

## **Impact of COVID-19 on Major Macroeconomic Variables of Bangladesh: An ARIMA Model**

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### **Abstract**

*This paper attempts to reveal the shock of COVID-19 on major six macroeconomic variables throughout the first phase of pandemic by using time series data from 2004 to 2020 (quarterly). Using the ARIMA model, the researchers discovered that the GDP growth rate has slowed, but it may begin to recover as early as 2020Q3. On the other hand, Quantum index demonstrated an upward trend after going down to 2037 in 2020Q3. The average lending interest rate fell to 8.03 percent in 2020Q2. Private investment also fell by \$1 billion in 2020Q2. Since 2020Q3, Inflation rate did not change so much while the unemployment has risen from 4.17 to 4.28 percent in 2021Q4. In this paper, the forecasted result has shown that Bangladesh's economy may resume a steady growth within early 2023.*

**Keywords:** COVID-19, Macroeconomic Variables, ARIMA, Recovery Period

### **1. Introduction**

Bangladesh is one of the world's fastest developing countries with a Gross Domestic Product (GDP) growth rate of above 7.5 percent since 2018 (World Bank, 2020). However, the unexpected pandemic has made this country, like many other countries, a victim and posed a serious challenge to the enviable pace of economic growth. The uncertainty during this pandemic about potential economic outcomes

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has been a major concern for the policymakers in the country. The Asian Development Bank (2020) estimated that Bangladesh's gross domestic product might decline by as much as 1.1 percent in the worst-case scenario wiping \$3.02 billion off from \$300 billion-plus GDP and the scenario might result in the loss of 894,930 employments. Experts predict that the pandemic will have a severe impact on Bangladesh's economy. Economist Intelligence Unit (2020) predicts that Bangladesh's GDP may drop by more than 4 percent over the next year. The COVID-19 pandemic is a major global catastrophe. Analysts consider it as dangerous as the Great Depression of the 1930s. Current policy actions may mitigate some of the pandemic's effects. Since the epidemic arrived abruptly and on short notice a large part of the final economic impact will be determined by SARS-CoV-2 itself. It depends on how the containment and tremendous efforts, as well as the development and deployment of a vaccine, are carried out. During the pandemic, both the depth and length of the economic outcomes are highly uncertain. A study of International Centre for Diarrhea Disease Research (2000) found that about 91 percent of simple families deem themselves financially unstable during pandemic. This entails that a proactive economic stimulus program is urgently necessary for the economic wellbeing of the country.

The primary purpose of this study is to determine the impact of the COVID-19 pandemic on significant macroeconomic factors. Such as impact on the rapid growth rate of Gross Domestic Product, rate of inflation, rate of unemployment, rate of average lending interest, and index of industrial production in case of Bangladesh's economy. Secondly, the paper attempts to analyze the future behavior of major macro-variables by forecasting their future trends, and estimate the amount of time required for the recovery of these macroeconomic variables.

The rest of the paper is divided into six sections. Section 2 presents the literature review, section 3 focuses on the methodology of the paper, section 4 handles the data analysis with the forecasted model, section 5 concentrates on discussion of major findings, and section 6 concludes the paper with some policy recommendations.

## **2. Review of Literature**

The world economy is facing a hard time during the covid-19 pandemic. The government enacted some rules and regulations to cut down the pace of spreading the disease as per the suggestion of the World Health Organization. Numerous research papers have been studied for analyzing the long-term impact of the pandemic on economic growth. Nicola et al. (2020) reported a significant negative impact of the pandemic on different economic sectors. They said that social isolation, self-isolation, and travel restrictions had resulted in a reduced workforce across all economic sectors, resulting in the loss of numerous employments and the demand for commodities and manufactured goods have fallen, whereas the need for medical supplies has climbed dramatically.

In this vein, Lalon (2020) seeks to determine what probable consequences are imminent for Bangladesh and how the government, together with all other stakeholders, may respond to maintain socio-economic improvements gained in recent fiscal years despite being drowned by inverse trade growth. He found a strong

revenue deficit, mounting non-performing loans, falling private sector investment, the volatility of market rate of interest, capital market unrest, and imminent horrid worldwide economic recession.

