correlation at any significance level.

4. Methodology and Empirical Analyses

In case of COVID-19 pandemic the focus on credible estimation of GDP, total export values (TEX), sales revenue of the garment sector of Bangladesh (REVGS), remittance (REM), unemployment rate at national level and also for employment of the garment sector of Bangladesh are assumed to be fostered importance because they have significant implications for economic policy-making at an ultimate time. That is why in this paper to predict the loss of individual variables due to COVID-19, firstly we predicted the individual variables for the year 2020 and 20201 using the Holt-Winters' seasonal additive method of the type:

$$\hat{Y}_{t+h|t} = L_t + hT_t + S_{t+h-m(k+1)} \tag{4}$$

$$L_t = \alpha\left(Y_t - S_{t-m}\right) + \left(1-\alpha\right)\left(L_{t-1} + T_{t-1}\right) \tag{5}$$

$$T_t = \beta\left(L_t - L_{t-1}\right) + \left(1-\beta\right)T_{t-1} \tag{6}$$

$$S_t = \gamma\left(Y_t - L_{t-1} - T_{t-1}\right) + \left(1-\gamma\right)S_{t-m} \tag{7}$$

The predicted value of the variable Y at time t is given by:

$$\hat{Y}_t = L_{t-1} + T_{t-1} + S_{t-m} \tag{8}$$

where k, is the integer part of $(h-1)/m$, which ensures that the estimates of the seasonal indices used to forecast come from the final year of the sample, m is the frequency of the seasonality, i.e., the number of seasons in a year. The level Equation (5) shows a weighted average between the seasonally adjusted observation

$\left(Y_t - S_{t-m}\right)$ and the non-seasonal forecast $\left(L_{t-1} + T_{t-1}\right)$ for time t. The trend Equation (6) is identical to Holt's linear method which indicates a weighted average between the adjusted level observations and trend rate at time $(t-1)$. The seasonal Equation (7) shows a weighted average between the current seasonal index, $\left(Y_t - L_{t-1} - T_{t-1}\right)$ and the seasonal index of the same season last year.

The equation for the seasonal component is often expressed as

$$S_t = \gamma^* \left(Y_t - L_t\right) + \left(1 - \gamma^*\right) S_{t-m} \tag{9}$$

If we substitute L_t from the smoothing equation for the level of the component form above, we get

$$S_t = \gamma^* \left(1-\alpha\right)\left(Y_t - L_{t-1} - T_{t-1}\right) + \left(1 - \gamma^* \left(1-\alpha\right)\right) S_{t-m} \tag{10}$$

which is identical to the smoothing equation for the seasonal component we specify here, with $\gamma = \gamma^* \left(1-\alpha\right)$. The usual parameter restriction is $0 < \gamma^* < 1$, which implies that $0 < \gamma < \left(1-\alpha\right)$.

4.1. Economic Impact

After predicting the values of the variables GDP, total export values TEX), sales revenue of the garment sector of Bangladesh (REVGS), and remittance for the years 2020 and 2021 using the Holt-Winters' seasonal additive method, then the losses of the variables which occurred due to lockdowns for COVID-19 outbreak are obtained using the following technique:

$$YL\left(t\right) = \frac{\hat{Y}\left(t\right)}{365} \times \text{Lockdown days}\left(t\right); \text{ where } t = 2020, 2021 \tag{11}$$

where, YL indicates the predicted loss of the variable Y due to lockdowns for COVID-19 in the year t, $\hat{Y}\left(t\right)$ is the predicted value of the variable Y in the year t and Lockdown days is the no of days of lockdown for COVID-19 in the year t. The software RATS is used to forecast the variables GDP, total export values (TEX), sales revenue of the garment sector of Bangladesh (REVGS), and remittance inflows (REM) in the years 2020 and 2021 and then the losses of the respective variables are predicted, and the number of years that the respective variable will be downgraded for COVID-19 are also predicted which are reported below in **Table 6**.

From the estimated results in **Table 6**, it is found that in the year 2020, the losses of GDP, total export values (TEX), sales revenue of the garment sector (REVGS) and remittance inflows (REM) of Bangladesh would be $ 31,677.475 million, $6771.5296 million, $6854.0890 million and $3941.4486 million and in the year 2021 the loses would be $13,544.415 million, $3044.7328 million, $2026.187 million and $934.513 million respectively due to lockdown during the period of COVID-19 and in terms of percentage the loses would be 13.973%, 13.9726%, 21.789% and 21.650% in the year 2020 and 6.945%, 7.303%, 6.395% and 5.826% in the year 2021 respectively. The GDP, total export values (TEX), sales revenue of the garment sector (REVGS) and remittance inflows (REM) of

Table 6. Losses of GDP, total export values, sales revenue of the garment sector, and remittance inflows, and the number of years that each variable will be downgraded.

Predicted Loss for the Year 2020			
Variable	**Predicted Loss (in million $)**	**Predicted Loss in %**	**Downgraded Years**
GDP	31,677.475	13.973	2
TEX	6771.5296	13.9726	2
REVGS	6854.0890	21.789	0
REM	3941.4486	21.650	0
Predicted Loss for the Year 2021			
GDP	13,544.519	6.945	0
TEX	3044.7328	7.3030	0
REVGC	2026.187	6.395	Declining Trend
REM	934.513	5.826	0

Bangladesh would be downgraded for 2 years, 2 years, 0 years and 0 years respectively due to COVID-19 outbreak from 2020 but from 2021 the downgraded would be 0 years, 0 years and 0 years for GDP, TEX and REM respectively but the sales revenue of the garment sector (REVGS) of Bangladesh will be declining trend from 2021. The long-lasting declining trend of the sales revenue is a red alarming for the garment sector of Bangladesh. Therefore the Bangladesh Garment Manufacturers and Exporters Association (BGME) including other important stakeholders say Bangladesh Apparel & Textile Exposition (BTEXPO), Bangladesh Bank (BB), The Bangladesh Export Processing Zone Authority (BEPZA), The Bangladesh Foreign Trade Institute (BFTI), Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA), Bangladesh Labor Welfare Foundation (BLWF), Bangladesh Labor Welfare Foundation (BLWF), Best Practice Garments Bangladesh (BPGB), Global Alliance for Fair Textile Trade (GAFTT), Government of Bangladesh (GoB), International Apparel Federation (IAF), International Labor Organization (ILO), and Owners and Workers of the Garment Sector of Bangladesh have to take necessity steps to overcome this problem. Otherwise the garment sector of Bangladesh will face a critical situation in future as a result the socio-economic condition of Bangladesh is going to be worst in near future. In order to realize the post COVID-19 economic scenario of Bangladesh including the garment sector the GDP, export values, sales revenue of the garment sector and remittance are forecasted from 2021-2030 and are reported below in Table 7. Also these predicted values of different variables including the actual values of the previous years are presented below in Figure 6, Figure 7, Figure 8, and Figure 9.

From the forecasted values in Figure 6 and Figure 7 it can be said that the

Table 7. Predicted values of GDP, total export values, sales revenue of the garment sector and remittance inflows of Bangladesh from 2021-2030.

