

## Foreign Direct Investment, External Debt, and Balance of Payment: A Causality Analysis for Bangladesh

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### ABSTRACT

*The purpose of this study is to analyze the causal relationship of external debt and balance of payment with foreign direct investment (FDI) in Bangladesh for the period of 1980 to 2017 through the application of Johansen Cointegration technique, Vector Error Correction Model (VECM), and Granger Causality approach. Results of cointegration and VECM indicate a significant long-run relationship between dependent (FDI) and independent variables (external debt and balance of payment). External debt is found to have a significant negative impact on FDI in the long-run, but it is found insignificant in the short-run. In contrast, the balance of payment has a significant positive effect on FDI both in the long-run and short-run. Results of the Granger causality test reveal that there exists bidirectional short-run causality between the balance of payment and FDI; that is, both the balance of payment and FDI affect each other. But no unidirectional or bidirectional short-run causality is found between external debt and FDI.*

**Keywords:** FDI, external debt, balance of payment, cointegration, VECM, causality

### INTRODUCTION

With the expansion of the global free-market economy, the importance of foreign direct investment (FDI) in the developing and least developed countries of the world is increasing. Many reasons are lying behind this. Foreign investment helps meet the country's capital deficit, create job opportunities, increase the consumption of unproduced products in the country, promote technological development, and, above all, contribute to the country's economic growth. Unlike many developing countries, FDI is not a significant source of investment in Bangladesh. Since its independence, Bangladesh has been trying to create a favorable investment environment by introducing new economic policies, incentives for investors, promoting privatization, etc. Despite these, flows of FDI were very low in the 1970s and were even negative in some years of the 1980s. Since the mid-1990s, FDI flows started to rise due to the development of the domestic market, better infrastructural facilities, and availability of low-cost workers. Now Bangladesh has the most systematic investment regime in South Asia (ADB, 2006), and it is being considered as the most liberal and business-friendly economy in this region

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(Bangladesh Board of Investment, 2010). Though FDI flows in Bangladesh increased substantially by 67.89% in 2018 compared to 2017 (World Investment Report, 2019), the yearly average inflows is still far lower in Bangladesh compared with India and Pakistan, two major FDI recipients of South Asia. Therefore, it is essential to formulate appropriate policies to increase the flow of FDI in Bangladesh.

Various macroeconomic variables affect FDI flows in a country. These variables and their effects may vary from country to country. That is why economists around the world investigate various economic issues that may affect the flow of FDI in a country and make necessary recommendations for formulating policies based on it. In this paper, however, the relationship of FDI with external debt and balance of payment (BOP) will be examined because an adverse debt burden and unfavorable balance of payment is a long-standing problem for Bangladesh. The debt of the Bangladesh government has increased almost one and a half times in the last four fiscal years and is expected to double in the next five years. Even after paying off debts with interest, the overall debt of the government is increasing every year to implement the budget. Economic analysts believe that the government's debt is increasing every year due to non-collection of revenue as per the target and lack of proper debt management. If this situation continues, the country's financial sector and the government will be under a lot of pressure to repay the loan in the next few years. According to the data of the Economic Relations Division (Ministry of Finance, Bangladesh), external debt in Bangladesh reached \$33.51 billion in June 2018 from \$28.34 billion in the previous year. Since its independence, the country's foreign borrowing has been \$51.83 billion till June 2018. The government has repaid only \$22.71 billion, among which \$16.84 billion is the principal amount, and \$5.87 billion is the interest. Hence the outstanding debt (principal) stood at \$34.99 billion till June 2018. As a result, the pressure of repayment is increasing over time.

Moreover, the risk of foreign debt is gradually increasing in Bangladesh. This risk is increasing as state-owned and autonomous institutions are taking inflexible loans (hard-term loans) against government guarantees. Not only that, due to the global economic downturn, the European-centric debt crisis, and changes in the geopolitical context, the source of flexible credit is also shrinking.

Another concern for Bangladesh is the deficit in the balance of payments it has been experiencing since independence. Excessive dependence on imports and borrowing from foreign sources to implement development plans have made the trade deficit a permanent problem for Bangladesh. Due to frequent catastrophic storms, floods, and other natural calamities in the last three decades, Bangladesh has had to import vast amounts of food grains, which resulted in a massive deterioration in the country's balance of payments situation. Besides, the rise in import prices and the instability of the flow of export earnings has led to an abnormal deterioration of the trade situation in Bangladesh, resulting in a persistent deficit in trade accounts of the balance of payments. In 2002, for the first time, a surplus was seen in the balance of payment of Bangladesh. After several years of surplus in its continuity, the deficit was seen again in 2017. Most economists are concerned about the growing trade deficit in Bangladesh. The World Bank recently released an updated report on Bangladesh's economy, commenting on the trade deficit as one of the significant challenges.

External debt, the balance of payment, and FDI are interlinked. All three issues are concerned with foreign relations with a country. In Bangladesh, very few studies have been

conducted to estimate the relationship of FDI with various macroeconomic determinants. But no previous research has investigated the impact of external debt and balance of payment on FDI and their causal relationship by applying an advanced econometric approach. This study investigates the impacts of external debt, and balance of payment on FDI flows in Bangladesh for the period 1980-2017 by using the Vector Error Correction Model and Granger Causality approach as an attempt to fill up the gap in the academic literature. Since the importance of FDI in the economy of Bangladesh is undeniable, it is momentous to examine whether there is a link between these two chronic problems and the flow of FDI. The results of this study can play an essential role in formulating policies to attract FDI in Bangladesh.

