Volume: 4, Issue: 11
Page: 53-69
2020

ISSN 2520-4750 (Online) & ISSN 2521-3040 (Print)

International Journal of Science and Business

Impacts of Inflation and Exchange Rate on Foreign Direct Investment in Bangladesh

Muhammad Mahmud Mostafa

Abstract:
The objective of this study is to investigate the impacts inflation and exchange rate on foreign direct investment (FDI) in Bangladesh. To meet the purpose of the study, time series data on dependent and independent variables are collected from various secondary sources covering the period 1980 to 2017. For estimation purpose the study employs different econometric techniques such as Augmented Dickey-Fuller (ADF) test, Johansen Co-integration Test, and Vector Error Correction Model (VECM). Apart from these, various diagnostic tests have been applied to evaluate the goodness-of-fit of the model. Results of the study reveal that there exists a long-run relationship between dependent and independent variables. Inflation rate is found to have a significant negative impact on FDI in the long-run but it is insignificant in the short-run. The results also show that exchange rate has a significant positive relationship with FDI both in the long-run and short-run. That is, depreciation of Bangladeshi taka against US dollar induces FDI flows in Bangladesh. Therefore, in order to increase the flow of FDI in Bangladesh, it is essential to take necessary steps to curb high inflation and to prevent the devaluation of oreign currencies against Bangladeshi taka.

IJSB
Accepted 16 October 2020
Published 20 October 2020
DOI: 10.5281/zenodo.4114319

Keywords: FDI, Inflation Rate, Exchange Rate, Co-integration, ADF, VECM.

About Author (s)

Muhammad Mahmud Mostafa, Assistant Professor (Economics), Officer on Special Duty, Directorate of Secondary and Higher Education, Bangladesh, Dhaka, and Ph.D. Fellow, Institute of Bangladesh Studies, University of Rajshahi.
E-mail: mahmud.bcs@gmail.com.

1. Introduction

The amount invested in a country by the resident of a foreign country, either directly or through other related enterprises, over which the foreign investor has effective control is referred to as foreign direct investment (FDI). Due to insufficient capital for domestic savings and investment, a developing country like Bangladesh is always looking forward to achieving foreign capital for creating employment opportunities for huge labor force, for importing suitable technology and equipment for effective use of domestic raw materials, for collecting and processing natural resources, and for achieving economic growth by reducing import dependence and establishing export-oriented industrial enterprises. From the information of Bangladesh Investment Board, it is obvious that the flow of foreign direct investment in Bangladesh is not encouraging at all. After the independence of Bangladesh, the new government adopted the policy of nationalizing all the medium and large scale industries. As a result, there was no new foreign direct investment in the country till 1977. Later in 1980, the Foreign Private Investment (Promotion and Protection) Act and the Bangladesh Export Processing Zones Authority Act were passed. Nevertheless, foreign investment did not come much in the entire eighties. Although different governments were experimenting with new industrial policies, the flow of foreign direct investment remained very limited until 1993 as the political situation was unstable in the country. However, since then, the registration of companies with foreign investment has increased rapidly. The main reasons for the comparative progress in foreign direct investment are the investment potential of Bangladesh and the relatively stable political, social and economic condition of recent times. But foreign investment in Bangladesh is not consistent with the rate at which the growth of the economy is moving forward. Although the growth rate of GDP has gone up for years, it does not seem to attract foreign investors yet. Foreign investment is yet to rise to 2% of GDP. According to the World Investment Report 2019, the amount of FDI inflows in Bangladesh from 2013 to 2018 is 1599, 1551, 2235, 2333, 2152, and 3613 million US dollars, respectively. That is, investment decreased by 5% in 2014 compared to 2013, increased by 44% in 2015, increased by 4.38% in 2016, decreased by 7.76% in 2017, and increased by 67.89% in 2018 compared to immediate previous year. This record jump in 2018 was driven by significant investments in power generation and in labor-intensive industries such as ready-made garments, as well as the $1.5 billion acquisition of United Dhaka Tobacco by Japan Tobacco. However, in terms of quantity, this investment is so negligible that we have to go a long way to get closer to the more invested countries.