Year	GDP	TEX	REVGS	REM
2021	192,445.042	45,563.045	30,814.933	15,308.217
2022	197,137.737	46,046.075	30,528.936	15,653.069
2023	201,922.259	46,535.446	30,242.940	16,102.294
2024	206,706.781	47,024.817	29,956.943	16,551.520
2025	211,491.303	47,514.188	29,670.946	17,000.745
2026	216,275.825	48,003.559	29,384.950	17,449.971
2027	221,060.347	48,492.930	29,098.953	17,899.196
2028	225,844.869	48,982.302	28,812.956	18,348.422
2029	230,629.391	49,471.673	28,526.960	18,797.647
2030	235413.912	49,961.044	28,240.963	19,246.873

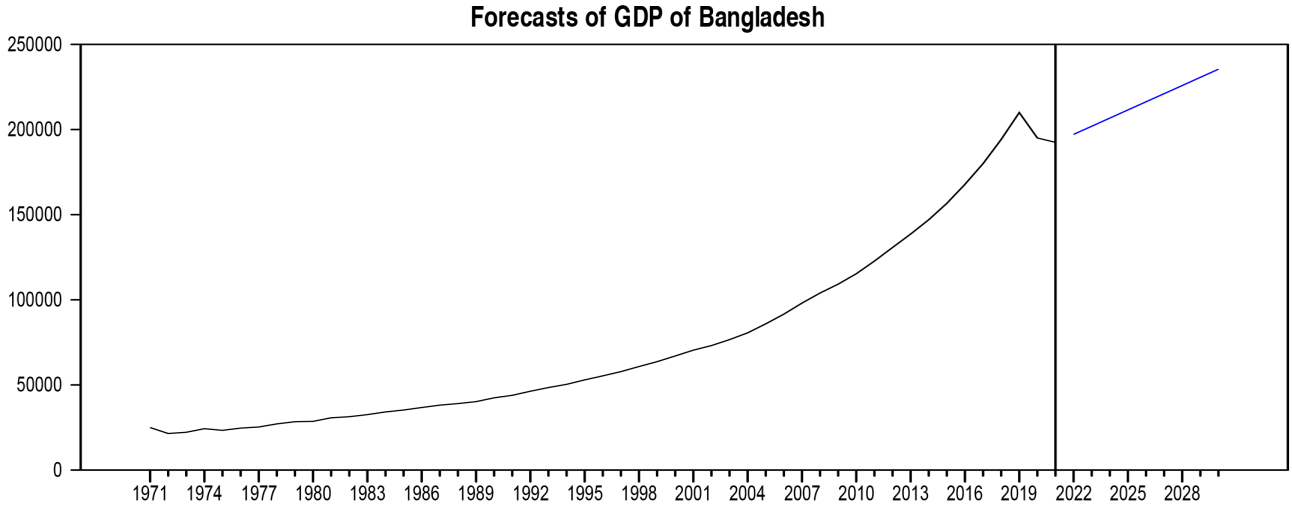

Figure 6. Predicted values of GDP from 2021-2030.

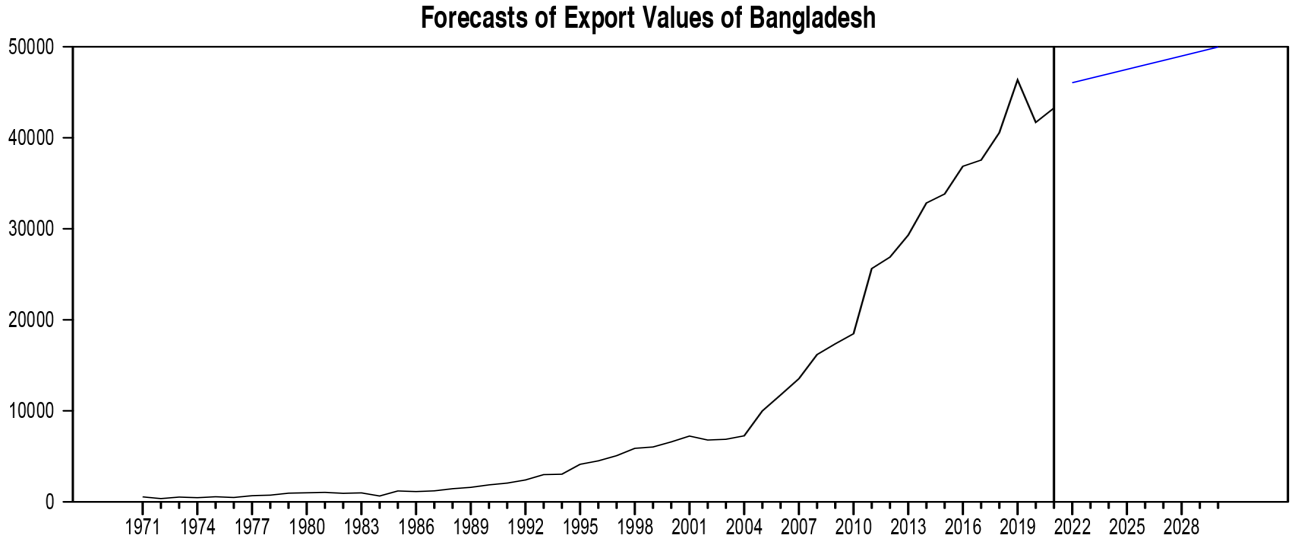

Figure 7. Predicted export values of Bangladesh from 2021-2030.

GDP and export values decline until 2021 due to COVID-19 outbreak and then again they will be increased with growth rate 4.744% and 9.847% respectively. From Figure 8, it can be said that due to COVID-19 outbreak, the remittance inflows of Bangladesh will be declined in 2020 again it will be increased with growth rate 9.408 and from Figure 9, it can be said that the sales revenue of the garment sector will be declined in 2020 with decreasing rate 0.716% and in the 2021 the sales revenue will be also be declined with decreasing rate −2.737% and will be continuned for a long period of time. Thus it can be said that the long-lasting declining trend of sales revenue is not a good sign for the garment sector as well as for the Bangladesh economy. Therefore the government of Bangladesh including other stakeholders should take necessary actions to tackle this problem. From the predicted values of GDP, export values and remittance it can be said that the COVID-19 will not be a big threat for Bangladesh economy and the post COVID-19 Bangladesh economy will not fall in risky situation. The growth rate of these variables are also predicted which are reported below in Table 8.

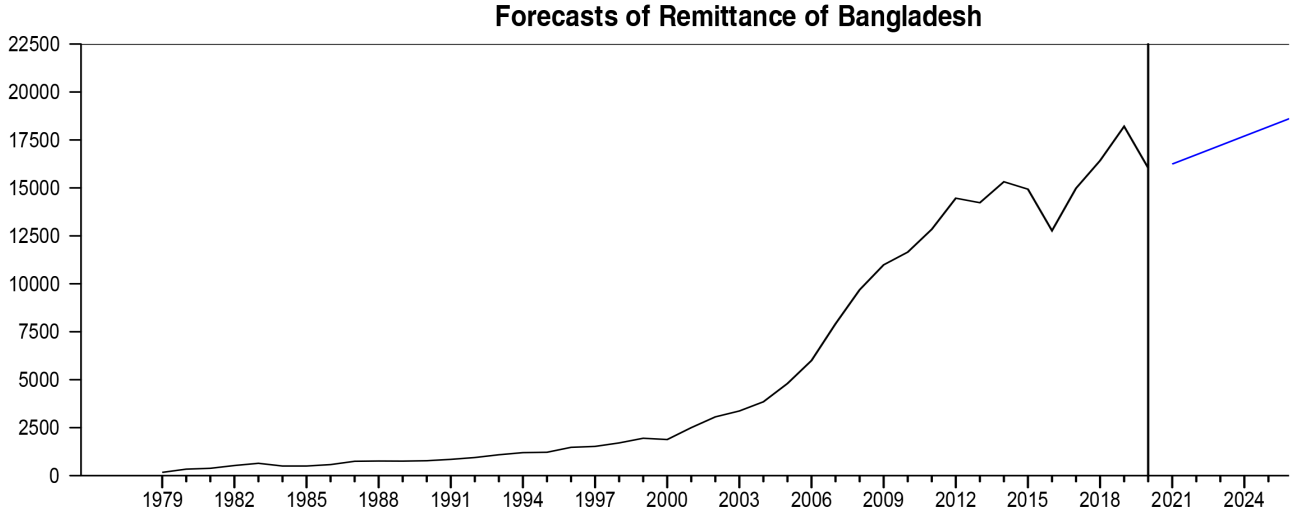

Figure 8. Predicted remittance inflows of Bangladesh from 2021-2030.

