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# Macroeconomic Influence on the Balance of Payments of Bangladesh

## Abstract

The present study investigated how the macroeconomic factors have affected the balance of payments (BOP) of Bangladesh using the time series data from 1990 to 2021. The study found that balance of payments has been greatly affected by the exchange rate of currencies (EXR), growth rate of the gross domestic product (GDP), the foreign direct investment (FDI) and the balance of trade (BOT) during the period. Various pre and post estimation tools and techniques have been employed followed by running of regression models utilizing the STATA software to confirm the model suitability and to consider the model outcomes to the researchers, policy makers and the enthusiastic readers for further studies and decision making. The study suggests that the efficient implementation of government policies is vital in determining how the economy of a nation is formed and to perform. It emphasizes how important it is to create a friendly atmosphere for foreign investments because these investments could have an impact on the BOP and economic growth of the country.

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## 1. Introduction

The Balance of Payments (BOP) of any nation is a summary of all economic transactions the country has had with the rest of the world over a specific time period, often a year. It contains both tangible and intangible components of international trade and is helpful for spreading vital information about a nation's trading situation. Information on foreign exchange reserves and global debt is also provided. Due to its reliance on imports and high inflation, Bangladesh has an unfavorable balance of payments. Due of Bangladesh's dependence on foreign trade and investment, the BOP has attracted a lot of attention there. Over the years, Bangladesh's BOP situation has fluctuated, with both trade deficits and surpluses. The global financial crisis (GFC) of 2008, slow output growth, decreased imports, contractionary devaluation of the Bangladeshi Taka, and decreased foreign exchange transfers are further contributory causes. The trade balance of the nation, when imports exceed exports, is a factor in the BOP's total imbalance. Different strategies have been offered to correct this discrepancy, and there have been discussions over how many of these problems should influence governmental regulations. To understand the elements that influence Bangladesh's external sector dynamics, it is imperative to analyze the determinant s of the BOP.

The present study primarily focuses on examining the variables that affect the nation's trade balance. The goal of the study is to identify the factors that have a major impact on the BOP. Understanding the important elements that influence Bangladesh's BOP is the ultimate goal. The assessment of the data for the study is

based on yearly reports published by the World Bank. Thus, the goal of this study is to examine the macroeconomic variables that significantly influence how Bangladesh's BOP is determined. The study includes a thorough evaluation of the relevant literature, a strong research methodology, and an analysis of the data before providing recommendations and conclusions based on the findings.

## 2. Objectives of the Study

The principal objective of the study is to analyze the factors that influence the BOP of Bangladesh. It aims to support policy discussions that support a stable and advantageous BOP position by offering insightful information on the variables driving Bangladesh's external sector dynamics. In order to improve Bangladesh's BOP performance and economic stability, policymakers, economists, and researchers can use the study's findings as a starting point when developing strategies and policies.

### 2.1 Literature Review

Numerous academic studies have generated interest in the factors that influence BOP, similar to how the actual application of BOP has. For instance, utilizing econometric evidence and variables including the surplus money supply, net foreign assets, exchange rate, inflation, and interest rate, Ali (2011) conducted research on the BOP as a monetary phenomenon in Pakistan. It was established that the BOP, exchange rate, inflation, and net foreign asset all have close ties. Similar to how the practical implementation of BOP has sparked interest, academic examination of the elements that affect BOP has done the same. For instance, Ali (2011) conducted research on the BOP as a monetary phenomenon in Pakistan using econometric evidence and variables such as the excess money supply, net foreign assets, currency rate, inflation, and interest rate. It was determined that there are connections between the BOP, exchange rate, inflation, and net foreign asset. The BOP and the BOT are associated favorably, and a positive BOT stabilizes the BOP, claims Tijani (2014). IMF (2009) claims that whereas all imports have a negative impact on a country's BOP, all exports have a positive benefit. Ethiopia (Anega, 2010), India (Srivastava, et al., 2016), and the Arab Maghreb Union all offer some evidence in favor of this assertion.

Selma and Kastrati (2013) assert that FDI has positive effects on the BOP in both developing and developed countries. These advantages include the spread of technology, assistance for the development of human resources, and enhancement of business development. In addition to the host country benefiting from capital inflows, FDI can replace imports of goods and services, improving BOP through the current account. According to research from publications like Gugliemo and Mudida (2012) and Osoro (2013), the currency rate, foreign direct investment, economic growth, relative income, and trade balance are some aspects that favorably affect Kenya's BOP. A study by Sezgin and Zkan (2015) used an econometric approach to examine how the BOP affects FDI in Turkey and found that it had no impact on the BOP. According to Selma & Kastrati (2013), both developed and developing countries' BOPs were positively impacted by FDI.

Studies by Imoisi (2012), Braima and Korsu (2013), Kennedy (2013), Tijani (2014) and Afolabi and Kolawale (2020) revealed a positive correlation between foreign exchange and the BOP. It is also inferred that exchange rate volatility has a negative correlation with the BOP. Studies by Batool et al. (2015), Yousif and Musa (2017), Udochi et al. (2017), Gebremariam et al. (2018), Gatawa et al. (2018), and Sujianto (2017) showed that the real exchange rate has a significantly negative impact on the BOP. A change in the exchange rate in one country has an effect on the BOP performance of many other

countries (Priyatharsiny, 2017).