## **LITERATURE REVIEW**

Many studies have been conducted to examine the nature and direction of the causal relationship of FDI inflows with external debt and balance of payment. An overview of some of these studies is given below:

### **External Debt and FDI**

External debt is the portion of a country's debt that was borrowed from foreign lenders, including commercial banks, governments, or international financial institutions. These loans, including interest, have to be paid in the currency in which the loan was made. The borrowing country may sell and export goods to the lender's country to earn the needed currency. It has both positive as well as negative effects on the economy. Though external debt creates pressure on the economy, it is a vital source of financing government budget deficit. Proper utilization of public debt can promote economic growth and develop the social welfare of the citizen. According to Onyeiwu & Shrestha (2004, p.96), debt may be a result of inappropriate macroeconomic policies that discourage foreign investment. Azam & Khan (2011) mention that a higher debt burden creates constraints not only in terms of new private lending but also in terms of FDI inflows.

There have been several studies on the relationship between external debt, and FDI flows in a country. Ostadi & Ashja (2014) examined the relationship between external debt and foreign direct investment in D-8 member countries using panel data over the period 1995-2011. The results show that external debt has a significant negative effect on foreign direct investment in D-8 countries. The study explained the impact of external debt on FDI inflows to D-8 countries as a whole but did not interpret the results separately for each country. Therefore, although Bangladesh is a member country of D-8, this study does not confirm the effect of external debt on FDI inflows to Bangladesh. Tanna et al. (2018) investigated the relevance of external debt as a factor inhibiting economic growth gains to be accrued from FDI using 5-year averaged data for 39 developing countries, including Bangladesh, over the period 1984-2010. They noticed a significant negative influence of high external debt on FDI-growth nexus. Their study did not directly examine the effect of external debt on FDI, but instead reviewed the impact of external debt on FDI-induced growth. Therefore, it is difficult to get an idea of the impact of external debt on FDI inflows in Bangladesh from this study. Moreover, both studies were conducted using data from about ten years ago that may not be consistent with the current data.

There are two more panel analyses in this regard where Bangladesh is not included. Onyeiwu & Shrestha (2004) applied the fixed and random effects models to explore the magnitude, dynamics, and determinants of FDI in Africa using a panel dataset for 29 African countries over the period 1975 to 1999. In their study, external debt was found insignificant for FDI flows to Africa in the fixed-effect model but significant in the random-effects model. They got two different results in two methods from which it is not possible to understand the real effect of external debt on FDI. Hunady & Orvisca (2014) identified the key determinants of FDI in 26 EU countries covering the period 2004 to 2011 based on panel data regression models. The results suggest that higher public debt positively influences FDI. One of the possible explanations of this result is that countries with higher public debt have a better quality of infrastructure, services, and institutions due to higher public expenditures in previous periods. Although Bangladesh is plagued by external debt, its infrastructural development has not yet reached the level of EU countries. Therefore no conclusion can be drawn in favor of Bangladesh from the results of this study.

Ouhibi et al. (2017) conducted a study to examine the causal relationship between public debt, foreign direct investment, and economic growth in the southern Mediterranean countries using annual data for 26 years from 1990 to 2015. The empirical findings show that public debt has a significant negative effect on FDI. They also found that there exists a unidirectional causal relationship running from public debt to foreign direct investment. Ajisafe et al. (2006) also investigated the causal relationship between external debt and foreign private investment in Nigeria between 1970 and 2003. It is evident from their findings that there exists a bi-directional relationship between external debt and foreign private investment in Nigeria; this implies that both external debt and foreign private investment leads to one another. The result of the analysis suggests that external debt contributes significantly to foreign private investment in Nigeria. However, it is not evident from this study, whether the effect of external debt on FDI is positive or negative.

Kaur & Sharma (2013) explore the determinants that influence the inflows of FDI into India based on quarterly data during the periods 1990-1991 and 2010-2011. In their findings, long-term debt (external indebtedness) is found to have a positive impact on FDI. In line with this result, Kiprotich (2015), Wani & Rehman (2017), and Azam & Khan (2011) also found a positive correlation between external debt and FDI in Kenya (2000-2014), Afghanistan (2005-2015), and Pakistan (1981-2007) respectively. Among these countries, Afghanistan is remarkably rich in natural resources, Kenya is one of the largest foreign aid recipients in Africa, India and Pakistan are the highest and second-highest FDI attracting countries in South Asia, respectively. Despite differences in size and economic characteristics, similar results have been found in these countries. Again, previous reviews have shown that despite considerable similarities between the countries, their results have differed.

In summary, the previous literature on the impact of external debt on FDI is inconclusive. While some studies have shown a positive influence of external debt on FDI, other studies indicate a negative effect among them. This nebulosity needs further investigation, especially in Bangladesh, where the trend of FDI inflows is increasing. On the other hand, external debt as another source of finance has been growing every year due to a deficit budget, especially for development projects.

## **Balance of Payment and FDI**

The Balance of Payment is a statement or record of all economic transactions made between a country and the rest of the world within a particular period (e.g., a year). These records include all external visible and non-visible transactions of a country made by individuals, firms, and government bodies. There are three main categories of BOP: the current account, the financial account, and the capital account. BOP statement of a country indicates whether the country has a surplus or a deficit of funds. When a country's export is more than its import, its BOP is said to be in surplus. On the other hand, the BOP deficit indicates that a country's imports are more than its exports. According to economist J. M. Keynes, a lack of trade balance between the two countries could have severe consequences for the deficit economy. Amir & Mehmood (2012) state, if FDI is concentrated in export promotion industries, it will increase the exports of a host country, which will improve the BOP situation. But FDI inflows tend to increase imports of a recipient country because MNCs import capital and intermediate goods and services, which will deteriorate BOP of a host country.