Ma, Rogers, and Zhou (2020) has estimated the consequences of major global disease outbreaks within the 21st century on GDP growth using cross-sectional data on macro and micro level. They discovered that GDP is the most preferred variable to represent economic growth and real GDP growth slows down over time of pandemic in countries where government spending is less aggressive in the initial year. Though it is also evident that industrial output may impact positively on GDP since a study found that approximately 28.79 percent of GDP can be contributed by the industry sector (O. Aarron, 2021).

Bangladesh Bureau of Statistics (2020) uses the Quantum Index as a measure of industrial production. It considered the Quantum Index as one of the key factors of measuring economic growth for middle-income countries. Su and Yao (2016) found that manufacturing development can improve the incentives of savings and enhance technological accumulation. Almosabbah and Almoree (2017) suggested policymakers stimulate industrial production since it influences productivity, social returns, and other economic sectors.

Nazmi and Ramirez (1997) looked at the impact of governmental and private investment spending on economic development. They anticipated that government investment had a positive and significant influence on economic output growth. Investment is the key element of accelerating growth either made privately or by the government. There has been a lot of empirical research on the relationship between public and private investments and economic growth. The empirical research of Eberts & Stone (1986), Aschauer D. (1989), and Munnell (1992) on the relationship between government investments in economic infrastructure and economic growth at the national, regional, and statewide levels found a positive relationship between them.

Krnić (2014) investigated the factors that influence the lending rates offered to businesses in Croatia, taking into account macroeconomic indicators (GDP Growth rate, inflation, public debt level in GDP percent, T-Bill rate). The study finds that inflation, T-Bill rate are strongly positively related to lending rates among commercial banks.

McKenna and Zannoni (1990) demonstrated the link between interest rates and investment. They explained that interest rates have an impact on investments when increased interest rates cannot be passed on through higher prices. Changes in interest rates can indicate the fundamental aspect of the macro economy's activity.

Inflation is relevant to the functions of government and central bank because it affects the purchasing power of the national currency. There is extensive literature on the potential real effect and costs of inflation. Empirical findings on this topic fall into four categories: inflation has no effect on economic growth (Sidrauski, 1967); inflation encompasses a positive impact on economic growth (Benhabib & Spiegel, 2006); inflation has a negative impact on economic growth (Fischer, 1983); inflation affects economic growth in terms of specified specific thresholds (Aydin, 2016). The

results of Mundell (1963) and Tobin (1965) that there is a positive relationship between economic growth and inflation are supported by empirical evidence as well; the higher rate of inflation can generate more employment.

Hence, the unemployment rate is also an important indicator to determine the health of the economy. Indeed, it expresses the well-being of the labor market. For the period 2000-2011, Chowdhury and Hossain (2014) investigated the macroeconomic determinants of the unemployment rate in Bangladesh's economy. They discovered that the rate of inflation boosts unemployment whereas the rate of GDP growth has a negative impact on unemployment. Sodipe and Ogunrinola (2011) examined the link between employment and economic growth in Nigeria from 1986 to 2010 and identified a positive and substantial link between employment and the economy's real GDP.

Some economists studied the impact of the pandemic on different sectors and others studied some selected economic variables. Analysis of covid-19' impacts on major macroeconomic variables simultaneously is inexistent. To identify the pandemic impact on some major variables, we have selected six macroeconomic variables in terms of extensive evidence discussed above.

### 3. Methodology

We performed Augmented Dickey-Fuller (ADF) test (Dickey D. and Fuller W.) and Philips-Perron (PP) test (Philips and Perron, 1988) to check the integration orders of the variables based on the null hypothesis that the data has a unit root. In order to investigate the impact of COVID-19 on major macroeconomic variables of Bangladesh, the ARIMA approach was employed.

#### 3.1 Unit Root Test

Stationarity is one of the most important qualities of a variable, and it has a significant impact on its behavior. The effect of a shock will be sustained if a variable is stationary. A non-stationary variable's variance and mean are not constant, and the covariance is consistent with the actual time variables are observed. The unit root features of the data must be checked before any econometric analysis is performed. The unit root test is used to determine whether or not a variable is stationary.

The form of ADF test with trend and intercept is given below:

$$\Delta y_t = \alpha + \delta_t + \beta y_{t-1} + \sum_{i=1}^k \gamma \Delta y_{t-1} + u_t \quad (1)$$

Where  $\Delta y_t$  is the first difference of  $y$ ,  $u_t$  is the error term and  $\alpha$ ,  $\delta$ ,  $\beta$ , and  $\gamma$  are parameters.