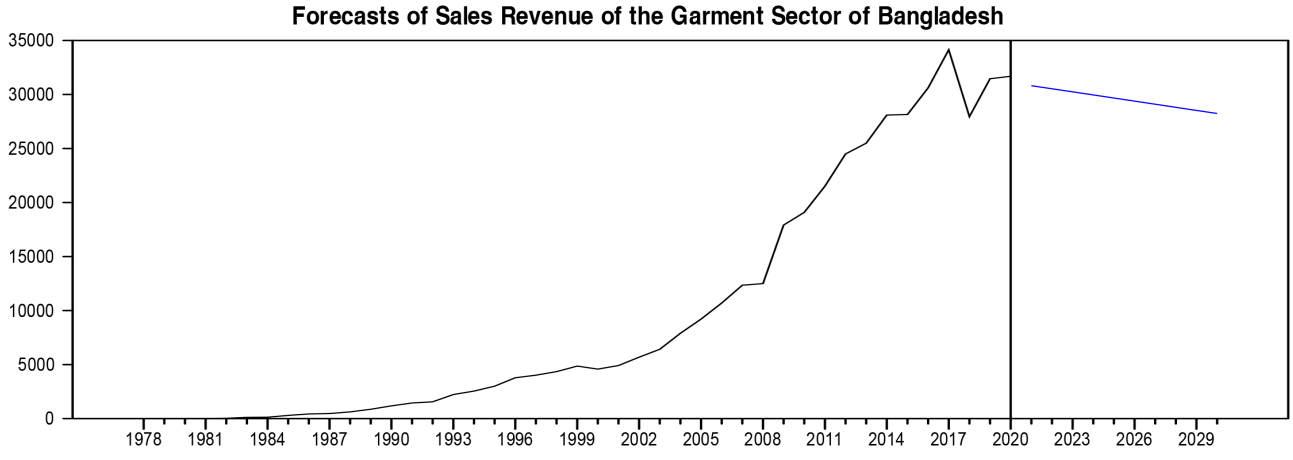

Figure 9. Predicted sales revenue of the garment sector of Bangladesh from 2021-2030.

Table 8. The yearly changes (in %) of GDP, expot values, remittance inflows and unemployment.

Year	Yearly Changes of GDP (in %)	Yearly Changes of Total Export (in%)	Yearly Changes of Sales Revenue (in%)	Yearly Changes of Remittance (in %)
1971	------	-------	--------	--------
1972	−13.974	−35.193	--------	--------
1973	3.326	48.196	--------	--------
1974	9.592	−12.429	--------	--------
1975	−4.088	21.583	--------	--------
1976	5.661	−14.720	--------	--------
1977	2.673	41.516	--------	--------
1978	7.074	8.630	--------	--------
1979	4.802	28.825	400.000	--------
1980	0.819	4.798	108.036	97.891
1981	7.234	4.257	55.079	12.514
1982	2.134	−9.506	191.236	38.160
1983	3.881	4.953	268.071	22.024
1984	4.803	−34.879	13.150	−22.051
1985	3.342	86.676	127.160	0.343
1986	4.173	−5.922	45.284	14.689
1987	3.772	7.439	8.566	29.765
1988	2.416	18.994	32.493	2.114
1989	2.837	10.519	38.878	−0.739
1990	5.622	17.082	36.426	2.756
1991	3.485	10.480	22.193	9.089
1992	5.443	16.633	7.666	11.170
1993	4.712	24.320	43.229	15.261
1994	3.890	1.638	14.306	10.003
1995	5.121	35.606	17.829	1.622
1996	4.523	9.353	26.012	21.228
1997	4.490	12.599	6.294	3.390
1998	5.177	15.789	8.195	11.820
1999	4.670	2.584	11.735	14.280
2000	5.293	9.278	−5.681	−3.448
2001	5.077	9.707	7.163	32.890
2002	3.833	−6.037	15.757	22.423
2003	4.740	1.261	12.866	10.124
2004	5.240	5.533	23.110	14.126
2005	6.536	37.720	16.586	24.793
2006	6.672	17.510	16.160	24.905

Continued

2007	7.059	15.201	15.402	31.947
2008	6.014	19.591	1.206	22.420
2009	5.045	7.285	43.353	13.398
2010	5.572	6.409	6.560	6.033
2011	6.464	38.733	12.708	10.241
2012	6.521	4.914	13.832	12.596
2013	6.014	8.994	4.081	−1.610
2014	6.061	12.030	10.210	7.651
2015	6.553	3.015	0.198	−2.518
2016	7.114	9.003	8.756	−14.478
2017	7.284	1.850	11.493	17.324
2018	7.864	8.026	−18.117	9.598
2019	8.153	14.308	12.550	10.873
2020	−7.115	−10.078	0.716	−11.895
2021	−1.327	3.764	−2.737	−4.559
2022	2.438	6.439	−0.928	2.253
2023	2.427	1.063	−0.937	2.870
2024	2.369	1.052	−0.946	2.790
2025	2.315	1.041	−0.955	2.714
2026	2.262	1.030	−0.964	2.642
2027	2.212	1.019	−0.973	2.574
2028	2.164	1.009	−0.983	2.510
2029	2.118	0.999	−0.993	2.448
2030	2.075	0.989	−1.003	2.390

The yearly growth rate of these variables are also presented below graphically to get the clear idea about the impacts of COVID-19 on these variables.

From the predicted values in Table 8, it is found that in Bangladesh due to COVID-19 outbreak the growth rate of GDP will be negative in the year 2020 with −7.115% and it will be continued until 2021 with −1.327% but from 2022 the growth rate of GDP will be increased with increasing rate 2.438% (see Figure 10). The growth rate of export values will be negative in the year 2020 with −10.078% (see Table 8), but from 2021 it will be increased with increasing rate 3.764% (see Figure 10). Due to COVID-19 outbreak the growth rate of remittance inflows will be negative in 2020 with −11.895% and will be continued until 2021 with −4.559% (see Table 8) but from 2022 it will increased with increasing rate 2.253% (see Figure 13). Also from the predicted values in Table 8, it is found that due to COVID-19 outbreak, the growth rate of sales revenue will be declined from 12.55% to 0.716% in the year 2020 and in the year the growth rate will be negative with −2.737% and will be continued for a long period of time (see Figure 12). It is to be noted that the RMG industry is fully export oriented

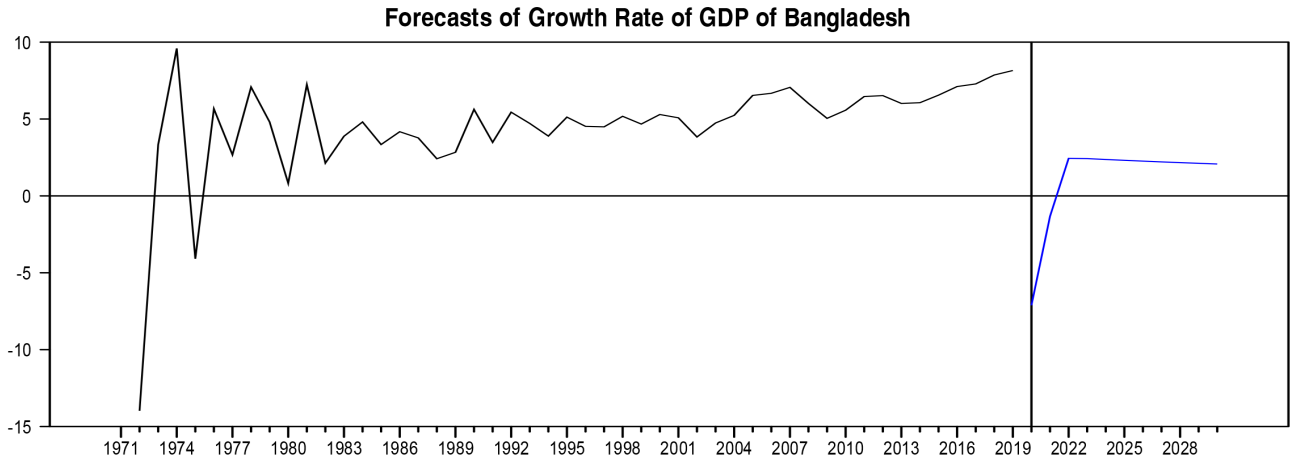

Figure 10. Forecasts yearly growth rate of GDP of Bangladesh.