Several studies have been conducted to understand the relationship between the balance of payment and FDI in both developed and developing countries. Wint & Williams (2002) developed a model of determinants of foreign direct investment flows to test the extent to which countries can attract foreign direct investment through promotional activities differentially. The model was tested on randomly chosen 36 developing countries. They found that the current account has no significant impact on FDI. Amir & Mehmood (2012) analyzed the long-run impact of FDI on real imports and real exports in Pakistan. This study shows that FDI inflows have a positive effect on imports as well as exports of Pakistan, and the net impact of FDI on BOP is positive. By employing the autoregressive distributive lag (ARDL) approach, Jaffri et al. (2012), investigate the effect of FDI inflows on current account balance excluding current transfers (CABECT) and income outflows (IO) of the balance of payments (BOP) of Pakistan for the period 1983-2011. The results of the study show that an increase in FDI causes an increase in IO and worsens CABECT of Pakistan in the long-run. Although Wint & Williams (2002) examined the effect of the balance of payment on FDI, the result was insignificant. On the other hand, Amir & Mehmood (2012) and Jaffri et al. (2012) have explained the effect of FDI on the balance of payment. So, no idea about the impact of the balance of payment on FDI can be developed from here.

Other studies have tried to determine the causal relationship between FDI and the balance of payment. Siddiqui et al. (2013) investigate the relationship between FDI and current account (CA) in Pakistan using quarterly data from 1976:Q1 up to 2005:Q4. The results indicate that FDI and CA are cointegrated and thus exhibit a reliable long-run relationship. The Granger causality test findings indicate a unidirectional causality running from FDI to CA. Mukherjee et al. (2014) attempt to explore the underlying long-term cointegrated relationship between FDI inflow in India and current account balance (CAB) by analyzing quarterly data over the period 1990-1991: Q1 to 2010-2011: Q4. Their result indicates that there exists a unique long-run relationship among FDI and CAB with two endogenous structural breaks. The analysis also reveals a unidirectional causality from India's FDI to CAB at a 5% level. The results of both studies indicate that, although the current account is affected by FDI, FDI is not affected by the current account. Rahman (2016) aims to measure the impact of FDI inflows on the capital account of India's balance of payment for the period 1991-1992 to 2014-2015. The results show that there is

bidirectional causality between capital account balance and FDI inflows; this means that FDI inflows impact capital account balance in India, and capital account balance also impacts FDI inflows as well. Bedir & Soydan (2016) empirically investigate the relationship between FDI and current account deficits in several middle-income countries, by focusing on the indirect links through exports and imports. Most of the countries in their panel do not seem to have any association between FDI and exports and imports for the period of analysis.

Similar to the relationship of FDI with external debt, empirical studies have mixed conclusions regarding the relationship between the balance of payment and FDI. No acceptable link was found between them. This difference is usually due to differences in the country, the method used, and the data collected. Since Bangladesh faces an unfavorable balance of payment most of the time and FDI is crucial for its development, it is necessary to study whether it has any effect on FDI inflows.

The results of the literature review are briefly presented in Table-1 below for easy understanding.

**Table 1: Summary of Literature Review**

Relationship with FDI	External Debt	Balance of Payment
Positive	Kaur & Sharma (2013) Hunady & Orvisca (2014) Kiprotich (2015) Wani & Rehman (2017)	Amir & Mehmood (2012)
Negative	Azam & Khan (2011) Ostadi & Ashja (2014) Ouhibi et al. (2017) Tanna et al. (2018)	Jaffri et al. (2012)
Insignificant	Onyeiwu & Shrestha (2004)	Wint & Williams (2002)
Causes FDI	Ajisafe et al. (2006) Ouhibi et al. (2017)	Rahman (2016) Bedir & Soydan (2016)
Caused by FDI	Ajisafe et al. (2006)	Siddiqui et al. (2013) Mukherjee et al. (2014) Rahman (2016) Bedir & Soydan (2016)

### Data and Variables

Time series data are collected from World Development Indicators covering the period 1980 to 2017 to meet the purpose of the study. Table-2 represents a description of the variables used in this study and their secondary sources.

**Table 2:** Description of the Variables

Variable	Type	Description	Sources of Data
Foreign Direct Investment (FDI)	Dependent Variable	Net FDI inflows (Current US\$)	World Development Indicators (World Bank)
External Debt (EXD)	Independent Variable	External Debt Stocks (% of GNI)	World Development Indicators (World Bank)
Balance of Payment (BOP)	Independent Variable	Current Account Balance (% of GDP)	World Development Indicators (World Bank)

**Econometric Model**

In this study, the ordinary least square (OLS) estimation method is used. The multiple linear regression model is specified as:

$$FDI = f(EXD, BOP) \dots\dots\dots (1)$$

Since our data is collected at discrete points in time, the model can be expressed as:

$$FDI_t = f(EXD_t, BOP_t) \dots\dots\dots (2)$$

Variables are expressed in the logarithmic form to avoid situations of existing the non-linear relationships between the dependent and independent variables. After converting the data into a logarithm form, the model can be represented as:

$$LFDI_t = \beta_0 + \beta_1 LEXD_t + \beta_2 LBOP_t + \mu_t \dots\dots\dots (3)$$

Where,

- $LFDI_t$  = Natural logarithm of foreign direct investment at time  $t$
- $LEXD_t$  = Natural logarithm of external debt at time  $t$
- $LBOP_t$  = Natural logarithm of balance of payment at time  $t$
- $\mu_t$  = Error term
- $\beta_0$  = Intercept
- $\beta_1, \beta_2$  = coefficient parameters to be estimated.

**METHODS OF DATA ANALYSIS**

As mentioned earlier, this research aims to explore the causal relationship of FDI with external debt and the balance of payment. Various time series econometric techniques are employed in this study to fulfill our objectives. At the beginning of time series data analysis, one has to check whether the series is stationary or not. A time series is said to be stationary if its mean and variance are constant over time. If all the variables are found stationary at their levels, i.e., I(0), we can simply apply Ordinary Least Square (OLS) estimation. If the variables are stationary at different orders, e.g., I(0) and I(1), we adopt Autoregressive Distributed Lag (ARDL) model because this model avoids the problem of variables in stationary tests having mixed results in their orders. But If all the series are stationary at the first difference, i.e., I(1), we examine the cointegration between them using Johansen Cointegration Test. If the two series are found cointegrated, we estimate the time series by using the Vector Error Correction Model (VECM).