The Phillips-Perron (PP) test for checking stationarity of variables is as follows:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + u_t \quad (2)$$

Where  $u_t$  is I(0) and may have heteroscedasticity issue. The PP tests will modify the test statistic  $t_n = 0$  and  $T_\pi$  to correct autocorrelation and heteroscedasticity in  $u_t$ .

**3.2 Model Specification**

**Autoregressive Models AR**

An autoregressive (AR) model forecasts future behavior using data from the past. When there is a correlation between the values in a time series and the values that before and succeed them, it is useful for predicting.

**Autoregressive Models AR (p)**

An AR (p) model is an autoregressive model where specific lagged values of a variable  $X_t$  are used as predictor variables of desired  $X_t$ . Lags exist when the outcomes of a single period have an impact on subsequent periods. AR (p), an autoregressive model of order p, can be written as:

$$X_t = c + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + \alpha_p X_{t-p} + \varepsilon_t, \quad t \geq p \dots \dots \dots (3)$$

Where,  $X_t$  is the dependent variable at time t.  $X_{t-1}, X_{t-2}, \dots, X_{t-p}$  are the dependent variables at time lags  $t - 1, t - 2, \dots, t - p$  respectively,  $\varepsilon_t$  is the error term in the equation; where  $\varepsilon_t$  is a white noise process, a sequence of independently and identically distributed (iid) random variables with  $E(\varepsilon_t) = 0$  and  $var(\varepsilon_t) = \sigma^2$ ; i.e.  $\varepsilon_t \sim iid N(0, \sigma^2)$ .

**Moving Average Model MA (q)**

Each observation  $y_t$  is created by a weighted average of the random disturbance extending back to q periods in the moving average (MA) process of order q. MA(q) is the abbreviation for this process, and the equation is written as-

$$X_t = \varepsilon_t - \phi_1 \varepsilon_{t-1} - \phi_2 \varepsilon_{t-2} - \dots - \phi_q \varepsilon_{t-q} \dots \quad (4)$$

Where:  $X_t$  = dependent variable at time t.

$\varepsilon_t$ : Series of random errors, with mean zero and constant variance.

i.e.  $\varepsilon_t \approx (0, \sigma_\varepsilon^2)$

$\varepsilon_{t-1}, \varepsilon_{t-2}, \dots, \varepsilon_{t-q}$  = Errors in previous time periods that are incorporated in the response  $y_t$

$\phi_i$  = Parameters of moving average model.

q = Degree Model

**Mixed Models ARMA (p, q)**

A time series model,  $\{X_t\}$ , is an *autoregressive moving average model of order p, q*, ARMA (p, q), if:

$$X_t = \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + w_t + \beta_1 \varepsilon_{t-1} + \beta_2 \varepsilon_{t-2} \dots + \beta_q \varepsilon_{t-q} \dots \dots (5)$$

Where,  $\varepsilon_t$  is white noise with  $E(\varepsilon_t) = 0$  and variance  $\sigma^2$ .

**Autoregressive Integrated Moving Average Model ARIMA (p, d, and q):**

ARIMA (p, d, q) informs us how many lags the dependent variable has (p), how many times the variable is differenced to become stationary (d), and how many lags the error term requires (q)

The following is the general formula for Autoregressive Integrated Moving Average Models (ARIMA):

$$X_t = \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + \alpha_p X_{t-p} + \dots + dX_{t-p-d} + \varepsilon_t \dots (6)$$

### **3.3 Single Equation Econometric Model**

Granger and Newbold (1986) showed how time series analysis can yield very exact short-run forecasts for suitably large amounts of data on the variables in question. The ARIMA models are versatile and commonly utilized in univariate time series analysis. The ARIMA model is made up of three different processes: (i) Autoregressive (AR), (ii) Differencing, and (iii) Moving-Average (MA) processes. These processes are referred to as the primary univariate time series models in the statistical literature, and they are widely used in a variety of applications.

## **4. Data Analysis**

### **4.1 Description of Variables**

We have taken some major macroeconomic variables, they are Gross Domestic Product (GDP), Quantum Index (IQI), Private sector credit as a proxy variable for private investment (PIN), Average Lending Interest rate (ALI), Inflation rate (INF), and Unemployment rate (UER).