According to Djohanputro (2008), the GDP is the total final value (in units of currency) of all final products, including both goods and services, in a country. The entire amount of goods and services produced over the course of a year by domestic production units on a country's territory is what Silalahi (2014) defines as the gross domestic output of that nation. Masdjojo (2005) found a link between income and the BOP that is positive. An increase in income causes the BOP to rise, other things being equal. The equilibrium of the domestic money market is also impacted by changes in public income. The demand for money rises when people's incomes do as well. Similar to this, real GDP is regarded in study as a significant factor in determining the BOP. Both immediately and over time, real GDP has a favorable impact by Sangeetha and Patni (2018), the factors influencing the BOP in the US and India were examined. According to a study by Mwai (2015), Kenya's inflation rate and BOP have a direct (positive) link. Furthermore, Shafi et al. (2015) showed that inflation benefits the BOP. However, Yousif and Musa (2017) discovered that the BOP is negatively impacted by the rate of inflation.

After conducting studies on how trade liberalization affects growth and the BOP in developing nations, Parikh (2004) found that trade liberalization can result in quicker import growth than export growth and an unsustainable BOP situation in developing nations. It was determined that trade liberalization might impede growth by having a negative effect on the BOP. He linked trade liberalization in the majority of African nations to the rise in current account deficits of African economies between 1980 and 1999. Exports and imports are important determinants of current account balances in advanced economies, according to a study by Bussière et al. (2013). According to Amelia U. Santos-Paulino's (2012) research, import constraints should be eliminated more gradually than export barriers in emerging nations like Bangladesh. This is actually due to the fact that exporters take longer to respond to currency liberalization than imports do, which may result in genuinely challenging issues with changing installments. The BOP can be significantly impacted by changes in exchange rates. Exchange rate changes can impact the trade balance, especially in nations with large import and export elasticity, according to a 2017 study by Obstfeld and Rogoff. Additionally, the study discovered that exchange rate volatility might lessen trade and investment flows and raise uncertainty, both of which can harm the BOP. Hossain and Alauddin (2005) studied the trade liberalization process in Bangladesh and its effects on GDP growth and structure, as well as other macroeconomic variables with a focus on export. They experimentally discovered that trade liberalization has had a favorable influence on growth by employing econometric analysis based on the ARDL and the ARDL co-integration approaches, finding that both the reduction of anti-export bias and the import-GDP ratio have had a significant impact on export in the long run.

Although numerous studies have examined the variables that affect BOP in Bangladesh, yet there is still a knowledge gap that has to be filled. There is a paucity of thorough research on the long-term dynamics and trends of BOP drivers in Bangladesh in the current literature, especially when considering the years from 1990 to 2021. Political upheavals, economic shifts, and instability are just a few of the significant national and international occurrences that occurred throughout this study period. Additionally, the research that is currently accessible on BOP in Bangladesh typically focuses on specific elements on their own, such as the impact of trade or FDI on BOP. It is necessary to do thoughtful analyses that consider the interplay and cumulative effects of

numerous variables, including balance of trade (BOT), foreign direct investment (FDI), gross domestic product (GDP), inflation (INF), and exchange rates (EXR). To properly know the dynamics of BOP in Bangladesh, it is essential to comprehend the complex linkages and relationships between these variables. Lack of focus on current events, such as how the COVID-19 pandemic has impacted Bangladesh's BOP determinants, is another lacuna in the research. The exact effects of this event on BOT, FDI, GDP, INF, and EXR, as well as the subsequent effects on BOP, must be examined because they have significantly disrupted and uncertain the global economy.

## 3.1. Econometric Model

The methodology used to conduct the present research has been explained in this section. The study design is next thoroughly analyzed after which the dependent and independent variables that were used to run the model are explained. The main source of this information have collected from websites for economic data that are widely recognized. This research question is investigated using the causal research design. The emphasis of causal research is cause-and-effect linkages (Ahamad and Das, 2018). In a causal research design, specific objectives regarding the effects of altering one variable on another variable are the main focus. This kind of research includes an experiment wherein the effect of a dependent variable is determined by using an independent variable. This study benefits from the use of a causal research design since it enables the researcher to analyze how changes in the independent variables impact the dependent variable. Given that this study's data is largely quantitative or empirical, in-depth analyses are required, and a descriptive technique makes them possible.

### 3.2. Data Collection

The World Bank's World Development Indicators database has been mined for quantitative data, verifying the accuracy and legitimacy of the data. The data gives a complete picture of the important factors by including pertinent metrics for balance of trade (BOT), foreign direct investment (FDI), gross domestic product (GDP), inflation rate (INF), exchange rate (EXR), and the balance of payment (BOP).

### 3.3 Sample Design

- As 30 years is a reasonable period of time to capture changes in the BOP, 30 years was selected as the sample size.
- The sample period, 1990-2021 has been chosen for the data since it included both economic expansion and contraction.

### 3.4 Data Analysis Techniques

To evaluate the data for this study, we used a variety of statistical methods and tests. The associations between the independent variables and BOP have been estimated using trend analysis, descriptive analysis, regression analysis, and correlation matrix, allowing the identification of relevant determinants. Additionally, we have tested for multicollinearity to confirm the variables' independence and for autocorrelation to assess the data's time series characteristics.

#### 3.4.1 Descriptive Statistics

The process of using descriptive statistics to describe, summarize, and convey important information involves the analysis of data. This analysis offers a thorough overview and knowledge of the dataset by assisting in the identification of patterns, trends, and significant qualities within the data. A wide variety of indicators that provide details about a dataset are included in descriptive statistics. These indicators include measures of variability like variance and standard deviation as well as measures of central tendency like the mean.