But if the two series are not cointegrated, we apply unrestricted VAR approach. Then we need to conduct a Granger causality test to know the direction of causality. Note that Eviews 10 software is used to apply these econometric techniques.

**Unit Root Test**

A unit root refers to a stochastic trend in time series that can cause problems in statistical inference involving time series models. The presence of unit roots makes a time series non-stationary, which creates a problem because the non-stationarity of data breaks down the normal properties of test statistics (t-statistic, F-statistic, etc.) and R<sup>2</sup>. Running a regression with such data may produce invalid or spurious results. Therefore, it is important to check the stationarity of data before proceeding with estimates. There are several tests of stationarity. Among them, Phillips–Perron (PP) test, Augmented Dickey-Fuller (ADF) test, and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests are prominently applied in the literature. In this study, however, the Phillips-Perron (PP) Test is applied to test the stationarity of the variables as it is widely used in the literature.

**Phillips-Perron (PP) Test**

In 1988, Phillips and Perron developed a non-parametric statistical method to take care of the serial correlation in the error terms without adding lagged difference terms. It takes the same estimation scheme as in the Dickey-Fuller test. Still, it corrects for any serial correlation and heteroscedasticity in the errors of the test regression by directly modifying the test statistic. The main disadvantage of the PP test is that it is based on asymptotic theory. Therefore it works well only in large samples. The PP test detects the presence of a unit root in a series by estimating the following regressions:

No intercept, no trend :  $\Delta Y_t = \gamma Y_{t-1} + \varepsilon_t$  ..... (4)

Intercept, but no trend :  $\Delta Y_t = \alpha + \gamma Y_{t-1} + \varepsilon_t$  ..... (5)

Intercept and trend :  $\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \varepsilon_t$  ..... (6)

where  $\alpha$  is the intercept (constant),  $\beta$  is the coefficient of time trend  $t$ ,  $\gamma$  is the parameter,  $\Delta Y$  is the first difference of Y series, and  $\varepsilon_t$  is the error term. The null and alternative hypothesis for the existence of a unit root in variable  $Y_t$  is:

- H<sub>0</sub> :  $\gamma = 0$  ; unit root is present
- H<sub>1</sub> :  $\gamma < 0$  ; there is no unit root

The PP test is verified by the  $t$  value associated with the estimated coefficient of  $\gamma$ . The series will be stationary if  $\gamma$  is negative and significant.



**Table 3: Phillips-Perron (PP) Test Result**

Var.	Test for Unit Root	Test Equation	PP. Test Statistic	Critical Values at 5% Level	P-Value	Inference
LFDI	Level	Constant	-3.3661	-2.9434	0.0188	Non-Stationary
		Constant & Trend	-7.1000	-3.5366	0.0000	
		None	0.0918	-1.9501	0.7057	
	1st Difference	Constant	-28.600	-2.9458	0.0001	Stationary
		Constant & Trend	-29.585	-3.5403	0.0000	
		None	-17.394	-1.9504	0.0000	
LEXD	Level	Constant	-0.8370	-2.9434	0.7966	Non-Stationary
		Constant & Trend	-6.4005	-3.5366	0.0000	
		None	-0.2975	-1.9501	0.5718	
	1st Difference	Constant	-4.3530	-2.9458	0.0015	Stationary
		Constant & Trend	-4.7786	-3.5403	0.0025	
		None	-4.4227	-1.9504	0.0001	
LBOP	Level	Constant	-2.5542	-2.9434	0.1115	Non-Stationary
		Constant & Trend	-3.5462	-3.5366	0.0490	
		None	-1.5288	-1.9501	0.1169	
	1st Difference	Constant	-7.7316	-2.9458	0.0000	Stationary
		Constant & Trend	-11.058	-3.5403	0.0000	
		None	-7.3653	-1.9504	0.0000	

Table-3 reveals that all the variables are non-stationary at their levels but become stationary after the first difference. At first difference, the calculated PP test statistics and corresponding p-values clearly reject the null hypotheses of unit root at 5% significance levels. This result suggests a cointegration analysis to examine the long-run relationship between the variables.

### Cointegration Analysis

The concept of cointegration was first introduced by Granger in 1981 and developed by Engle and Granger in 1987. Cointegration between two-time series suggests that there exists a long run or equilibrium relationship between them. It has been identified that two or more time-series data can be cointegrated even though each of the series is individually non-stationary. When we go for running cointegration analysis, we assume that all the variables are non-stationary and integrated of the same order. There are three main methods for the cointegration test – Engle-Granger two-step method, Johansen cointegration test, and Phillips-Ouliaris cointegration test. Due to some advantages, the Johansen test will be used in this model.

### Johansen Test

Johansen's (1988) cointegration approach is applied to examine the long-run relationship that may exist among the variables. The Johansen approach suggests a maximum likelihood procedure to obtain cointegrating vectors and speed of adjustment coefficient identifying the number of cointegrating vectors within the Vector Autoregressive (VAR) model. Since

Johansen's method follows the VAR-based cointegration test, considering a VAR model of order  $p$ :

$$Y_t = \alpha + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \dots \dots \dots (7)$$

Where  $Y_t$  is an  $(n \times 1)$  vector of  $I(1)$  variables,  $\alpha$  is an  $(n \times 1)$  vector of constants,  $A_p$  is an  $(n \times n)$  matrix of coefficients,  $p$  is the maximum lag included in the model, and  $\varepsilon_t$  is an  $(n \times 1)$  vector of error terms. Since  $Y_t$  is assumed to be non-stationary, it is convenient to rewrite equation (7) in its first difference or error correction form as:

$$\Delta Y_t = \alpha + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \dots + \Gamma_{k-1} \Delta Y_{t-(p-1)} + \Pi Y_{t-p} + \varepsilon_t \dots \dots \dots (8)$$

Where,  $\Gamma_i = (A_1 + A_2 + \dots + A_{p-1} - I)$  represents the short-run dynamics of the model,  $\Pi = (A_1 + A_2 + \dots + A_p - I)$  represents the long-run relationship among the variables included in the vector  $Y_t$ , and  $I$  is the identity vector. The key idea of the Johansen approach is to determine the rank  $r$  of the matrix  $\Pi$ , which represents the number of cointegrating vectors among the variables. If  $r = 0$ , then there are no cointegrating vectors.