### **4.2 Data Source**

The yearly data for GDP growth rate and unemployment has been taken from the International Monetary Fund (IMF) and the World Bank respectively from 2004 to 2020 and then it is broken down in quarterly form using Eviews 11. All other data have been taken from the Bangladesh Bank quarterly report. Data has been taken as a calendar year from January to December (Quarterly).

### **4.3 Group Presentation of Variables**

We have presented variables here as a group considering most correlation between them to make reader friendly. Around 28% of GDP contribution was done in Bangladesh economy by industrial sector. Gokmenoglua K., Azina V., Taspinara N. (2015) found a long run relationship between GDP growth and Industrial Production. Nilsson R. (1987) have concluded a close relationship between industrial production and GDP for some countries. There is also a strong short run and long run relationship between investment and interest rate (Wuhan, Suyuan, Khurshid A., 2015). Thus we have made a group of Interest rate and private investment. Lastly we discussed unemployment and inflation in one group as they have strong inverse relationship between them (Phillips W. A., 1958).

### **4.4 Summary of Descriptive Statistics**

We used time-series data from the last quarter of 2004 to the second quarter of 2020. Data for six macroeconomic variables have been taken and each variable has a total of 63 observations. The Minimum GDP growth rate is 5.04 percent and the maximum rate is 8.15 percent. We found minimum Inflation rate is 4.23 percent and the maximum inflation rate is 11.41 percent. The Unemployment rate was a minimum of 3.38 percent and a maximum of 5.00 percent and the lending interest rate ranges from 7.5 to 13.9 percent. Private investment and quantum index show a minimum of 14.46 billion USD and 202.1, and a maximum of 140 billion USD and 603.6 respectively over the discrete time period.

**Table 1: Summary of descriptive statistics.**

Variables	Mean	Median	Maximum	Minimum	SD	Probability	Observations
<b>GDP</b>	6.5031	6.43	8.153	5.045	0.7280	0.4155	63
<b>IQI</b>	366.69	352.7	603.6	202.1	104.05	0.4003	63
<b>PIN</b>	62.479	51.97	140	16.46	37.851	0.0641	63
<b>ALI</b>	11.672	12.24	13.94	7.476	1.7109	0.0916	63
<b>INF</b>	7.0519	6.603	11.41	4.25	1.7942	0.0103	63
<b>UER</b>	4.2383	4.3	5	3.38	0.2921	0.0017	63

Source: Author calculation

Note:

SD: Standard deviation

GDP: Gross Domestic Product

IQI: Quantum Index

PIN: Private Investment

ALI: Average Lending Interest rate

INF: Inflation rate

UER: Unemployment rate

#### 4.5 Summary of Unit Root Test:

To examine the stationarity of the variables, we performed the two most popular tests widely used to check the characteristics of variables. One is the Augmented Dickey-Fuller (ADF) test another one is Phillip-Perron (PP) test. The ADF tests result suggests that the GDP growth rate is stationary at the level and intercept, the rate of Inflation, Quantum Index, and Privet Investment are integrated of order 1, i.e. I(1). Unemployment rate and Average Lending Interest rate are integrated of order 2, i.e. I (2). Phillip Perron's test result suggests that all variables, accept GDP growth rate and ALI, are integrated of an order of 1, i.e. I (1). GDP growth rate and ALI are found I(2). So a mixed strategy is present here.

**Table 2: Summary of unit root test.**

Variables	Augmented Dickey-Fuller (ADF) Test			Phillips-Perron (PP) Test		
	T-Stat	P-value	Form	T-Stat.	P-value	Form
GDP	-3.10877	0.0308	Level	-7.928	0	2nd Difference
GDP	-8.06776	0	2nd Difference	-3.716	0.006	1st Difference
INF	-7.84922	0	1st Difference	-8.081	0	1st Difference
UER	-4.6073	0.0005	2nd Difference	-2.837	0.059	1st Difference
IQI	-9.11077	0	1st Difference	-9.794	0	1st Difference
ALI	-3.91579	0.0037	2nd Difference	-2.609	0.096	2nd Difference
PIN	-5.6948	0.0001	1st Difference	-5.822	0	1st Difference

Source: Author calculation

Note: GDP: Gross Domestic Product, IQI: Quantum Index, PIN: Private Investment, ALI: Average Lending Interest rate, INF: Inflation rate, and UER: Unemployment rate