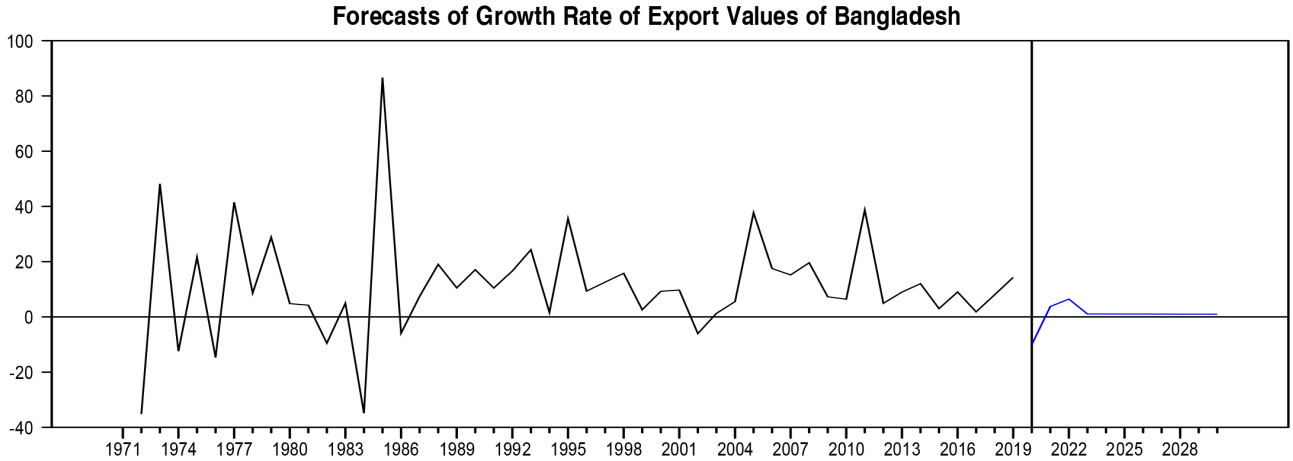

Figure 11. Forecasts yearly growth rate of export values of Bangladesh.

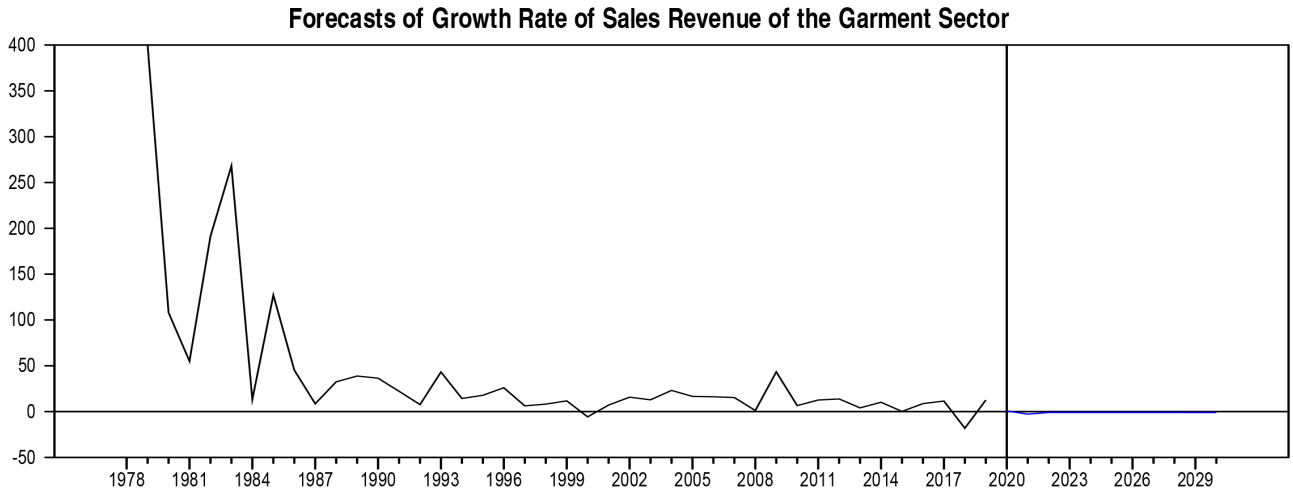

Figure 12. Forecasts yearly growth rate of sales revenue of the garment sector of Bangladesh.

sector, due to the outbreak of COVID-19, the disruptions in the export market are happened in different societies in the world which causes the adverse effects on the garment industry in Bangladesh. In this context it needs to highlight that

the garment industry is not doing well in export even before it was hit by the COVID-19 crisis. In the fiscal year 2019-20 (July-February), out of first 10 months (July-April) the growth of exports was positive only in December which indicates that the situation of the garment industry was not well. The negative growth of exports was continued until April 2020 but the real hit came in February-March from the global shock which is happened due to COVID-19 crisis when international buyers and brands started to cancel existing orders[7] but in May-20 the growth was in positive again from June-20 the negative growth is continued and the situation became from bad to worst during the subsequent months in the fiscal year 2019-20 (see Figure 14). In the fiscal year 2020-21 the situation is going to little bit improve and the overall growth during the period of COVID-19 from 2019:8-2021:12 is positive which is equal to 9.51 percent.

4.2. Impacts of COVID-19 Pandemic on Employment in the Garment Sector

The impacts of COVID-19 pandemic can be transmitted to the employment of

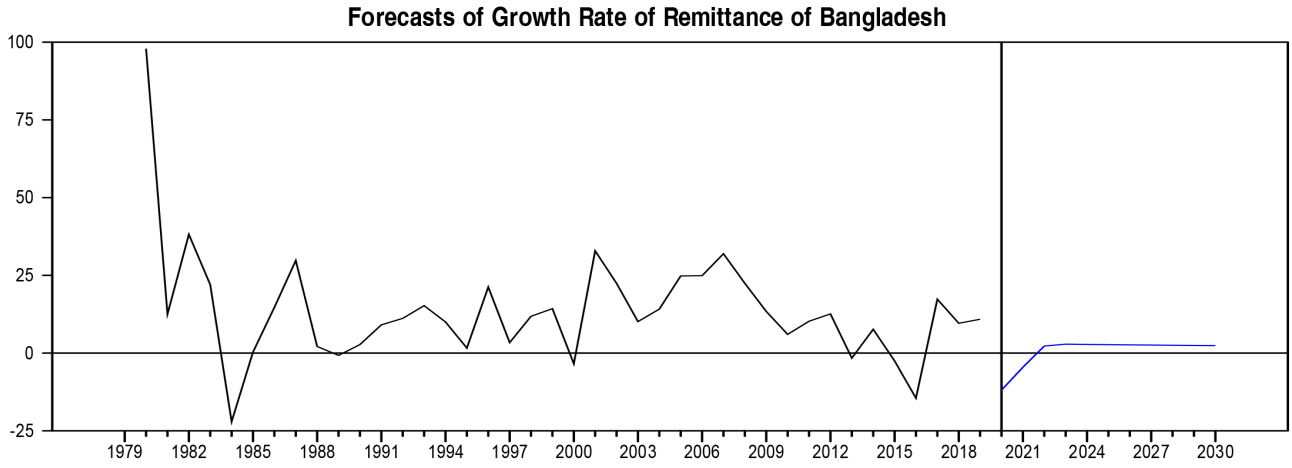

Figure 13. Forecasts yearly growth rate of remittance inflows of Bangladesh.