Johansen suggests two test statistics for estimating the number of cointegrating vectors or equations – Trace test statistic and Max-eigen value test statistic.

Trace Test Statistics :  $\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \dots \dots \dots (9)$

$H_0: r \leq n$  (there are at most  $n$  number of cointegrating vectors)

$H_1: r > n$  (there are at least  $n$  number of cointegrating vectors)

Max-eigen Value Test Statistics :  $\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \dots \dots \dots (10)$

$H_0: r = n$  (there are exactly  $n$  number of cointegrating vectors)

$H_1: r = n+1$  (there are exactly  $n+1$  number of cointegrating vectors)

Where  $r$  is the number of cointegrating vectors,  $T$  is the sample size and  $\hat{\lambda}$  is the estimated eigenvalue. If the estimated statistic (Trace and/or Max-eigen Value) is greater than the critical value, then the relevant null hypothesis is rejected, and the alternative hypothesis is accepted, meaning that there is a long-run relationship between the dependent variable and independent variable(s). If there comes up a different result between trace statistic and maximum eigenvalue test, then the maximum eigenvalue result is preferred.

**Selection of Lag**

The first step of the cointegration test is the selection of lag order. Five different methods, namely Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQ) are applied to determine the lag lengths used in the VAR. From Table-4, it is seen that all the five methods are suggesting lag 3. So, the optimal lag order for the VAR model is 3.

**Table 4:** VAR Lag Order Selection Criteria

Endogenous Variables: LFDI LEXD LBOP			Exogenous Variables: C			
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-127.5243	NA	0.348174	7.458531	7.591847	7.504552
1	-69.23213	103.2604	0.020884	4.641836	5.175098	4.825918
2	-62.49864	10.77358	0.024092	4.771351	5.704560	5.093495
3	-30.28377	46.02125*	0.006606*	3.444787*	4.777942*	3.904992*

\* indicates lag order selected by the criterion

Both the trace test (Table-5A) and maximum eigenvalue test (Table-5B) reject the null hypothesis of no cointegration at a 5% significance level, and both the test indicate 3 cointegrating equations at a 5% significance level. Therefore, it can be concluded that a significant long-run relationship exists between dependent and independent variables.

Table-5C represents the existing cointegrating equation of the dependent variable LFDI. The coefficients are statistically significant at 5% level. The signs of the coefficients are reversed in the long run. The equation indicates that in the long run, LEXD has a negative impact on FDI. That is, an increase in LEXD will lead to a decrease in LFDI. The equation also indicates that LBOP has a positive impact on FDI in the long run, which means that an increase in LBOP will lead to an increase in LFDI.

**Table 5:** Johansen Co-integration Test Result**Table 5A:** Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value (at 0.05 level)	Prob.
None *	0.622816	60.22741	29.79707	0.0000
At most 1 *	0.447787	27.07662	15.49471	0.0006
At most 2 *	0.183354	6.886696	3.841466	0.0087

Trace test indicates 3 cointegrating equation(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

**Table 5B:** Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value (at 0.05 level)	Prob.
None *	0.622816	33.15079	21.13162	0.0007
At most 1 *	0.447787	20.18992	14.26460	0.0052
At most 2 *	0.183354	6.886696	3.841466	0.0087

Max-eigenvalue test indicates 3 cointegrating equation(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

**Table 5C:** Cointegrating Equation

Normalized cointegrating coefficients (standard error in parentheses)		
LFDI	LEXD	LBOP
1.000000	3.921741 (0.82487)	-3.068993 (0.40950)

**Vector Error Correction Model (VECM)**

If there exist at least one or more cointegrating relationships among the variables, then Vector Error Correction Model (VECM) is applied to investigate the long-run causality and short-run dynamics of the cointegrated variables. The basis of VECM is the Granger Representation Theorem (Engle and Granger, 1987) which states that if two variables are cointegrated, then there exists a unidirectional or bi-directional Granger causality between them and an error correction model (ECM) combines the long-run relationship with the short-run dynamics of the model.

Equation (8) can be rewritten in conventional ECM form as follows:

$$\Delta Y_t = \alpha + \sum_{i=1}^p \Gamma_i \Delta Y_{t-i} + \Pi Y_{t-p} + \varepsilon_t \dots\dots\dots (11)$$

Where,  $\Pi = \sum_{i=1}^p A_i - I$  and  $\Gamma_i = -\sum_{j=i+1}^p A_j$ . The matrix  $\Pi$  contains the information regarding the long-run coefficients of the variable  $Y_t$  in the vector.

From equation (1), the vector error correction model (VECM) can be written as:

$$\begin{aligned} \Delta LFDI_t = & \alpha + \beta(LFDI_{t-1} - \gamma_0 + \gamma_1 LEXD_{t-1} - \gamma_2 LBOP_{t-1}) + \lambda_1 \Delta LFDI_{t-1} + \lambda_2 \Delta LFDI_{t-2} \\ & + \lambda_3 \Delta LFDI_{t-3} + \delta_1 \Delta LEXD_{t-1} + \delta_2 \Delta LEXD_{t-2} + \delta_3 \Delta LEXD_{t-3} + \sigma_1 \Delta LBOP_{t-1} \\ & + \sigma_2 \Delta LBOP_{t-2} + \sigma_3 \Delta LBOP_{t-3} \dots\dots\dots (12) \end{aligned}$$

The above equation is the error correction equation where  $\Delta$  shows the changes in the variables;  $\beta$  is the adjustment parameter.