#### 4.6 Autoregressive Integrated Moving Average Model (ARIMA)

We have performed Automatic ARIMA using the ARMA Maximum Likelihood (BFGS) method to forecast selected variables. ARIMA model has been selected automatically based on Akaike Information Criterion (AIC) and Hannan-Quinn criterion (HQ) from the best twenty models. The best model is considered which has the least AIC and HQ value. The applied model for GDP Growth Rate is (2, 1, and 1) has been chosen among the best 20 models. The model has the least AIC value (-4.49) and HQ value (-4.42). In the same way, we have found appropriate models for other variables. The best model for the rate of Inflation is (1, 1, 4) and which has the least AIC value of (-0.90) and the HQ value of (0.80). Model for Quantum index (IQI) is (2, 0, 0) which has the least AIC value of (10.17187) and HQ value (10.22). Model for the unemployment rate (UER) is (4, 0, 4) with the least AIC value of (-2.43) and HQ value of (-2.29), and the Private Investment (PIN) model is (0, 2, 4) with the least AIC value of (3.36) and HQ value of (3.44). Lastly, we have accepted as an appropriate model (0, 2, and 4) for the Average Lending Interest rate because it has the lowest AIC value of (1.00) and HQ value of (1.06). Selecting the appropriate model for each variable we performed automatic ARIMA using Eviews 11.

#### 4.7 Forecasting

We consider a minimum of two variables as a group of correlated variables for convenience. The first group has been formed with GDP growth rate and industrial output. The following groups are investment and interest rate and inflation and unemployment respectively.

##### 4.7.1 GDP Growth Rate and Industrial Production

Within the emergence of COVID-19, the GDP growth pace slowed to 7.06 percent in the first quarter of 2020 and to 5.9 percent in the second quarter. On 22<sup>nd</sup> March, the government of Bangladesh declared a periodical shutdown for March 26, 2020, to May 30, 2021 (Zaman & Sakib, 2020). Our forecasting started from 2020Q3 shows a possible decline till the middle of the second quarter in 2021 if shut down remain operative. In the last of 2020, the projected GDP growth rate turns to be 4.70 percent, and in the second quarter of 2021, it turns to be at least 4.40 percent. Having the COVID-epidemic situation, lots of workers lost their jobs, Medium and Small Enterprises were almost ineffective, where more than 50 million workers work in the informal sector (BBS, 2012). The forecasting is showing that the recovery of GDP growth rate may start from 2021Q3 and the growth rate may reach 8.3 percent within 2023Q3. It shows that the GDP growth rate may cross the previous record within 2023Q3 in Bangladesh.<sup>3</sup>

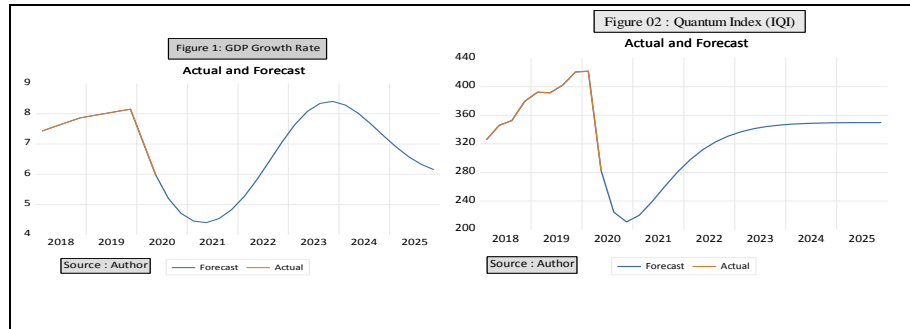
The government has taken some preventive measures to protect the economy of the country. It took important measures to create working capital to assist affected industries. The Industrial sector contributes 29.65 percent to the country's GDP (Economic Review of Bangladesh, 2019). Quantum Index is a modest representative

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<sup>3</sup> See graph-01 and forecasted value in table-01 in the appendix.



of industrial output. Quantum Index reached the lowest point with 237 in third quarter of 2020. The study predicts that the recovery of quantum Index may start from 2020Q4 and grow at a relatively slower pace as it is affected by the pandemic situation. These increases of the quantum index may be the result of SME and large industries’ reopening from 2020Q4. Besides, the government’s measures Bangladesh Bank granted loans to promote production and to stimulate demand for investment. Immediately after the predicted GDP growth the industrial production may start to grow.<sup>4</sup>