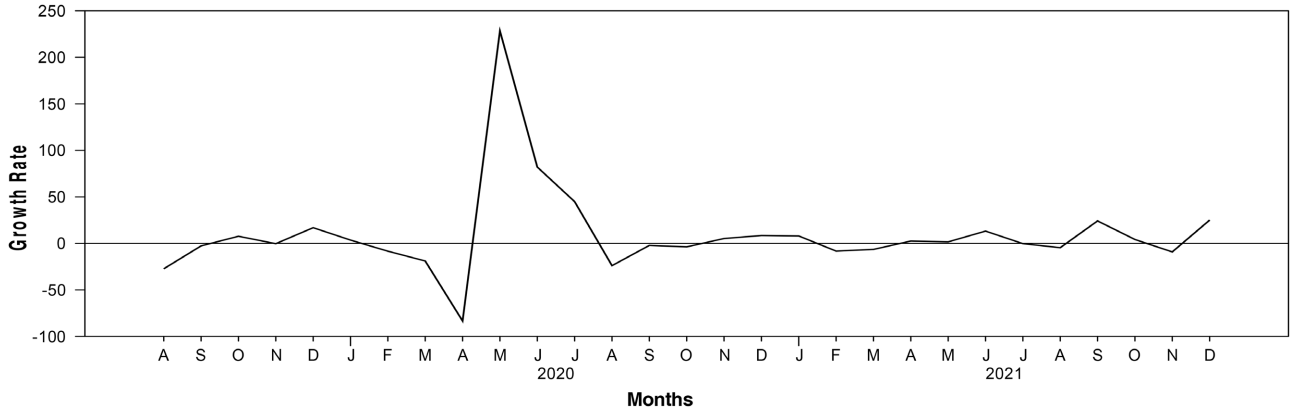

Figure 14. Monthly growth (in %) of RMG export during the period of COVID-19.

[7]A number of studies pointed out how the orders cancellation affected the RMG sector of Bangladesh. See for example Hossain (2021), ADB (2020b), Anner (2020).

the garment sector of Bangladesh through different channels. Among them country-wide lockdown, order cancellation by international buyers and brands, slowdown of national economy, the decline in demand of goods and services and the global economic recession are the important channels. Due to lockdown the factories were closed on an average 41 days[8] which caused the immediate effects on the RMG workers including factory closure, loss of working days, retrenchment, income, livelihood, and job loss etc. During the period of COVID-19, country-wide lockdown days were 75, which caused the slowdown of national economy and economic activities indirectly impacting the income and livelihood of the garment workers. During the period of COVID-19, due to orders cancellation by international buyers and brands the garment industry lost $4.33 billion worth of exports between March-20-June-20 in the year 2020 the garment industry lost $6854.0890 million worth of sales revenue, and $2026.187 million worth of sales revenue in the year 2021 (see Table 6) due to lockdowns which caused the shutdown of more than 348 garment factories including 0.4 million job loss (CPD estimation) which indirectly effects the socio-economic conditions of the garment workers which increase the vulnerability of the livelihoods of the garment workers including their family members. The yearly growths in percentage of employment in the garment industry of Bangladesh are shown below in Table 9.

From the reported values IN Table 9 it can be said that in the year 2020 the growth of employment is declined by 1.442% but in the year 2021 the employment is declined by 10.406%, thus it can be said that during the period of COVID-19 a large number of garment workers lost their jobs. The effect is shown below graphically.

Table 9. Yearly growth (in %) of the employment in the garment sector of Bangladesh.

Year	Growth (in %)	Year	Growth (in %)	Year	Growth (in %)
1980	22.190	1994	0.545	2008	15.536
1981	19.700	1995	0.459	2009	−7.011
1982	13.885	1996	0.879	2010	13.110
1983	9.612	1997	0.497	2011	2.997
1984	1.706	1998	0.158	2012	0.765
1985	8.453	1999	0.606	2013	14.141
1986	−2.657	2000	−15.808	2014	9.246
1987	9.043	2001	13.407	2015	4.721
1988	0.224	2002	5.264	2016	0.526
1989	10.838	2003	8.433	2017	2.292
1990	11.503	2004	5.142	2018	0.397
1991	−0.008	2005	−8.074	2019	2.384
1992	84.857	2006	9.734	2020	−1.442
1993	0.470	2007	7.214	2021	−10.406

[8]Report of Karmojibi Nari, February 2021.

From the Figure 15, it is very clear to us that the declining rate of employment in the garment sector of Bangladesh will be long-lasting. The long-lasting declining trend of the employment in the garment sector will be a big threat for the garment sector development as well as for future development of the Bangladesh economy. Also due to the adverse effects of the economy which is caused by COVID-19 pandemic the unemployment rate in Bangladesh is increasing rapidly. It is found that in Bangladesh the unemployment rate will be increased by 2.24 due to COVID-19 pandemic while in the world the unemployment rate will be increased by 1.36. The unemployment rates are forecasted for the next 10 years and are given below in Table 10.

The predicted yearly unemployment rates are presented below in Figure 16 due to COVID-19, the unemployment rate will be increased rapidly in Bangladesh as a results in the garment sector the employment rate will be declined. The yearly changes of unemployment rate in percentage are reported below in Table 11.

The predicted changes of unemployment rate of Bangladesh are graphed below with Figure 17:

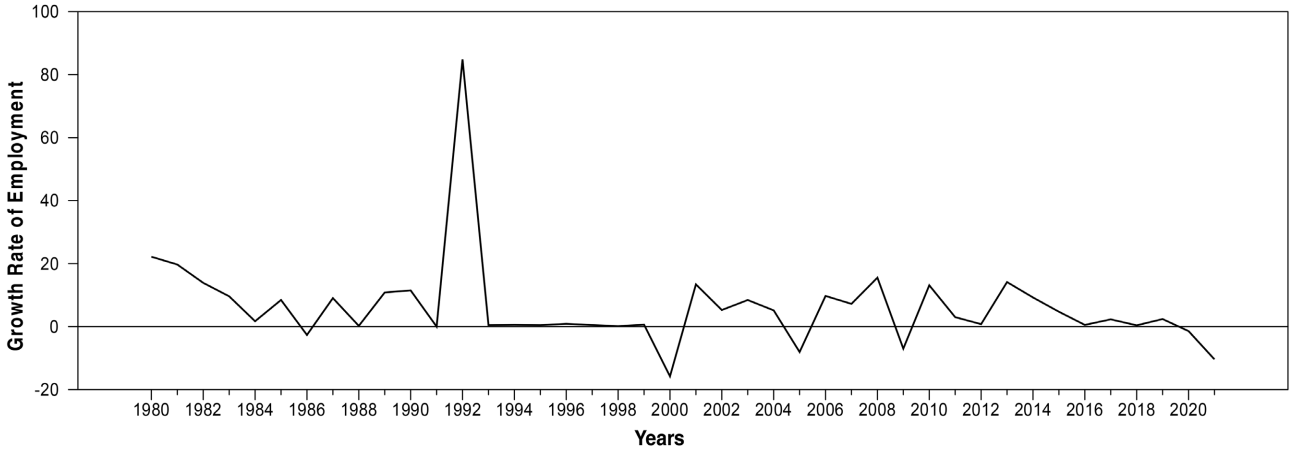

Figure 15. Yearly growth in percentage of the employment of the garment sector of Bangladesh.

Table 10. Forecasted unemployment rate of Bangladesh from 2021-2030.