**Table 6:** Result of Vector Error Correction Model (VECM)

Cointegrating Eq:	CoIntEq1		
LFDI(-1)	1.000000		
LEXD(-1)	3.921741		
LBOP(-1)	-3.068993		
C	-28.05609		

Error Correction:	D(LFDI)	D(LEXD)	D(LBOP)
CoIntEq1	-1.557412	-0.008469	0.150508
D(LFDI(-1))	0.595821	-0.000317	-0.148017
D(LFDI(-2))	0.819813	7.12E-05	-0.144434
D(LFDI(-3))	0.819117	0.001735	-0.003349
D(LEXD(-1))	1.649813	0.356041	-0.244707
D(LEXD(-2))	1.054984	-0.318195	-1.224384
D(LEXD(-3))	-13.04600	0.262193	0.979719
D(LBOP(-1))	0.723516	0.024609	0.433547
D(LBOP(-2))	-4.232019	-0.014233	-0.094605
D(LBOP(-3))	0.933939	0.003099	0.127831
C	-0.030475	-0.010646	0.017755

From Vector Error Correction Estimates (Table-6) we obtain,

The cointegrating equation (long-run model):

$$ECT_{t-1} = 1.000000LFDI_{t-1} + 3.921741LEXD_{t-1} - 3.068993LBOP_{t-1} - 28.05609 \dots\dots\dots (13)$$

Where ECT is Error correction Term. We obtain from equation (13),

$$LFDI_{t-1} = 28.05609 - 3.921741LEXD_{t-1} + 3.068993LBOP_{t-1} - ECT_{t-1} \dots\dots\dots (14)$$

Equation (14) is similar to the cointegrating equation produced by the Johansen method (Table-5C). We may interpret equation (14) as follows: A one-unit increase in external debt leads to a 3.92 unit decrease in FDI in Bangladesh. Similarly, a one-unit increase in the balance of payment will increase FDI by 3.7 units.

The lower part of Table 6 contains 3 columns for error correction estimates of 3 dependent variables, namely D(LFDI), D(LEXD), and D(LBOP). Among these 3 variables, our target dependent variable is D(LFDI). So we obtain the estimated VECM with D(LFDI) as target variable:

$$\begin{aligned} \Delta LFDI_t = & -1.557412ECT_{t-1} + 0.595821\Delta LFDI_{t-1} + 0.819813\Delta LFDI_{t-2} + 0.819117\Delta LFDI_{t-3} \\ & + 1.649813\Delta LEXD_{t-1} + 1.054984\Delta LEXD_{t-2} - 13.04600\Delta LEXD_{t-3} + 0.723516\Delta LBOP_{t-1} \\ & - 4.232019\Delta LBOP_{t-2} + 0.933939\Delta LBOP_{t-3} - 0.030475 \dots\dots\dots (15) \end{aligned}$$

Where  $ECT_{t-1}$  is defined in equation (13). Equation (15) is nothing but the numerical representation of the vector error correction model of equation (12). As an interpretation, it can be said that a unit increase in FDI of lag 1 is associated with a 0.595821 times increase in FDI on average. Again, the coefficient of  $LEXD_{t-3}$  is -13.046, which means that a unit increase in external debt of lag 2 is associated with a 13.046 times decrease in FDI.

From Table-6, we see that the coefficient of error correction terms of FDI is -1.557412. That is, about 155.74% of disequilibrium corrected each year by changes in FDI. The interpretation is that the previous period's deviation from long-run equilibrium is corrected in the current period as an adjustment speed of 155.74%. It confirms the stability of the system. The coefficient of error correction term of external debt is -0.008469. It implies that any divergence from equilibrium due to changes in external debt is corrected in the current period at a speed of 0.85%. It means that the speed of adjustment of external debt towards equilibrium is a slow one. Similarly, the speed of adjustment towards equilibrium of the balance of payment is 15.05%.

### Long-run Causality

In Table-7, C(1) is the error correction term or speed of adjustment towards long-run equilibrium. The value of C(1) has to be negative and statistically significant to retain its economic interpretation. In our model, the value of C(1) is -1.557412, and the corresponding p-value is 0.0043. That is, C(1) is negative in sign and statistically significant at 5% level. So, there is a long-run causality running from LEXD and LBOP to LFDI. The value of C(1) in our model also tells us that the speed of adjustment of any disequilibrium towards long-run equilibrium is 155.74%.

Our findings indicate that external debt has a significant negative impact on FDI in the long-run. This result is consistent with the findings of Azam & Khan (2011), Ostadi & Ashja (2014), Ouhibi et al. (2017), and Tanna et al. (2018) but in contrast with the findings of Kaur & Sharma (2013), Hunady & Orvisca (2014), Kiprotich (2015), and Wani & Rehman (2017). On the other hand, the balance of payment has a significant positive impact on FDI in the long-run.

Though this finding is as expected and is similar to the result of Amir & Mehmood (2012), it confronts the conclusions from Jaffri et al. (2012).

**Table 7:** Results of Ordinary Least Square Estimates

Dependent Variable: D(LFDI)				
Method: Least Squares (Gauss-Newton / Marquardt steps)				
$D(LFDI) = C(1)*(LFDI(-1) + 3.92174096194*LEXD(-1) - 3.06899266208*LBOP(-1) - 28.0560859072) + C(2)*D(LFDI(-1) + C(3)*D(LFDI(-2) + C(4)*D(LFDI(-3) + C(5)*D(LEXD(-1) + C(6)*D(LEXD(-2) + C(7)*D(LEXD(-3) + C(8)*D(LBOP(-1) + C(9)*D(LBOP(-2) + C(10)*D(LBOP(-3) + C(11)$				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.557412	0.492409	-3.162842	0.0043
C(2)	0.595821	0.429250	1.388051	0.1784
C(3)	0.819813	0.401347	2.042655	0.0527
C(4)	0.819117	0.367674	2.227838	0.0360
C(5)	1.649813	7.632941	0.216144	0.8308
C(6)	1.054984	6.411326	0.164550	0.8707
C(7)	-13.04600	6.053403	-2.155152	0.0419
C(8)	0.723516	1.423186	0.508378	0.6160
C(9)	-4.232019	1.076071	-3.932844	0.0007
C(10)	0.933939	0.935179	0.998674	0.3283
C(11)	-0.030475	0.510864	-0.059654	0.9529
R-squared	0.696000	Akaike info criterion		5.006574
Adjusted R-squared	0.563826	Schwarz criterion		5.500397
F-statistic	5.265786	Hannan-Quinn criter.		5.174982
Prob(F-statistic)	0.000484	Durbin-Watson stat		1.515403