**Figure 1& 2:** GDP growth rate and Industrial production

**4.7.2 Average Lending Interest Rate and Private Investment**

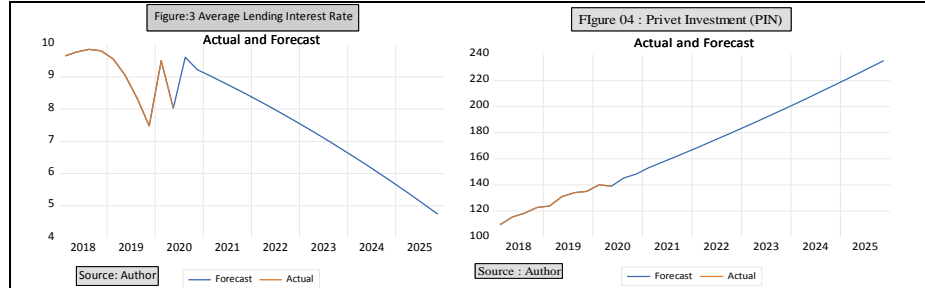
Investment and Interest rates are highly correlated. These two variables go in the opposite direction of each other. During the pandemic, business was interrupted; output reduced, and demands for investment declined. Private investment shows a downward trend during the pandemic. It has been reduced by 1 billion dollars in 2020Q2. From 2020Q3, private investment resumes its rising trend. The cause may be that after the virus's pace slowed in July, the government allowed several SMEs and major businesses to resume operations. Low-interest borrowing may also be a motivator for private investment. Our forecasting result shows that the PIN may be USD 164.8 billion within 2021Q4.<sup>5</sup>

The demand for investments may influence the lending interest rate or vice versa. The average lending interest rate has fallen at 8.03 percent in the second quarter of 2020 which was 9.4 only four months ago. To promote investment demand, to operate the different social programs, and to control epidemic situations government had provided monetary supports by Bangladesh Bank. The banks' required cash reserve requirement (CRR) was cut down from 5.5 percent to 5% on a bi-weekly average basis and from 5% to 4% on a daily basis. From April 15, the interest rate reduced more, the CRR reduced to 4% on a bi-weekly average basis and to 3.5 percent on a daily basis (Ali, 2021). As a result, the average lending interest rate reached 8.1 percent. From the third quarter of 2020 lending interest rate starts to

<sup>4</sup> See graph-02 and forecasted value in table-01 in appendix.

<sup>5</sup> See figure-04 and forecasted value in appendix table-02

grow. The prediction shows it may reach 9.6 percent within 2020Q3, and then it may fall gradually.<sup>6</sup>

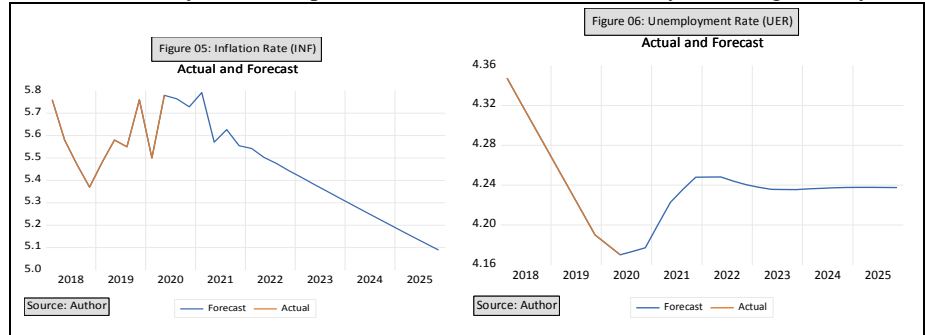


**Figure 3 & 4:** Average Lending Interest Rate and Private Investment

**4.7.3 Inflation and Unemployment Rate**

Phillips Curve shows the inverse relationship between Inflation and unemployment. The unemployment rate has faced a slower decreasing rate in quarter-1 of 2020 than the normal rate. Lots of industries had been shut down. Some institutes fired their workers. Maximum SMEs were inoperative (Islam, R. 2020). Figure 06 shows an increasing rate in unemployment from 4.17 percent in 2020Q2 to 4.28 percent in 2021Q4.<sup>7</sup>

The inflation rate was 5.5 percent in the first quarter of 2020. The rate increased and reached 5.7 percent in the second quarter of 2020. Reasons behind the increase in inflation may be the government’s grand and money supply in the second quarter of 2020. The Prime Minister announced another stimulus package of BDT 677.5 billion (about USD 8 billion) on 5 April, which will be implemented in four programs: raising public expenditure, formulating a stimulus package, expanding social safety net coverage, and raising monetary supply (Ali, 2021). From 2020Q3 rate of inflation may decline at a slower pace than what was in 2020Q2. Again inflation rate may reach 5.8 percent in 2021Q1 and then it may decline gradually.<sup>8</sup>



**Figure 5 & 6:** Inflation rate and unemployment rate

<sup>6</sup> See, figure-03 and table-02 in the appendix.