Year	Forecasts Unemployment Rate
2021	5.389
2022	5.522
2023	5.659
2024	5.799
2025	5.943
2026	6.090
2027	6.240
2028	6.395
2029	6.553
2030	6.715

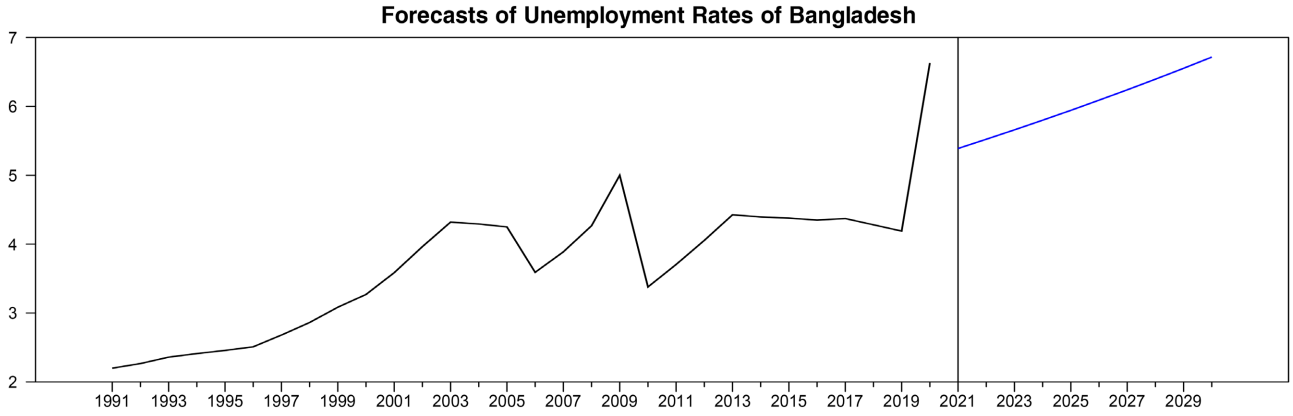

Figure 16. Forecasted unemployment rate of Bangladesh from 2021-2030.

Table 11. Yearly changes of unemployment rate of Bangladesh.

Year	Yearly Changes of Unemployment Rate (in %)	Year	Yearly Changes of Unemployment Rate (in %)	Year	Yearly Changes of Unemployment Rate (in %)
1992	3.045	2005	−1.002	2018	−2.081
1993	4.102	2006	−15.506	2019	−2.126
1994	2.203	2007	8.271	2020	58.234
1995	1.907	2008	9.748	2021	−18.718
1996	2.116	2009	17.178	2022	2.468
1997	6.813	2010	−32.420	2023	2.481
1998	6.789	2011	9.648	2024	2.474
1999	7.754	2012	9.447	2025	2.483
2000	5.997	2013	9.149	2026	2.473
2001	9.664	2014	−0.700	2027	2.463
2002	10.541	2015	−0.387	2028	2.484
2003	8.981	2016	−0.640	2029	2.471
2004	−0.625	2017	0.506	2030	2.472

From the reported values in Table 11, it can be said that the COVID-19 outbreak causes upswing 58.234% in the unemployment rate. The resulting high indicator will fall back by 18.72% in the year 2021, but from 2022 again increases returning to moderate levels with increasing rate 2.47% and will be continued for a long period of time (see Figure 17). Therefore it can be said that the effect of COVID-19 outbreak on unemployment rate will be large-scale and will be long-lasting which may cause the adverse effects on socio-economic conditions of Bangladesh. The increases in unemployment rate will be a big threat for the development of Bangladesh economy including the socio-economic conditions of Bangladesh. Therefore from now all the stake holders including the government of Bangladesh have to take necessary actions to control the unemployment rate in Bangladesh.

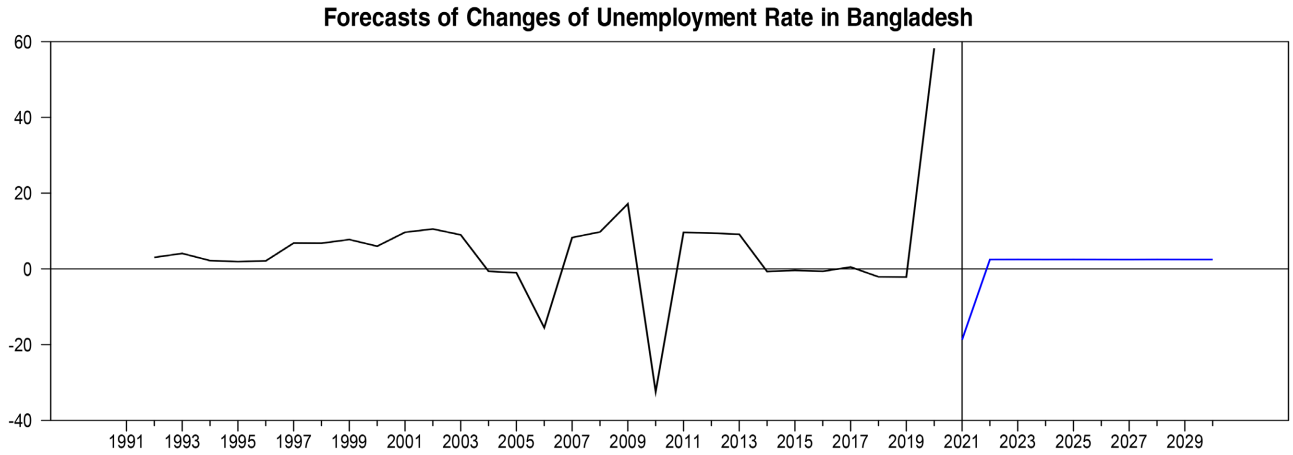

Figure 17. Forecasts of yearly changes in unemployment rate of Bangladesh

4.3. Other Impacts

In Bangladesh the minimum salary for the garment workers are paid around $95 per month which is not enough for daily requirements of their families. Most of the workers are female and came from rural and low income group. A national survey which is conducted by Rural Advancement Committee from March 31, 2020 to April 5, 2020 in order to find the impacts of COVID-19 pandemic, it is found that 14% garment workers among 2675 respondents from low income had no food reserves at home, only 29% workers had enough food from 1 - 3 days. It had become more critical situation when the workers from low-income group did not get their wages during the lockdown period due to COVID-19 pandemic. Thus it can be said that for the workers who came from rural and low-income group, starvation is a potential outcome of COVID-19 and force them to be absolute poor in the society and also it can be said that in Bangladesh about 150 - 200 million people (if we assume on an average 3 - 4 members in a garment worker's family) who are associated with the garment industry have a high risk for their livelihoods. Thus it can be said that the marginal people who are associated with the garment industry will face multidimensional socio-economic problems due to COVID-19 pandemic in Bangladesh. During the ongoing highest level infection due to omicron, the workers in the garment sector fail to follow the safety rules properly. In the factories the workers do no use personal protective equipment (PPE) but they only use the masks which are made in cloth and quality is not good enough and failure to protect the virus. In most of the garment factories are operated within limited space as a result it is very difficult for the workers to practice physical and social distancing. As a result the risk of COVID-19 infection for the entire population of the garment sector is increasing and purring millions of lives at risk. In most of the industries the workers of the garment sector are working with fear of infection because the number of new infections and deaths are increasing that have been reported in the national electronic and print media. At present due to COVID-19, fear of becoming newly infected with or dying severely affects the mental health status of the garment

workers. Unexpected outcomes such as reported women raped and suicide[9] during the period of COVID-19 pandemic may adversely affect the mental health status of the garment female workers for future. Therefore all the stake-holders of the garment industry have to take necessary steps to improve their mental health status and safety measures.