**Short-run Causality**

In Table-7, C(5), C(6), C(7) are the short-run coefficients associated with LEXD, and C(8), C(9), C(10) are the short-run coefficients associated with LBOP. To know whether LEXD and LBOP have a short-run causality with LFDI, we need to run the Wald Test for these coefficients.

**Table 8:** Wald Test Results

Null Hypothesis	Test Statistic	Value	Probability	Inference
C(5) = C(6) = C(7) = 0	F-statistic	1.736576	0.1875	Accepted
	Chi-square	5.209729	0.1571	
C(8) = C(9) = C(10) = 0	F-statistic	5.805133	0.0042	Rejected
	Chi-square	17.41540	0.0006	

From Table-8 it is seen that p-value of chi-square for null hypothesis C(5) = C(6) = C(7) = 0 is 0.1571 (15.71%) which is more than 5%. That is, we cannot reject the null hypothesis. So, there is no short-run causality running from LEXD to LFDI. In other words, LEXD is insignificant in explaining changes in LFDI in the short-run.

Wald test results also show that that p-value of chi-square for null hypothesis  $C(8) = C(9) = C(10) = 0$  is 0.0006 (0.06%) which is less than 5%. So, we can reject the null hypothesis; this means that there is a short-run causality running from LBOP to LFDI. Among these three coefficients, only  $C(9)$  is statistically significant at 5% level. That is, Lagged 2 values of LBOP has a significant relationship with FDI in the short-run.

**Causality Test**

To know the direction of the causality between variables, the Granger causality test (1969) is applied. Suppose we have two variables X and Y. The cointegration tells us about the long-run and short-run relationships among these two variables. At the same time, causality indicates whether X is causing Y, or Y is causing X, or both variables are causing each other. However, between X and Y, if X Granger causes Y and Y Granger causes X, we call it bidirectional causality. If only one exists, then it is the case of unidirectional causality. If neither do exist, then the variables are independent of each other.

The concept of Granger causality is based on the assumption that the future cannot cause the past, but the past causes the present or the future. A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and lagged values of Y also), that those X values provide statistically significant information about future values of Y. Causality between X and Y, that is, whether Y is caused by X ( $X \rightarrow Y$ ) or X is caused by Y ( $Y \rightarrow X$ ), can be represented by the following pair of regressions:

$$Y_t = \sum_{i=1}^n \alpha_i X_{t-i} + \sum_{i=1}^n \beta_i Y_{t-i} + \varepsilon_t \dots\dots\dots (15)$$

$$X_t = \sum_{i=1}^n \gamma_i X_{t-i} + \sum_{i=1}^n \delta_i Y_{t-i} + \varepsilon_t \dots\dots\dots (16)$$

Equation (15) postulates that current Y is related to the past value of itself as well as that of X, and equation (16) postulates that current X is related to the past value of itself as well as that of Y. The null and alternative hypothesis for the equations are as follows:

$H_0$ : X does not Granger cause Y and vice versa

$H_1$ : X does Granger cause Y and vice versa.

**Table 9:** VEC Granger Causality Test Results

Dependent variable: D(LFDI)				
Excluded	Chi-square	df	Probability	Inference
D(LEXD)	5.209733	3	0.1571	Accepted
D(LBOP)	17.41539	3	0.0006	Rejected

Dependent variable: D(LEXD)				
Excluded	Chi-square	df	Probability	Inference
D(LFDI)	0.148671	3	0.9854	Accepted
D(LBOP)	0.453598	3	0.9290	Accepted

Dependent variable: D(LBOP)				
Excluded	Chi-square	df	Probability	Inference
D(LFDI)	57.25337	3	0.0000	Rejected
D(LEXD)	5.001264	3	0.1717	Accepted

Table-9 reveals the results of the VEC Granger Causality Test. The upper box is for the dependent variable D(LFDI) under which there are two null hypotheses. The first null hypothesis, D(LEXD), does not Granger cause D(LFDI), cannot be rejected as the concerned p-value 0.1571 is greater than 0.05 or even 0.10. But the second null hypothesis, D(LBOP) does not Granger cause D(LFDI), is rejected as the p-value (0.0006) in this case is less than 0.01. So, D(LBOP) Granger causes D(LFDI), which is significant at a 1% level. It is seen from the table that both the null hypotheses in the middlebox are rejected as the corresponding p-values exceed the specified limit. The first null hypothesis in the lower box, D(LFDI) does not Granger cause D(LBOP), is rejected as the concerned p-value 0.0000 is less than 0.01. Therefore, D(LFDI) Granger causes D(LBOP) at 1% significant level. The other null hypothesis in the lower box cannot be rejected. So, the results indicate that a bidirectional Granger causality exists between D(LFDI) and D(LBOP), which means that each leads to another.