For the growing importance of FDI in developing and least developed countries, economists and policy makers have focused on examining its various determinants and their impacts on FDI worldwide. Numerous studies have tried to determine the factors that influence FDI flows into different countries. There are many factors that have been identified and tested either from the microeconomics or macroeconomics perceptive. The purpose of this study to examine the impacts of inflation rate and exchange rate on FDI inflows in the context of Bangladesh. As seen in the previous literature, these two variables have been considered as important determinants of FDI inflows in many countries of the world, and the results are varying among the studies. Although there exists a great deal of literature in this area, there is hardly any evidence of such a study in the case of Bangladesh.

2. Literature Review

A lot of work has been done to explore the relationship between FDI and inflation rate, and exchange rate along with other macroeconomic variables in different contexts and regions. An overview of some of these studies is given here:

Obwona (2001) attempted to identify the key factors that motivate foreign investors to come and invest in Uganda. The study uses both primary and secondary sources of data. Primary data were collected by questionnaire survey and secondary time series data for the period 1975-1991 were collected from various sources. The empirical results indicate that GDP, growth rate of GDP, trade account balance, and public expenditure are the significant determinants of FDI flows in Uganda. The other variables namely inflation rate, domestic savings rate, and external debt service are found insignificant in the study. Onyeiwu and 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. Regardless of whether the impact of country- and time-specific factors were fixed or stochastic, economic growth, inflation, openness of the economy, international reserves, and natural resource availability were found to be the significant determinants for FDI flows to Africa. External debt and taxes were found significant in random effects model but insignificant in fixed effects model. Interest rate, infrastructures, and political rights were found to be insignificant for FDI flows to Africa in both random effects and fixed effects model. Grosse and Trevino (2005) combined institutional variables with traditional factors to demonstrate that institutions matter in the context of foreign direct investment (FDI) in the transitional economies of Central and Eastern Europe (CEE). For this purpose, standard OLS models, least-squares dummy variable models, and random effects GLS models were employed on the data set of annual FDI inflows into 13 CEE countries during 1990-1999. They found support for the positive link between institutional variables and FDI flows into CEE. Corruption and political risk were negative and significantly related to inward FDI, while the presence of bilateral investment treaties and the level of restrictions on repatriation of earnings of CEE affiliates were positive and significantly related to inward FDI. Traditional variable foreign exchange rate was significant and negatively correlated to FDI, while market size was highly significant and positively correlated to FDI. Inflation was found insignificant in explaining FDI. Alba et al. (2009) examined the impact of exchange rates on FDI inflows into the United States using Markov Zero-Inflated Poisson (MZIP) regression model. They used unbalanced industry-level panel data from the US wholesale trade sector for the period of 1982 to 1994. They found that FDI is interdependent over time and under a favorable FDI environment, the exchange rate has a positive and significant effect on the average rate of FDI inflows.