5. Overall Discussion

Bangladesh is one of the fastest growing economies in the world with an average growth rate of 4.75% (1971-2021) in its Gross Domestic Product (GDP, constant 2010 $). It is well known to us that the garment sector plays significant roles for the economic growth and for the development of the socio-economic conditions in Bangladesh. At present situation a common question raises to the people of Bangladesh: Is there any impact of COVID-19 outbreak on the garment sector of Bangladesh as well as on Bangladesh economy? Therefore in this study the principal purpose has been made to investigate the impacts of COVID-19 outbreak on the garment sector of Bangladesh and Bangladesh economy using the modern econometric techniques based on time series data. In order to investigate the impacts of COVID-19 on garment sector and Bangladesh economy here we used different indicator time series variables say: GDP, total export values (TEX), sales revenue of the garment sector of Bangladesh (REVGS), remittance inflows, (REM), unemployment rate at national level (UNR) and also the employment (EMP) of the garment sector of Bangladesh. Before investigating the impacts of COVID-19 on the garment sector of Bangladesh, firstly in this study the COVID-19 situations in Bangladesh including different continents are investigated. As of February 11, 2022, the highest number of total infected cases is in the USA followed by India, Brazil, France, UK, Russia, Turkey, Italy, Germany, and Spain, but globally the position of Bangladesh is 40 among 225 countries in respect of total infected cases it is also observed that the highest number of deaths is in the USA followed by Brazil, India, Russia, Mexico, Peru, UK, Italy, Indonesia, and Colombia but in respect of the total number of deaths the position of Bangladesh is 32, the highest number of recovered cases is in the USA followed by India, Brazil, France, UK, Turkey, Russia, Italy, Germany, and Argentina but in respect of total recovered cases globally the position of Bangladesh is 36. It is also observed that the highest number of death rate with respect to total infected cases is in Sudan followed by Peru, Mexico, Syria, Egypt, Somalia, Ecuador, Afghanistan, Taiwan (China), China, and Bosnia and Herzegovina but the position of Bangladesh is 79 based on death rate with respect to total confirmed cases among 225 countries. It is also observed that as of February 11, 2022, the highest number of death per million people is in Peru followed by Bulgaria, Bosnia and Herzegovina, Hungary, Montenegro, North Macedonia, Georgia, Croatia, Czechia, and Slovakia but the position of Bangladesh is 153 in respect of total deaths per million people. In respect of tests per million people

[9]Ain O Salish Kendra, Bangladesh, Bangladesh National Women Lawyers' Association.

globally the position of Bangladesh is 168 in which Denmark is the 1st, Austria is the 2nd and Faeroe Islands is the 3rd respectively, in respect of total doses the position of Bangladesh is 16 globally in which China's position is one, India's position is second and USA's position is 3 respectively. As of February 11, 2022, in respect of fully vaccinated per 100 people the position of Bangladesh is 150 globally in which the position of Gibraltar is one, Palau is the 2nd position and Brunei Darussalam is the 3rd position. From the analytical results it can be said that the COVID-19 situation of Bangladesh is not so bad relative to other countries in the world but in respect of total tests per million people and vaccinated people per 100 people the position of Bangladesh is very poor relative to other countries. From the analytical results it is found that from January 22 in Bangladesh the COVID-19 infected cases are increasing rapidly as a result the no. of death is higher relative to previous time periods. As of February 11, 2022 (see Figure 4) it is found that there are four waves of COVID-19 pandemic in Bangladesh, the first wave was from March-September 2020, the second wave was from February-May 2021, the third wave was May-September 2021 and the fourth wave was started from January 22 and still now it is continuing. Among them the third and fourth waves were very dangerous. Also it is found that during the lockdown periods 23 March-May 30 in 2020, and 5 April-28 April in 2021 the spreading rate was relatively smaller than any other time period. Thus it can be said that in Bangladesh lockdowns were playing significant role to prevent spreading COVID-19 from human to human. As of February 11, 2022 (see Table 1) it is found that the Europe has the highest number of infected cases followed by Asia, North America, South America, Africa and Oceania. It is also observed that Europe has the highest number of deaths followed by North America, Asia, South America, Africa and Oceania. The Europe has the highest number of recovered cases followed by Asia, North America, South America, Africa and Oceania respectively. South America has the highest deaths ratio to total infected cases followed by Africa, North America, Europe, Asia, and Oceania respectively. Asia has the highest recovered ratio to total infected cases followed by Oceania Africa, South America, Europe, and North America, respectively. South America has the highest death ratio to total recovered cases followed by Africa, North America, Europe, Asia, and Oceania. Thus from analytical results (see Table 1) it can be said that the situation of the continent Oceania is good in respect of total infected cases, total deaths, and death ratio to total infected relative to other continents but the situation of the continent in South America is worst in respect of death ratio to total cases and death ratio to total recovered cases. From the estimated results (see Table 2) it is found that in Bangladesh on an average 2698 people are infected by COVID-19 virus per day of which on an average 41.36 people died and 2385 people are recovered per day. It is also found that on an average 18,400.39 cases are tested per day in Bangladesh. From the analytical results (see Table 2) it is found that for increasing per 100 confirmed cases averagely 1.8452 people have died and 74.9007 people recovered

and for per 100 recovered cases averagely 7.1773 people have died. From the estimated result (see Table 3) it is found that the coefficient of variation (CV) is highest for the variable DRRC followed by DTR, DTD, DTC, DRTC, TT and RRTC respectively. Except the variable RRTC all the variables are positively skewed and the curves of all the variables are leptokurtic. The population means of the variables DTC, DTD, DTR, TT, DRTC, RRTC and DRRC are statistically significant individually from their zero mean at any significance level with their 95% confidence interval estimations are [2454.89, 2941.21], [37.43, 45.29], [2156.71, 613.49], [17,619.0, 19,181.79], [1.7335, 1.9569], [72.8589, 76.943], and [5.6256, 8.7290] respectively. In case of economic variables from the estimated results (see Table 4) it is found that the variability is highest for the variable total export values [TEX} followed by sales revenue of the garment sector (REVGS), remittance inflows (REM), GDP, employment in the garment sector (EMP) and unemployment rate (UNR) respectively. The results also support that all the variables are positively skewed. The results also support that the curves of the variables TEX and UNR are leptokurtic and for the variables GDP, REVGS, REM and EMP are platykurtic. It is also found that all the variables are statistically significant from their zero mean at any significance level with their 95% interval estimations are [61,330.32 91,497.77], [7322.78, 15,079.28], [6549.14, 13,382.58], [3749.93, 7418.90], [3.412, 4.124], and [1,804,557.96, 2,530,798.04] respectively. It also found (see Table 5) that the total infected cases are highly associated with total deaths, total recovered cases and total tests. The total deaths are also highly associated with total recovered cases and total tests, and the total recovered cases is highly associated with total tests. It is also found that all the associations are statistically significant individually from their zero correlation at any significance level.

Later on the economic impacts of COVID-19 outbreak on the garment sector are investigated using the modern econometric techniques based on different time series variables. From the estimated results (see Table 6) it is found that in the year 2020, the losses of GDP, total export values, sales revenue of the garment sector and remittance of Bangladesh were $31,677.475 million, $6771.5296 million, $6854.0890 million, and $3941.4486 million and in the year 2021 the losses were of these variables would be $13,544.415 million, $3044.7328 million, $2026.187 million, and $934.513 million respectively due to lockdown during the period of COVID-19 pandemic. In terms of percentage the loses of these variables are 13.973%, 13.9726%, 21.789% and 21.650% in the year 2020 and 6.945%, 7.303%, 6.395% and 5.826% in the year 2021 respectively. From the forecasted results (see Table 6 and Table 7) it is found that the GDP, total export values, sales revenue of the garment sector and remittance inflows of Bangladesh are downgraded for 2 years, 2 years, 0 years and 0 years respectively due to COVID-19 outbreak from 2020 but from 2021 it would be 0 years, 0 years and 0 years for GDP, total export values and remittance respective but the sales revenue of the garment sector of Bangladesh will be declining trend from 2021.