#### 3.4.2 Pre-estimations

*Unit Root test:* Performing a Unit Root Test to determine the integration sequence is a

requirement before conducting a time series analysis. This study used the Augmented Dickey-Fuller (ADF) unit root tests for each series to establish the order of integration. In order to assist prevent the issue of inconsistent and inaccurate regression results, the stationary test was applied in this study (Rubinfeld and Pyndick, 1998). The alternative hypothesis states that the variable is stationary, in contrast to the null hypothesis, which states that it is non-stationary for the Unit Root Test.

Normality test: The Shapiro-Wilk test was used in this investigation to determine whether the data were normal. If the sample or selected data are drawn from a population with a normal distribution, it can be determined using this test. The alternative hypothesis of the Shapiro-Wilk test contends that the data do not follow a normal distribution, contrary to the null hypothesis of the test, which claims that the data are normally distributed. Hanusz et al. (2016) explain that the goal of this test is to study the distributional characteristics of the data and assess how well they comply to the assumptions of normalcy.

Residuals Diagnostic test: Several diagnostic tests were run on the residuals to confirm the regression model's validity and reliability. These tests were designed to evaluate the model's presumptions and identify any potential problems, including heteroskedasticity, autocorrelation, and deviations from normality. The subsequent tests were run: (i) Cumulative Periodogram White-Noise Test: This test aimed to see if the residuals showed signs of white noise. The frequency distribution of the residuals was evaluated using the cumulative periodogram, which shed light on the existence of random patterns. (ii) Portmanteau Test for White Noise: The white noise assumption in the residuals was assessed using the Portmanteau test. This test evaluated whether there was any significant autocorrelation in the residuals, which would suggest the presence of recurring patterns. (iii) ARCH-LM Test: The presence of conditional heteroskedasticity in the residuals was evaluated using the Autoregressive Conditional Heteroskedasticity (ARCH) LM test. This test tried to find any clustering of volatility or time-varying variances. (iv) Durbin-Watson (DW) Test: The residuals were examined for the presence of autocorrelation using the DW test. It evaluated any potential serial connection by examining the linear relationships between nearby residuals. (v) Shapiro-Wilk test: The residuals' assumed normality was assessed using the Shapiro-Wilk test. In order to confirm that the regression model assumptions were true, it evaluated whether the residuals had a normal distribution.

### 3.4.3 Post-estimations

The following post estimation tests have been conducted for through investigation of the data and confident use of the model outcome based on this research.

*(i) Multicollinearity test*

The Variance Inflation Factor (VIF) coefficient assesses how much a model's standard errors depart from the errors of a "perfect model" in which the variables are uncorrelated. The issue of how much the coefficient of simple correlation should be taken into account when calculating VIF values and how high a VIF value should be in order to detect multicollinearity arises. According to Neter et al. (1990), collinearity can be detected by looking at the greatest VIF value. There are differing views on this subject, however, it is widely agreed that if the VIF ratio is greater than 5, there may be a multicollinearity issue among the variables.

*(ii) Auto-correlation test*

*(a) Breusch-Pagan test*

A Breusch-Pagan test is carried out to determine whether heteroskedasticity exists in the series by estimating the model

using ordinary least squares (OLS) without making the assumption of heteroskedasticity. For this, the regression equation is employed. The null hypothesis of constant variance in the series is rejected, indicating the presence of heteroskedasticity, if the p-value returned from the test is less than the set level of significance.

(b) Durbin-Watson test

A regression model's linear relationships between subsequent residuals are investigated using the Durbin-Watson test. The test is designed to determine whether autocorrelation is present. The following are the test's hypotheses: While the alternative hypothesis (Hi) contends that autocorrelation exists, the null hypothesis (Ho) asserts that it does not. In order to execute the test, an Ordinary Least Squares (OLS) regression has been run, and STATA has been used to calculate the Durbin-Watson statistic. The Durbin-Watson statistic's upper and lower critical values (DW upper and DW lower) have been taken into consideration, together with a significance level, to assess whether autocorrelation is present.

*(c) Breusch-Godfrey LM test*

A statistical test called the Breusch-Godfrey LM Test is used to determine whether autocorrelation exists in a regression model's errors. The test entails generating a test statistic using the residuals obtained from the regression model. There is no serial correlation in the residuals up to the stated order, according to the null hypothesis for this test. In other words, it is predicated on the notion that errors do not exhibit a temporal correlation. The test is run to see if it is possible to rule out the null hypothesis, which would indicate the presence of autocorrelation in the residuals.

### 3.5 Model Development

The theoretical framework that this study's model adheres to, take into account of all the variables affecting Bangladesh's BOP. We used the OLS estimate procedure to examine these factors and how they affected the BOP. The OLS technique was chosen due to its many advantages, which Wallace and Silver (1988) emphasized. These benefits include, among others, sufficiency, least variance, best linear impartiality (BLU), least mean square error (MSE), and effectiveness. In this model, one variable may be predicted based on the values of five other variables. The regression analysis model is as follows:

$BOP_t=\beta_0+\beta_1$ (BOT) + $\beta_2$ (FDI)+$\beta_3$ (GDP)+ $\beta_4$ (INF)+ $\beta_5$ (EXR) + $\varepsilon_t$. Equation (1)

Where,

$\beta_0$ = Constant

BOP = Balance of Payments (% of GDP)

BOT= Balance of Trade (% of GDP)

FDI=Foreign Direct Investment (% of GDP)

GDP= GDP growth Rate

INF= Inflation Rate

EXR= Exchange Rate, and

ε = Error Term

The BOP is used as the dependent variable in this study to represent the economic situation throughout a given time period.