Ho and Rashid (2011) investigated significant determinants of FDI in five ASEAN countries namely Indonesia, Malaysia, Philippines, Singapore and Thailand from 1975 to 2009. The study applied both individual and panel data analyses for this purpose. The findings depict that economic growth and degree of openness significantly affect FDI flows in the majority of these countries. Inflation plays a significant role on FDI flows for Thailand while exchange rate significantly affects FDI flows in Malaysia. Manufacturing output attracts FDI into the Philippines. In Indonesia and the Philippines employment negatively affects foreign investments, while tourism positively affects FDI in the Philippines and Malaysia. Other significant factors include the level of consumer income, skill and knowledge, and infrastructure development. Anna et al. (2012) sought to find out the impacts of interest rate and other determinants on FDI inflows in Zimbabwe in the period from February 2009 to June 2011. Data was analyzed using the classical linear regression model (CLRM), ordinary least squares (OLS) approach. The study found that GDP, labor cost, and risk factors (political instability, war, and failure to observe democratic rights) are the major determinant of FDI in Zimbabwe. The study also found out that interest rates, inflation rate, and exchange rate have no significant impact on FDI inflows and hence cannot be used for policy making purposes. Sharif-Renani and Mirfatah (2012) conducted a study to evaluate the determinants of inward FDI particularly volatility of exchange rate in Iran by using the Johansen and Juselius's cointegration approach covering the period $1980Q_2$-$2006Q_3$. Moving average standard deviation is used for calculating the volatility of exchange rate. The findings of this study reveal that GDP, openness, and exchange rate have significant positive impact but volatility of exchange rate and world crude oil prices have significant negative impact on the flow of inward FDI in Iran. Andinuur (2013) seeks to explore linkages between inflation, foreign direct investment and economic growth in Ghana using annual time series data covering the period 1980 to 2011. The study employs the cointegration approach by Pesaran, Shin and Smith (2001) and the Granger causality test suggested by Toda and Yamamoto (1995) to empirically examine the relationships among the variables under consideration. The study finds that there are significant relationships among inflation, foreign direct investment and economic growth in Ghana. Inflation has a significant negative impact on FDI as well as economic growth. Economic growth has a significant positive impact on FDI and vice versa. Saleem et al. (2013) investigated the impact of inflation and economic growth on foreign direct investment in Pakistan using annual time series data over the period of 1990 to 2011. A multiple regression analysis was used to determine the relationship between the variables. The result reveals that both inflation and economic growth have positive relation with FDI. Bilawal et al. (2014) aimed at exploring the impact of exchange rate on foreign direct investment in Pakistan using secondary time series data for the period of 1982 to 2013. Correlation and regression analysis were applied through SPSS software to check the relationship between Exchange rate and FDI. The results showed that there is a positive significant relationship between exchange rate and foreign direct investment in Pakistan. Alshamsi et al. (2015) attempted to examine the impact of inflation rate and GDP per capita on inward FDI inflows into United Arab Emirates using a 33-year time series data covering the period of 1980 to 2013. The auto regressive distributed lag (ARDL) model is applied in this study to examine the long-run relationship between the independent and dependent variables. The findings of the study reveal that inflation has no significant effect on FDI inflows whereas GDP per capita (which is a proxy for market size) has a significantly positive impact on FDI inflows.

Faroh and Shen (2015) examined the impact of interest rate on FDI flow in Sierra Leone using multiple regression analysis based on time series data for the period of 1985 to 2012. They found trade openness and exchange rates as the key determinants of FDI flow in Sierra Leone having significant positive signs. Other variables GDP, inflation, and interest rate were found to be insignificant factors causing the variability of FDI flows though the GDP and inflation have the expected signs, interest rate with an unexpected sign. Fornah & Yuehua (2017) tried to develop an empirical framework to identify the effect interest rate on FDI inflows in Sierra Leone using time series data for the period of 1990-2016. For this purpose, Johansen and Juselius cointegration techniques and vector error correction model (VECM) were applied in this study. Empirical analysis of the data reveals that GDP growth, trade openness, interest rate, and inflation are the major determinant of FDI in Sierra Leone. Inflation is negatively correlated with FDI whereas other 3 variables have significant positive effect on FDI. Exchange rate is found to be insignificant in this study. Ali et al. (2018) examined the determinants of FDI inflows in Southern African Development Community (SADC) member countries using data for the period 1995-2016. The study employed pooled OLS as the main estimation method. Their results reveal that inflation, infrastructure, trade openness and market size are the significant determinants of FDI inflows in SADC countries. Inflation has negative impact on FDI while infrastructure, trade openness and market size are positively related with FDI. The results also show positive but insignificant effect of human capital on FDI inflows to SADC member countries. Chol (2020) attempted to identify the location determinants of FDI inflows into Sudan for the period 1980-2018 using vector auto-regression (VAR) model and Granger causality test. The empirical results revealed that market size, external debt, and investment incentive are positively correlated to FDI flows into Sudan whereas inflation has a negative impact on it. No significant effect of gross fixed capital formation and trade openness on FDI are found in this study. Jahan (2020) intended to identify the underlying factors that affect the inflow of FDI to 24 emerging countries using panel data covering the period 1992-2016. The fixed effects model was chosen for this study through Hausman (1978) specification test. The empirical findings of this study demonstrate that market size, trade openness, infrastructure facilities, natural resources availability, and financial development level have significant positive effects and inflation have significant negative effects on inward FDI. Labor force appears to be an insignificant determinant of FDI flows to the emerging countries.