<sup>7</sup> See figure 06 and forecasted value in table-03 in the appendix.

<sup>8</sup> See figure 05 and forecasted value in table-03 in the appendix.

## 5. Discussion

During the spread of COVID-19, the global economy, particularly Bangladesh's economy shrinks dramatically. The GDP growth rate of Bangladesh has approximately been contracted by a 3.8% during the calendar year 2020. This paper reveals Bangladesh's probable GDP growth rate in 2020 is 4.4% percent. The International Monetary Fund (2020) reported that 3.8% GDP growth rate might be contracted in 2020 and predicted to rise by 6.8% within the fiscal year 2021. Bangladesh Bank projected a 5.2% GDP growth rate might be in the 2020-2021 financial year (Bangladesh Bank, 2020). Bangladesh Bank and Asian Development Bank forecasted GDP in terms of financial years; on the other hand, this study like International Monetary Fund used calendar year. The GDP growth rate of Bangladesh may reach at 6.4 percent within 2022Q3, (International Monetary Fund, 2020). This study shows a very early recovery of Bangladesh's economy which is 8.2% growth within 2023Q3.

This study shows, production has been hampered during pandemics significantly. The production representative Quantum index falls and it may affect the GDP growth rate from the last of 2020Q1 to the first of 2020Q3. From 2020Q4 industrial production may grow rapidly. The government launched a number of low-interest credit programmer to support middle and low-income people, small and medium-sized enterprises, and informal employees, as well as to maintain the employment rate and the farming sector. The government launched a number of low-interest loan schemes, which pushed down the average lending interest rate from the last of 2020Q1 to the last of 2020Q2. (Ali, A., 2020). During the period, private investment was affected a bit. From the second quarter of 2020 investment demand got a faster growth pace. Demand for investment increases the demand for private credit, which might create upward pressure on the average lending interest rate.

During the COVID-19 pandemic, different grants might influence the inflation rate. Data represents a rapid rising of inflation from the first quarter to the last of the second quarter in 2020. Projection shows a slower decline in inflation rate from second quarter to the middle of fourth quarter in 2020. The reason behind this decline during pandemic may be the reduction in consumption because of the financial crisis. Again it may increase as a result of government grants and then decline gradually. All indicators are expected to achieve rapid recovery. By 2023 Bangladesh's economy may be recovered fully. Although, the Bangladesh government expected a full recovery within 2021 with an 8.2% GDP growth rate (World Bank, 2020). During this crisis, major economies are predicted to decrease by 2.4 percent in 2020 (The Organization for Economic Co-operation and Development, 2020). The GDP of developing countries may shrink by 2.5 percent during the pandemic (World Bank, 2020). Even our neighboring country, such as India, has seen a reduction by 23.9 percent from April to June in 2020 (The Financial Express, 2020). The rapid recovery is the evidence that Bangladesh's economy is a potentially stable and rapidly growing economy.

## 6. Conclusion and Policy Recommendation

The major six macroeconomic variables of Bangladesh's economy have been studied in this paper to estimate the impact of the pandemic (2020) on these variables and to identify the time needed for their recovery. Major economic variables have been severely affected by the corona pandemic. Economists mainly focus on aggregates like GDP losses, with policies aimed at minimizing the economic damage. Accordingly, it will be up to economic policy to mitigate COVID-19's damage and minimize its legacy of suffering by constructing a recovery that does not increase the already-existing socioeconomic imbalances. The study explored that GDP growth rate, industrial output, and investment have fallen significantly and the rate of inflation and unemployment has risen. Our projection reveals that the whole economy may recover its previous position by the last of 2023. This paper recommends the government maintaining a lower rate of lending interest for a considerable duration, which may induce savings or investment, increase output, enhance GDP growth rate and reduce unemployment.