**Table 1: Expected Relationship among the variables**

Expected relationships between independent variable with dependent variables are shown below:

| Nature of the Variables | Variables | Notation | Expected Relation |
|---|---|---|---|
| Independent Variable | Balance of Payment | BOP | |
| Dependent Variables | Balance of Trade | BOT | Positive (+)/Negative (-) |
| | Foreign Direct Investment | FDI | Positive (+) |
| | Gross Domestic Product | GDP | Positive (+) |
| | Inflation Rate | INF | Negative (-) |
| | Exchange Rate | EXR | Positive (+) |

## 4. Analysis and Findings

Using time series data, all determinants are observed for each time period. Tables 1 to 16 show the findings of expected relationships, descriptive statistics, ADF test, Shapiro-Wilk test, correlation matrix, and the OLS regression respectively. The expected relationship between independent variable with dependent variables and descriptive statistics are shown in Tables 1 and 2. The graph of residual is shown in Figure 1, illustrating the trend of residual in a pictorial form. Appendix tables 1 and 2 indicate the Augmented Dickey Fuller test for unit root test and Shapiro-Wilk test for normality test respectively. The nature and degree of the relationship between the variables is investigated using a correlation analysis. The correlation matrix's results are presented in Table 3. The robust regression analysis is shown in Table 4which presents the significance of the variables. The standardized beta coefficients of the regression model of individual performance of the variables in the model are also shown in the OLS table. Summary of regression result is shown in Table 5 so that the expected relationship and reported relationship can be compared easily. Residual diagnostics test is conducted to examine the residual's stationary test, white noise test, arch effect test, normal distribution test, and heteroskedasticity test in the model. The results of these tests are presented in Table 6 to Table 10. Multicollinearity and Auto-correlation tests have also been done to check the model's Multicollinearity and Auto-correlation among the variables. The result of these tests is shown in Table 11 to Table 14 respectively.

### 4.1 Descriptive Statistics

The table displays the descriptive statistics results for each variable in the sample data set. Data about determinants are widely available. The information on the minimum, maximum, standard deviation, skewness, and kurtosis demonstrates the wide range of values for the BOP score. The variable's lowest and highest values are represented by its minimum and maximum values.

**Table- 2: The Descriptive Statistics**

| Variables | Number of Observation | Mean | Standard Deviation | Minimum Value | Maximum Value |
|---|---|---|---|---|---|
| Balance of Payments (BOP) | 32 | 0.02 | 1.49 | -3.79 | 3.47 |
| Balance of Trade (BOT) | 32 | -5.73 | 1.14 | -7.79 | -3.49 |
| Foreign Direct Investment (FDI) | 32 | 0.61 | 0.50 | 0.00 | 1.74 |
| Gross Domestic Product (GDP) | 32 | 5.60 | 1.16 | 3.45 | 7.88 |
| Rate of Inflation (INF) | 32 | 0.06 | 0.02 | 0.02 | 0.11 |
| Exchange Rate (EXR) | 32 | 0.03 | 0.03 | -0.05 | 0.10 |

Source: Author's calculation

The standard deviation shows how much variance or dispersion there is in comparison to the mean. When the standard deviation (Std. Dev.) is low, the data points are skewed toward the mean, whereas when the Std. Dev. is high, the data set is distributed throughout a wide range of values. The variance shows how the random variable is distributed around the mean value. If the variance is minimal, the distribution of the random variable is close to the mean value. When the variance is high, the random variable is dispersed far from the mean value.

The findings demonstrate that BOP is the difference between a country's total outgoing payments and total inward transfers. The average value of 0.02 denotes a modest average positive balance. The standard deviation of 1.49 indicates a rather high degree of data variability. The negative skewness (-0.32) indicates a distribution that is slightly left-skewed, whereas the positive kurtosis (0.52) indicates a distribution with heavier tails than a normal distribution. The average BOT number of -5.73, which denotes a negative average trade balance, shows

that the nation imports more than it exports. The results are relatively steady, as indicated by the 1.14 standard deviation. The distribution's somewhat negative skewness (-0.18) and negative kurtosis (-0.93) point to a distribution with fewer tails than a normal distribution. The net amount of investment coming from abroad is known as FDI. A positive average FDI is indicated by the mean value of 0.61. The data appear to be moderately variable, according to the standard deviation of 0.50. While the negative kurtosis (-0.64) shows a distribution with lighter tails than a normal distribution, the positive skewness (0.55) indicates a distribution that is slightly right-skewed. The worth of all the goods and services generated in a nation is shown by its GDP. A significantly high average GDP is shown by the median value of 5.60. The data appear to be moderately variable, according to the standard deviation of 1.16. The distribution's slightly negative skewness (-0.08) and negative kurtosis (-0.73) point to a distribution with fewer tails than a normal distribution. INF is a metric used to determine how quickly the average level of prices for goods and services has changed over time. The median value of 0.06 indicates a moderate average inflation rate. The data appear to be reasonably stable, as indicated by the standard deviation of 0.02. Positive skewness (0.18), and positive kurtosis (0.30), both of which show a distribution with heavier tails than a normal distribution, show a distribution that is slightly right-skewed. EXR shows how much one currency is worth in terms of another. The average value of 0.03 implies that the exchange rate is comparatively stable. Data variability is moderate, as indicated by the standard deviation of 0.03. While the negative kurtosis (-0.47) denotes a distribution with lighter tails than a normal distribution, the positive skewness (0.13) shows a distribution that is slightly right-skewed.

### 4.2. Pre-estimation Results

*4.2.1 Unit Root test (Augmented Dickey Fuller [ADF]) results*

Since the data in this study are time-series, it is necessary to verify that the data are stationary before moving on to a review of the regression analysis. Before performing any further estimation, we utilized the ADF test to confirm the existence of a unit root test in the series.