From the predicted values (see Table 8) it is found that in Bangladesh due to COVID-19 outbreak the growth rate of GDP will be negative in the year 2020 with −7.115% and it will be continued until 2021 with −1.327% but from 2022 the growth rate of GDP will be increased with increasing rate 2.438%. The growth rate of export values will be negative in the year 2020 with −10.078% but from 2021 it will be increased with increasing rate 3.764%. Due to COVID-19 outbreak the growth rate of remittance will be negative in 2020 with −11.895% and will be continued until 2021 with −4.559% but from 2022 it will increased with increasing rate 2.253%. Due to COVID-19 outbreak during the period of COVID-19, the export values of the garment sector is affected greatly. In the fiscal year 2019-20 (July-February), out of first 10 months (July-April) the growth of exports was positive only in December which indicates that the situation of the garment industry was not well. The negative growth of exports was continued until April 2020 but the real hit came in February-March from the global shock which is happened due to COVID-19 crisis when international buyers and brands started to cancel existing orders but in May-20 the growth was in positive again from June-20 the negative growth is continued and the situation became from bad to worst during the subsequent months in the fiscal year 2019-20 (see Figure 14). In the fiscal year 2020-21 the situation is going to little bit improve. The impacts of COVID-19 pandemic are transmitted to the employment of the garment sector of Bangladesh through different channels namely: country-wide lockdown, order cancellation by international buyers and brands, slowdown of national economy, the decline in demand of goods and services and the global economic recession. From the estimated values (see Table 9) it can be said that in the year 2020 the growth of employment is declined about 1.442% but in the year 2021 the employment is declined about 10.406%, thus it can be said that during the period of COVID-19 a large number of garment workers lost their jobs. Also due to the adverse effects of the economy which is caused by COVID-19 pandemic, the impacts of COVID-19 outbreak are also transmitted the unemployment in Bangladesh. It is found (see Table 10) that in Bangladesh the unemployment rate will be increased by 2.24 due to COVID-19 pandemic while in the world the unemployment rate will be increased by 1.36. It is found that (see Table 11) due to the COVID-19 outbreak the unemployment rate is upswing 58.234% in the year 2020 and then will fall back by 18.72% in the year 2021, but from 2022 again increases returning to moderate levels with increasing rate 2.47% in 2022 and will be continued for a long period of time. Therefore it can be said that the effect of COVID-19 outbreak on unemployment rate will be large-scale and will be long-lasting which causes the adverse effects on socio-economic conditions of Bangladesh. The increases in unemployment rate will be a big threat for the development of Bangladesh economy including the garment sector of Bangladesh. From March 31, 2020 to April 5 2020 a national survey is conducted by Rural Advancement Committee in order to find the impacts of COVID-19 pandemic, it is found that 14% garment workers among 2675 res-

pondents from low income had no food reserves at home, only 29% workers had enough food from 1 - 3 days. It had become more critical situation when the workers from low-income group did not get their wages during the lockdown period due to COVID-19 pandemic. Thus it can be said that the livelihoods of the garment workers including their family members will be in high risk for future. Also, it can be said that the marginal people who are associated with the garment industry will face multidimensional socio-economic problems due to COVID-19 pandemic in Bangladesh. During the period of COVID-19, the unexpected outcomes such as reported women raped and suicide may adversely affect the mental health status of the garment female workers for future.

6. Conclusion and Policy Implications

From the analytical results it can be concluded that the population means of the variables day wise total cases (DTC), total deaths (DTD), total recovered (DTR), total tests (TT), death ratio to total cases (DRTC), recovered ratio to total cases (RRTC), death ratio to recovered cases (DRRC), GDP, TEX, REVGS, REM, UNR and EMP, are statistically significant at any significance level from their zero means individually. It can also be concluded that the associations between different pairs of the variables TC, TD, TR and TT are very high and statistically significant at any significance level individually from the zero correlation. From the analytical results, it can be concluded that the COVID-19 situation of Bangladesh is not so bad relative to other countries in the world but in respect of total tests per million people and vaccinated people per 100 people the position of Bangladesh is very poor relative to other countries. From the predicted values it can be concluded that COVID-19 outbreak has negative effects on the garment sector, Bangladesh economy, export values, remittance, and employment of the garment sector of Bangladesh. The long-lasting negative effect on the garment sector of Bangladesh is found. It is a red alarming for the garment sector of Bangladesh. From the predicted values it can also be concluded that COVID-19 outbreak has a positive effect on the unemployment rate in Bangladesh and will be continued for a long-period of time. Therefore the long-lasting positive effect on the unemployment rate will cause adverse effects on the socio-economic conditions of Bangladesh. Therefore from the analytical results, the following points are recommended and should be implemented for the betterment of the garment sector as well as for the garment workers in Bangladesh. Due to omicron's highest level of infection is going on, as a result, the risk of COVID-19 infection for the entire population of the garment sector is increasing and purring millions of lives at risk. Therefore, to save the lives all the stakeholders of the garment industry including the Bangladesh Government have to take necessary actions for increasing awareness of the workers including the general people regarding the use of protective measures not only this the entire population of the garment industry should be vaccinated as soon as possible and also emphasis should be given to improve their mental health status and safety measures. Since the sales

revenue of the garment sector will be affected greatly due to COVID-19 outbreak and will be continuing for a long-period of time, thus it is a red alarming for the garment sector as well as for the whole economy of Bangladesh. Therefore to overcome this critical situation, all the stakeholders including the Bangladesh Garment Manufacturers and Exporters Association (BGME), Bangladesh Apparel & Textile Exposition (BTEXPO), Bangladesh Bank (BB), The Bangladesh Export Processing Zone Authority (BEPZA), The Bangladesh Foreign Trade Institute (BFTI), Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA), Bangladesh Labor Welfare Foundation (BLWF), Bangladesh Labor Welfare Foundation (BLWF), Best Practice Garments Bangladesh (BPGB), Global Alliance for Fair Textile Trade (GAFTT), Government of Bangladesh (GoB), International Apparel Federation (IAF), International Labor Organization (ILO), and Owners and Workers of the Garment Sector of Bangladesh have to take different steps from now. All the stakeholders have to develop and maintain good relationships with the international buyers and related stakeholders and have to negotiate with them regarding the price of the garment products. Price reduction policy should be implemented and the quality of the products should be maintained for which the global demand will be increased as a result sales revenue of the garment sector will be increased. As a result, the garment sector will be able to tackle the problem. Monetary motivation and minimum risk premium policy should be implemented for which the garment workers can work with full enthusiasm. Since due to COVID-19 outbreak Bangladesh economy is going through a transition period, thus in the meantime, Bangladesh Government should be implemented the following policies to tackle the problem of the economic crises: increase expenditure/investment on education to build skilled human capital, increase investment to cope with changing and more digitized, emphasize should be given on liberal trade policies; inject liquidity into the market, thus increasing the ability of financial institutions to disburse more money and when people will have more money in hand they will spend more. From the analytical results, it is found that the employment in the garment sector will be declined and unemployment rate will be increased in Bangladesh due to COVID-19 outbreak. As a result, the socio-economic conditions of Bangladesh will be deteriorated drastically. Therefore the following policies should be implemented to improve the employment condition in garment sector and also to improve unemployment conditions in Bangladesh. Emphasize should be given to facilitates working from home policy and encouraging such by providing tax benefits, to advance livelihoods programming for vulnerable workers, to formalize a centralized government database for the garment sector, to expand social protection programs for all garment workers, including unemployment benefits and housing and to rebuild trust between buyers, employers and workers. Bangladesh Government should provide incentive and reskilling programs. Bangladesh government including other stake holders should provide unemployment or employment benefits or medium/long-term loans with favorable

conditions and encourage not to shut down their business to the small trader and sole proprietor enterprise. Support small business enterprise supply chain by both private and public sector, safeguarding jobs by providing subsidies on wages. Develop a robust view of who need to retain their jobs or find a new job, identify which jobs are at risk and where demand for extra labor exists. This view will help to divert the additional labor into the sector where more laborers are needed. A heat map on country or state or city can be developed which will help private sector leader and government an opportunity to understand which sectors are vulnerable and thus require intervention for safeguarding the job. Collaboration between government and garment sector including other sectors should be developed to keep people employed and train them. Well-designed database can be created for matching job seekers and employers. Upskilling or reskilling the individual in conformance should be with the need of future driven skill trend. Enhancing digital literacy will help the workers to find a job in rapidly changing labor market. Entrepreneurs should be encouraged and different stimulus packages should be allocated and the techniques of management sciences should be applied for proper management of these packages so that there will be no scope of wastage money, as a result, money can be used for right purposes. It will help to reduce unemployment from the economy as a result Bangladesh's economy including the garment sector of Bangladesh will be free from risk for future development.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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