**Results of Residual Diagnostic Tests**

**Table 10:** Breusch-Godfrey Serial Correlation Test Result

F-statistic	1.876060	Prob. F(3, 20)	0.1662
Obs*R-squared	7.466708	Prob. Chi-Square(3)	0.0584

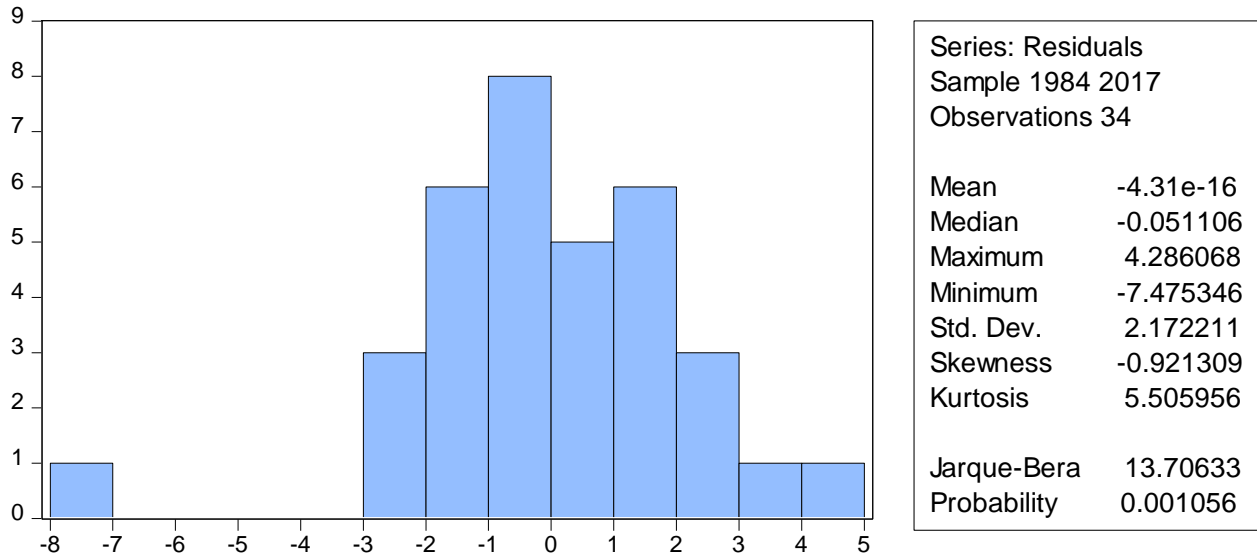
From Table-10, we see that the p-value of chi-square is 0.0584 (5.84%), which is more than 5%. Therefore we cannot reject the null hypothesis. So, there is no serial correlation in the model.

**Table 11:** ARCH Heteroskedasticity Test Result

F-statistic	0.310020	Prob. F(3, 27)	0.8179
Obs*R-squared	1.032289	Prob. Chi-Square(3)	0.7934



We see from Table-11 that the p-value of chi-square is 0.7934 (79.34%), which is more than 5%. Therefore we cannot reject the null hypothesis. So, there is no ARCH effect in the model



**Figure 1: Jarque-Bera Normality Test Result**

Chart-1 shows that the P-Value of Jarque-Bera is 0.01%, which is less than 5%. We can reject the null hypothesis. So, residuals in this model are not normally distributed.

The above diagnostic tests were performed to evaluate the goodness-of-fit of the model. The results suggest that there is no serial correlation and heteroscedasticity in the model, but the model is not normally distributed. The value of R-squared is 0.696, which means that the model explains only 69.6% of the variations of LFDI. The p-value of F-statistic (0.000484) is less than 5%, which is also a good sign for the model. We, therefore, can conclude that the model has a good fit.

## SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

This paper aims to examine the causal relationship of external debt and balance of payment with foreign direct investment in Bangladesh. Time-series data on dependent and independent variables have been collected from secondary sources covering the period 1980 to 2017 to meet the purpose of the study. Phillips-Perron (PP) Test, Johansen Cointegration Test, Vector Error Correction Model (VECM), and Granger Causality Test are employed in this model for estimation purposes. Besides, various diagnostic tests are applied to evaluate the goodness-of-fit of the model.

Results of the Johansen test and VECM indicate a significant long-run relationship between a dependent (FDI) and independent variables (external debt and balance of payment). External debt is found to have a significant negative impact on FDI. That is, an increase in external debt will lead to a decrease in FDI in Bangladesh. However, External debt is found insignificant in the short-run. On the other hand, the balance of payment has a significant positive impact on FDI in

the long-run as well as in the short-run, which means that an increase in the balance of payment will lead to an increase in FDI inflows in Bangladesh.

Our Granger causality results reveal that there exists a bidirectional short-run causality between the balance of payment and FDI, which implies that both the balance of payment and FDI affect each other. That is, the balance of payments makes a significant contribution to foreign direct investment in Bangladesh. In the same vein, foreign direct investment is also a significant determinant of the balance of payment in Bangladesh. But no unidirectional or bidirectional causal relationship is found between external debt and FDI and between external debt and balance of payment.

The main policy implications arising from the findings of the study can be presented as follows: The economy of Bangladesh is largely dependent on external debt. A large part of the funding required for Bangladesh's development activities comes from external debt. Due to low repayment, this burden of debt is increasing day by day. The debt burden indicates a country's poor financial condition, and it badly affects the investment climate of a country. The result also suggests that FDI is negatively affected by the country's poor debt conditions. As it is now proven that FDI is conducive to the economic development of a country, necessary steps should be taken to attract more FDI by avoiding excessive reliance on external debt as a crucial requirement for the economy. Moreover, policies need to be formulated to improve the debt service of the country.

We have already learned that in just a few years, the balance of payment of Bangladesh was favorable. Almost every year, a huge difference is noticed in Bangladesh's transactions with neighboring India and other countries, which is responsible for the unfavorable condition in the balance of payment of Bangladesh. According to the results of the study, a favorable balance of payment induces more FDI inflows. Therefore, it is necessary to reduce the huge differences in the transactions of Bangladesh with other countries through various negotiations at the diplomatic level. Besides, policy makers need to implement appropriate economic policies that can attract more FDI in the country and improve the country's balance of payment.

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