At a 5% level of significance, the ADF test statistic is compared to the critical value. We can reject the null hypothesis that the time series is non-stationary and come to the conclusion that the time series is stationary if the test statistic is less than the critical value. The ADF test results demonstrate that each of the six variables is stationary. This indicates that we can analyze these variables using the standard statistical techniques.

*4.2.2 Normality test (Shapiro-Wilk test)*

The study also uses the normality test to examine if a data set is normally distributed and to calculate the likelihood that a random variable that forms the basis of the data set is normally distributed.

The accompanying z-value of -0.759 and corresponding p-value (Prob>z) of 0.77610 from the Shapiro-Wilk test indicate that the BOP variable does not significantly deviate from a normal distribution. In light of the Shapiro-Wilk test, it may be said that the BOP variable is roughly regularly distributed. The BOT variable appears to be roughly regularly distributed according to the Shapiro-Wilk test results. The test statistic W of 0.96134 indicates that there is just a minor divergence from normalcy. The normalcy assumption is further supported by the BOT's z-value of 0.528 and the accompanying p-value (Prob>z) of 0.29883, both of which are above the conventional significance level of 0.05. According to the Shapiro-Wilk test, the FDI variable has a normal distribution. The test statistic W, which is 0.9670, indicates a slight deviance from normality. The normalcy assumption is supported by the FDI's z-value of 0.207 and the accompanying p-value (Prob>z) of 0.41782 because the p-value is higher than the

usual significance level. The GDP variable can be regarded as nearly regularly distributed based on the Shapiro-Wilk test. With a test statistic W of 0.97470, a minor departure from normalcy is indicated. The normalcy assumption is supported by the GDP's z-value of -0.353 and the accompanying p-value (Prob>z) of 0.63779, which is greater than the usual significance level. The findings of the Shapiro-Wilk test also imply that the INF variable has a roughly normal distribution. A minor divergence from normalcy is shown by the test statistic W, which is 0.95947. The normalcy assumption is supported by the z-value of INF, which is 0.626, and the related p-value (Prob>z), which is 0.26568. This is because the p-value is higher than the usual significance level. The Shapiro-Wilk test indicates that the EXR variable is roughly regularly distributed. A minor divergence from normalcy is shown by the test statistic W, which is 0.95129. The normalcy assumption is supported by the EXR's z-value of 1.008 and the accompanying p-value (Prob>z) of 0.15682 because the p-value is higher than the usual significance level.

*4.2.3 Correlation Matrix (Pearson correlation matrix)*

As a result, a correlation coefficient is generated, with values ranging from -1 to 1. The intensity of the associated value indicates how linearly related the variables are to one another.

**Table 3: Correlation Matrix**

| | BOP | BOT | FDI | GDP | EXR | INF |
|---|---|---|---|---|---|---|
| BOP | 1 | | | | | |
| BOT | -0.01571 | 1 | | | | |
| FDI | 0.400745 | -0.45868 | 1 | | | |
| GDP | -0.13532 | -0.30688 | 0.551267 | 1 | | |
| EXR | -0.50674 | 0.149589 | -0.25348 | -0.13232 | 1 | |
| INF | 0.100702 | -0.37709 | 0.447667 | 0.301287 | 0.123781 | 1 |

Source: Author's calculation

The BOP variable and FDI have a somewhat positive correlation (0.400745), indicating that there may be some connection between the two. The BOP and the EXR are inversely related, as seen by the BOP's moderately negative correlation with the EXR (-0.50674). The relationship between the FDI variable and GDP (0.551267) is moderately positive, indicating that there is a connection between FDI and GDP. Additionally, there is an inverse relationship between FDI and the BOT, as seen by FDI's somewhat negative correlation with BOT (-0.45868). There is a correlation between the GDP and FDI variable, which is somewhat positive and equals 0.551677 (showing a relationship between the GDP and FDI). There are no significant positive associations for the EXR variable. The EXR and the BOP, however, appear to be inversely related because of their moderately negative correlation (-0.50674).

### 4.3. OLS Regression Results- Based on Robust Regression Method

The results of the regression are displayed below. The empirical study indicates several notable disparities in terms of both the significance and the quantity of the estimation findings. The F-statistic value (0.0000) is considerable, demonstrating the validity and stability of the model used in our analysis. Thirty-two observations were made for this study. The model's R-square value is 0.55. This demonstrates that the independent factors in the analysis have a limited amount of explanatory power, accounting for just about 55% of the variation in the dependent variable BOP. Variables are significant at a 1%, or

10% significance level. The following examples of more accurate standard errors and t-statistic from the robust regression analysis employed in this model to account for probable heteroskedasticity in the data are given:

**Table 4: OLS Regression Results of the Macroeconomic Factors Affecting the Balance of Payments of Bangladesh (Sample Period from 1990 to 2021)**

| ***Variables*** *Dependent Variable: Balance of Payments* (BOP) | **Outcome** Coeff. | Robust S.E. |
|---|---|---|
| *Independent Variables* | | |
| Balance of Trade (BOT) | 0.2951758* | 0.169844 |
| Foreign Direct Investment (FDI) | 1.792924*** | 0.5655958 |
| Gross Domestic Product (GDP) | -0.6436327*** | 0.2114059 |
| Inflation (INF) | 8.322842 | 10.29562 |
| Exchange Rate (EXR) | -20.74474*** | 5.828248 |
| Constant | 4.367543*** | 1.4344 |
| *Number of observations* | 32 | |
| $R^2$ | 0.5562 | |
| *Wald test (p value)* | F (5, 26) = 6.20 | 0.0007 |
| Root MSE | 1.0873 | |