Immediate action is required to foster inclusive and long-term economic growth, job creation, and decent work for all. For the entire working-age population, job opportunities and suitable working conditions are also essential. Increased access to financial services to manage incomes, acquire assets, and make profitable investments should be a priority for the government. It is necessary to promote trade flexibility, financial strength, and agricultural infrastructure development in order to boost productivity and minimize unemployment.

Implementation of employment retention measures is required to recover natural unemployment rate. A young population faces a high danger of unemployment, but it could also be a valuable resource for successful national mobilization during recovery. Youth mobilization on a large scale can help unemployment to remain at natural rate. The government should provide more incentives to labor-intensive industries and sub-industries, particularly in the agriculture and RMG sector. It should resume labor-intensive infrastructure projects as soon as possible to protect vulnerable people. The labor-intensive public works projects that are supposed to produce short-term jobs, in particular, need to be restarted. Workers in the informal sector who do not have easy access to formal bank loans must be given immediate access to recovery funds.

Providing input tax break to companies in specific sectors might help enhance the economy's output. At the national and municipal levels organizations can also construct cooperative disaster reduction management capacity building programs. Government can encourage online shopping through incentives to keep the distribution system of industrial output running smoothly during the pandemic. Public reliability can be earned in potential ecommerce industry through policy intervention which may create huge export opportunity to the economy. The smooth distribution of commodities may aid in the maintenance of a steady price level and inflation control. Stable inflation rate or price may help to attract local and foreign investment.

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## Appendix

Forecasting Table-1		
Time	GDP GR	IQI
2020Q3	5.20202	237.7636
2020Q4	4.707604	244.1927
2021Q1	4.452456	267.2601
2021Q2	4.403212	287.7665
2021Q3	4.535482	299.2133
2021Q4	4.830229	308.0384
2022Q1	5.267219	317.7523
2022Q2	5.817536	326.7083
2022Q3	6.437592	332.6911
2022Q4	7.067686	337.3822
2023Q1	7.63766	341.8728
2023Q2	8.079538	345.1745
2023Q3	8.343204	347.2119
2023Q4	8.4086	349.6738
2024Q1	8.289088	352.433
2024Q2	8.024998	353.7019
2024Q3	7.671029	353.4943
2024Q4	7.283076	353.7298
2025Q1	6.908734	354.8942
2025Q2	6.58289	355.7402
2025Q3	6.32748	355.7471
2025Q4	6.153534	355.5248
Source: Author		

Forecasting Table-02		
Time	ALI	PIN
2020Q3	9.610155	145.2889
2020Q4	9.222427	148.2235
2021Q1	9.043525	153.1383
2021Q2	8.859865	156.9904
2021Q3	8.671445	160.8955
2021Q4	8.478267	164.8536
2022Q1	8.280331	168.8646
2022Q2	8.077635	172.9286
2022Q3	7.870181	177.0456
2022Q4	7.657968	181.2156
2023Q1	7.440997	185.4386
2023Q2	7.219266	189.7145
2023Q3	6.992777	194.0434
2023Q4	6.761529	198.4253
2024Q1	6.525523	202.8601
2024Q2	6.284758	207.3479
2024Q3	6.039234	211.8887
2024Q4	5.788951	216.4825
2025Q1	5.533909	221.1292
2025Q2	5.274109	225.829
2025Q3	5.00955	230.5817
2025Q4	4.740233	235.3873
Source: Author		

Forecasting Table-03		
Time	INF	UER
2020Q3	5.764124	4.173487
2020Q4	5.728666	4.177102
2021Q1	5.792019	4.20012
2021Q2	5.570899	4.222794
2021Q3	5.626807	4.235926
2021Q4	5.554533	4.24796
2022Q1	5.542364	4.248125
2022Q2	5.502481	4.248253
2022Q3	5.47577	4.243984
2022Q4	5.443177	4.240452
2023Q1	5.413577	4.237833
2023Q2	5.382834	4.235778
2023Q3	5.352873	4.235611
2023Q4	5.322795	4.235498
2024Q1	5.293019	4.236259
2024Q2	5.263348	4.236808
2024Q3	5.233871	4.237322
2024Q4	5.204546	4.237665
2025Q1	5.175392	4.237726
2025Q2	5.146399	4.237755
2025Q3	5.117569	4.237625
2025Q4	5.088899	4.237539
Source: Author		