Source: Author's calculation

From the regression output table-4, we can write the equation as:

$$Y_t = f(BOT_t, FDI_t, GDP_t, INF_t, EXR_t)$$

$$BOP = 4.367 + 0.295\ (BOT) + 1.792\ (FDI) - 0.643\ (GDP) + 8.322\ (INF) - 20.744\ (EXR)$$

**Table- 5: Summary of Regression Result**

| Variables | Expected Relation | Reported Relationship | Significance level |
|---|---|---|---|
| Balance of Trade | Positive (+)/Negative (-) | Positive (+) | Significant at 10% |
| Foreign Direct Investment | Positive (+) | Positive (+) | Significant at 1% |
| Gross Domestic Products | Positive (+) | Negative (-) | Significant at 1% |
| Inflation Rate | Negative (-) | Positive (+) | Not Significant |
| Exchange Rate | Positive (+) | Negative (-) | Significant at 1% |

Source: Author's calculation

It was anticipated that there would be a positive/negative relationship between balance of trade (BOT) and balance of payments (BOP), meaning that the balance of payments might be affected in either a positive or negative way. The reported link, however, demonstrates a favorable correlation between BOT and BOP. An estimated 29.5% rise in BOP results from a 1% increase in BOT. At a 10% level of significance, this positive association is statistically significant. There is a positive correlation between foreign direct investment (FDI) and the balance of payments (BOP), as seen in both the expected and reported correlations. An estimated 179.2% increase in BOP is correlated with a 1% increase in FDI. At a significance level of 1%, the reported association is statistically significant, indicating that changes in FDI are correlated with changes in BOP. The projected link between the balance of payments (BOP) and gross domestic product (GDP) was positive, pointing to a favorable association. The reported link, however, indicates a bad correlation between GDP and BOP. BOP is expected to decrease by 64.3% for every 1% increase

in GDP. At a 1% level of significance, this inverse association is statistically significant. The projected inverse relationship between the Inflation Rate (INF) and the Balance of Payments (BOP) was negative. The reported link, however, indicates a favorable correlation between INF and BOP. BOP is predicted to increase by 832.2% units for every 1% increase in INF. The observed association is not statistically significant, suggesting that there may be no statistically significant relationship between INF and BOP. Exchange Rate (EXR) and Balance of Payment (BOP) had a positive anticipated connection, indicating a favorable correlation. The reported link, however, reveals a bad correlation between EXR and BOP. BOP is predicted to drop by 20.74 units for every unit increase in EXR. At a 1% level of significance, this inverse association is statistically significant.

### 4.4. Post-estimation

#### 4.4.1. Durbin-Watson d-statistic

**Table 6: Durbin-Watson d-statistic**

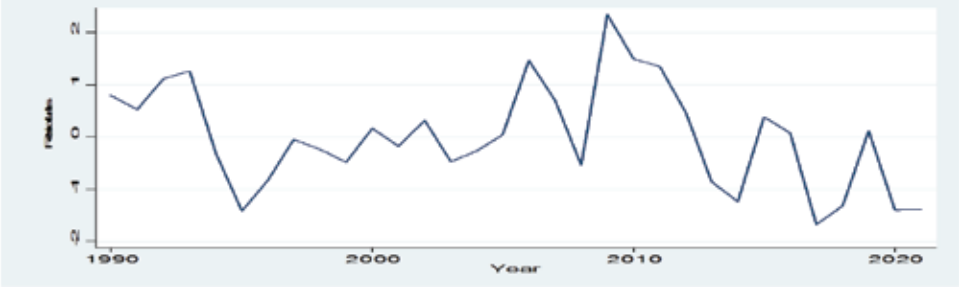
| Durbin-Watson d-statistic (6,32) = 1.066469 |
|---|

Source: Author's calculation

The stated R-squared value in this instance is lower than the Durbin-Watson statistic. This shows that the series under study is stationary, which is a desirable property for testing hypotheses, predicting the future, or making predictions. Being stationary means that the series' mean and variance, among other statistical characteristics, remain constant across time.

The residuals of the model have shown on a graph.

**Figure1: Residual in a graph**

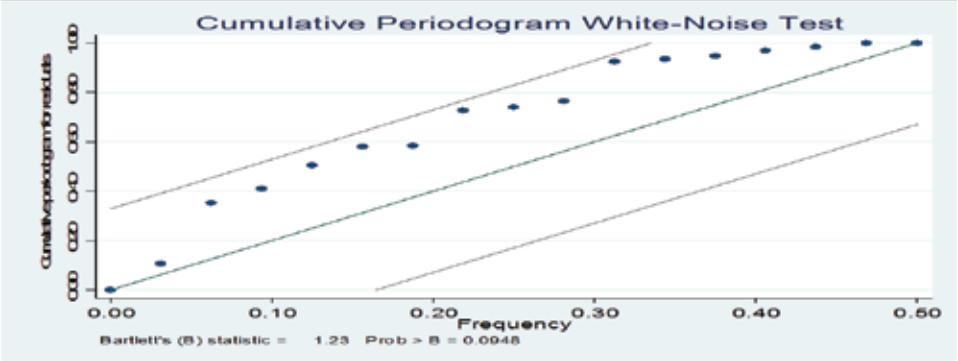



The plotted data points do not seem to show a distinct trend, according to the graph's description. Instead, they exhibit erratic variations, with some points increasing while others decreasing. As a result of this pattern, it appears that the residual differences between observed values and values predicted by a model can be classified as either stationary or white noise.

*4.4.2 Cumulative Periodogram White-Noise Test*

We can do a few tests to see if the residuals are white noise or not. A statistical test called Bartlett's test is employed to evaluate the homogeneity of variances across several groups or categories. It determines whether the variances of various groups in a dataset differ from one another in significant ways. Under the premise of equal variances, the test compares the observed variance ratio to the expected variance ratio.

**Figure 2: Cumulative Periodogram White-Noise Test**




We can see from this statistic that the probability is 9.48%, which is higher than 5%. The null hypothesis that the residuals are white noise cannot, therefore, be rejected.

*4.4.3 Portmanteau test for white noise*

A statistical test called the Portmanteau test is used to determine if a particular sequence of data has features of randomness or white noise. It investigates the statistical significance of the data autocorrelations at various delays.

**Table 7: Portmanteau Test for White-noise**

| Portmanteau test for white noise | |
|---|---|
| Portmanteau (Q) statistic | 8.6098 |
| Prob> $chi_2$ (5) | 0.1257 |

Source: Author's calculation

The null hypothesis cannot be rejected because the probability of 0.1257, or 12.57%, is greater than 5%, indicating that the residuals are white noise. The steady nature of residual is desirable for regression models.

*4.4.4 ARCH -LM Test*

To determine whether there are ARCH effects, which signify the presence of conditional heteroskedasticity (changing volatility) in the residuals of a model, one uses the LM (Lagrange Multiplier) test for autoregressive conditional heteroskedasticity (ARCH). H0: no ARCH effects and H1: ARCH p) disturbance

**Table 8: ARCH -LM Test**

| LM test for autoregressive conditional heteroskedasticity (ARCH) | | | |
|---|---|---|---|
| Lags (p) | $Chi^2$ | df | Prob> $chi^2$ |
| 1 | 0.560 | 1 | 0.4542 |

Source: Author's calculation

We fail to reject the null hypothesis since the given probability (0.4542) exceeds the standard significance level of 0.05. This implies that there is insufficient data to draw a definitive conclusion about the presence of conditional heteroskedasticity or ARCH effects in the residuals. The residuals can be considered as homoscedastic or having continuous volatility.

*4.4.5 Shapiro-Wilk Test for Residual*

The "residuals" variable, which is assumed to reflect the leftovers from a statistical model, is subjected to the Shapiro-Wilk W test. A sample size of 32 is used to conduct the test.

**Table 9: Shapiro-Wilk test**

| Shapiro-Wilk W test for normal data | | | | | |
|---|---|---|---|---|---|
| Variables | Obs | W | V | z | Prob> z |
| Residuals | 32 | 0.97412 | 0.863 | -0.305 | 0.61975 |

Source: Author's calculation

The null hypothesis makes the assumption that the data are normally distributed. In this instance, we are unable to reject the null hypothesis because the stated probability (0.61975) exceeds the standard significance level of 0.05. The residuals may be regularly distributed based on this.

*4.4.6 Breusch-Pagan Test for Residuals*

To determine whether there is evidence of variable variances (heteroskedasticity) in the residuals of a regression model, researchers employ the Breusch-Pagan/Cook-Weisberg test. H0: Residuals are homoscedastic (constant variance) and $H_1$: Residuals are heteroskedastic

**Table 10: Breusch-Pagan test**

| Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity | |
|---|---|
| $Chi^2$ (1) | 1.03 |
| Prob> $Chi^2$ | 0.3096 |

Source: Author's calculation

We are unable to reject the null hypothesis because the given probability (0.3096) exceeds the standard significance level of 0.05. Since the variance of the residuals is relatively constant, the regression model does not appear to be significantly heteroskedastic.

**4.4.7 Multicollinearity Test**

*4.4.7.1 Variance Inflation Factor test for Multicollinearity*

To determine whether a regression model contains multicollinearity, the Variance Inflation Factor (VIF) analysis is utilized. VIF quantifies the degree to which collinearity with other independent variables causes the variance of an estimated regression coefficient to increase.

**Table 11: VIF Test**

| Variable | VIF | 1/VIF |
|---|---|---|
| FDI | 1.93 | 0.519375 |
| GDP | 1.45 | 0.689991 |
| INF | 1.44 | 0.695915 |
| BOT | 1.35 | 0.742025 |
| EXR | 1.17 | 0.855888 |
| Mean VIF | 1.47 | |

Source: Author's calculation

If the VIF value is greater than 5, the model may have multicollinearity issues. Since the value is less than 5, we can infer that the model does not exhibit multicollinearity.

*4.4.7.2 Auto-correlation test*

*4.4.7.2.1 Constant Variance test*

To determine if the model satisfies the homoskedasticity assumption, the Breusch-Pagan/Cook Weisberg test is used. The following hypotheses will be tested: H0: Residuals are homoscedastic (constant variance) and H1: Residuals are heteroskedastic

**Table 12: Constant Variance Test**

| Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity | |
|---|---|
| $Chi^2$ (5) | 1.03 |
| Prob> $Chi^2$ | 0.9602 |

Source: Author's calculation

The data show that the probability value exceeds 5%. Thus, we concede that the model's variance is constant, which is the null hypothesis.

*4.4.7.2.2 Durbin's alternative test*

To determine whether there is evidence of serial correlation (autocorrelation) in the residuals of a regression model, one might utilize Durbin's alternative test for autocorrelation. The following are the test's hypotheses: H0: Residuals are not serially correlated and H1: Residuals are serially correlated. H0: no serial correlation.

**Table 13: Durbin's Alternative Test**

| Durbin's alternative test for autocorrelation | | | |
|---|---|---|---|
| Lags (p) | $Chi^2$ | df | Prob> $Chi^2$ |
| 5 | 9.932 | 5 | 0.0772 |

Source: Author's calculation

We are unable to reject the null hypothesis because the stated probability (0.0772) exceeds the usual significance level of 0.05. This implies that there is insufficient data to draw the conclusion that there is considerable serial correlation (autocorrelation) in the residuals.

*4.4.7.2.3 Breusch-Godfrey LM test*

To determine whether there is proof of serial correlation (autocorrelation) in the residuals of a regression model, one can apply the Breusch-Godfrey LM test for autocorrelation. H0: no serial correlation.

**Table 14: Breusch-Godfrey LM Test**

| Breusch-Godfrey LM test for autocorrelation | | | |
|---|---|---|---|
| Lags (p) | $Chi^2$ | df | Prob> $Chi^2$ |
| 5 | 10.275 | 5 | 0.0678 |

Source: Author's calculation

We are unable to reject the null hypothesis because the reported probability (0.0678) exceeds the standard significance level of 0.05. This implies that there is insufficient data to draw the conclusion that the residuals exhibit strong serial correlation (autocorrelation).

### 4.5. Major Findings

The study attempted to analyze the relationship between Bangladesh's trade balance, foreign direct investment, GDP, inflation rate, currency rate, and balance of payments from 1990 to 2021. Taking into account the results of earlier studies, an econometric model was created to regress the balance of payment on these factors. To guarantee accurate results, stationary tests were carried out, such as the Augmented Dickey-Fuller test. The variables, including balance of payments, balance of trade, foreign direct investment, gross domestic product, inflation rate, and exchange rate, were shown to be stationary, refuting the

null hypothesis of a unit root. The Shapiro-Wilk test was used to verify that the variables' and residuals' distributions were normal. The Cumulative Periodogram White-Noise Test and the Portmanteau test both confirmed the presence of white noise in the residuals, which was backed by the Durbin Watson statistic and tests like these. The ARCH-LM test showed that the residuals had constant variance. According to the Breusch-Pagan test, homoskedasticity of the variables and residuals was not found in the model. No multicollinearity problems were detected by the VIF test. Durbin's alternative test and the Breusch-Godfrey LM test indicated that the model did not contain any serial correlation.

The summary of the study are as follows: (i) the balance of payments for Bangladesh is positively and significantly impacted by the trade balance. This indicates that the nation's trade balance has a significant impact on its economic expansion and balance of payments. (ii) Foreign direct investment positively and significantly affects Bangladesh's balance of payments, demonstrating the value of this type of investment in preserving a positive balance of payments. (iii) The balance of payments for Bangladesh is negatively correlated with GDP growth. According to this result, an increase in GDP growth could upset the equilibrium of the nation's balance of payments. (iv) The rate of inflation has a positive but insignificant impact on Bangladesh's balance of payments, indicating that variations in the inflation rate have little bearing on the balance of payments. (v) Bangladesh's balance of payments is negatively and significantly impacted by exchange rates. This suggests that a rise in the exchange rate results in a fall in the country's balance of payments.

## 5. Conclusion

The present study leads to the logical conclusion that macroeconomic variables including the balance of trade, foreign direct investment, GDP growth, inflation rate, and exchange rate are important predictors of the country's balance of payments (BOP). The BOP is most significantly impacted by the trade balance and foreign direct investment among these variables, whereas GDP growth and exchange rates have the opposite effects. On the other side, the inflation rate has a beneficial but minor impact. The BOP statistics also include important information about changes in a country's foreign exchange reserves and its level of external debt. Bangladesh's international trade is mostly focused on a small group of nations, such as China, the USA, the UK, Russia, Japan, Germany, and Saudi Arabia. Bangladesh has battled with negative payment adjustments over the years due to its reliance on imports. The primary conclusion to be drawn from this study is that efficient implementation of government policies is vital in determining how the economy of a nation is formed. It emphasizes how important it is to create a friendly atmosphere for foreign investments because these investments could have an impact on the BOP and economic growth. Thus, maintaining a favorable BOP position and general economic well-being depends on the government's ability to develop and implement appropriate policies.

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## Appendix

**Table A- 1: Unit Root test using Augmented Dickey-Fuller (ADF)) results**

| Variables | ADF Test statistics | 5% critical value | P-Value | Remarks |
|---|---|---|---|---|
| BOP | -2.866 | -1.950 | 0.0080 | Stationary |
| BOT | -4.052 | -3.576 | 0.0074 | Stationary |
| FDI | -1.860 | -1.699 | 0.0365 | Stationary |
| GDP | -5.869 | -3.576 | 0.0000 | Stationary |
| INF | -4.102 | -3.576 | 0.0063 | stationary |
| EXR | -2.679 | -1.950 | 0.012 | Stationary |

Source: Author's calculation

A unit root test hypothesis is: $H_0$: The time series is non-stationary/ has a unit root and $H_1$: The time series is stationary/ does not have a unit root.

**Table A-2: Shapiro-Wilk test results**

| Variables | Obs. | W | V | z | Prob>z |
|---|---|---|---|---|---|
| BOP | 32 | 0.97920 | 0.694 | -0.759 | 0.77610 |
| BOT | 32 | 0.96134 | 1.289 | 0.528 | 0.29883 |
| FDI | 32 | 0.96607 | 1.105 | 0.207 | 0.41782 |
| GDP | 32 | 0.97470 | 0.844 | -0.353 | 0.63779 |
| INF | 32 | 0.95947 | 1.352 | 0.626 | 0.26568 |
| EXR | 32 | 0.95129 | 1.625 | 1.008 | 0.15682 |

Source: Author's calculation

According to the normalcy test hypothesis, H0: The data are normally distributed and H1: The data are not normally distributed.