Quader (2009) analyzed the determinants of FDI in Bangladesh employing extreme bounds analysis (EBA) on the annual time series data for the period 1990-1991 to 2005-2006. The results reveal that trade openness and trade balance have significant positive effect whereas GDP growth rate, wage rate, and tax rate have significant negative impact on the flow of foreign direct investment in Bangladesh. The study also finds that two years lagged values of FDI and change in the level of domestic investment have a positive significant effect on economic growth in Bangladesh. Hasan and Nishi (2019) aim to find out the impact of some macroeconomic variables (GDP, trade openness, inflation rate, and market size) in attracting FDI in Bangladesh. OLS estimation method has been applied to analyze the data for the period 1997-2016 to find out the impact of different variables on FDI. The results show a positive and significant relationship of market size and GDP on inward FDI in Bangladesh. The results also indicate that trade openness and inflation rate have a negative but insignificant influence on FDI. Thus, it is clear from the previous literature that the effect of inflation and exchange rate on FDI is mixed. All these studies have shown that either FDI has a positive relationship with these two variables, or a negative relationship exists, or there is no relationship between them. This difference in results is observed due to the differences in the country, the accuracy and duration of the data collected, and even the research methods applied. In the context of Bangladesh, this research work done using long 38 years of data (1980-2017) and applying distinct research methods will surely complement the research work of Hasan and Nishi (2019) and Quader (2009) and play an important role in policy making.

3. Data and Variables

Table 1. Description of Variables and Sources of Data

Variable	Type	Description	Sources of Data
Foreign Direct Investment (FDI)	Dependent Variable	Net FDI inflows (Current US$)	World Development Indicators (World Bank)
Inflation Rate (INF)	Independent Variable	Annual Percentage Change in Consumer Prices	World Economic Outlook Database (International Monetary Fund)
Exchange Rate (EXC)	Independent Variable	Average Exchange Rate (BDT per US$)	World Development Indicators (World Bank)

Source: Author

The study is based on secondary data. As noted earlier, the aim of this study is to examine the impacts of inflation and exchange rate on foreign direct investment (FDI) in Bangladesh. Therefore, the dependent variable of the study is FDI and the independent variables are inflation rate and exchange rate. To meet the purpose of the study, time series data are collected from various secondary sources covering the period 1980 to 2017. Table 1 shows the variables of this study and their secondary sources in brief.

4. Hypotheses of the Study

4.1 Inflation Rate and FDI

Price stability is a major indicator of macroeconomic stability in a country. Any form of instability introduce a type of uncertainty that pervert investor insight of the future profitability in the country. Inflation, defined as a continuous rise in the general price level, reflects a decrease in the purchasing power per unit of currency. Low inflation rate is considered a sign of internal economic stability in the host country which encourages FDI. High inflation rate is often seen as a measure of overall economic instability which increases the user cost of capital and negatively affects the profitability of firms in the host country (de Mello Jr., 1997). According to Onyeiwu and Shrestha (2004), a high rate of inflation reflects the poor economic conditions in the country that discourages the flow of FDI. So, in the context of previous literature, our hypothesis in this case is:

H_1: The lower the inflation rate, the higher the FDI inflow.

4.2 Exchange Rate and FDI

Exchange rate, the rate at which one currency is exchanged for another, is often cited as a critical determinant of FDI. Stable exchange rate is positive for FDI. According to Froot and Stein (1991), exchange rates can affect FDI through an imperfect capital market channel. A weaker real exchange rate might be expected to increase vertical FDI as firms take advantage of relatively low prices in host markets to purchase facilities (Walsh and Yu, 2010). A real depreciation of the domestic currency raises the wealth of foreign investors relative to that of domestic investors and thereby increases FDI. The stronger the foreign currency is in comparison to that of the host country, the more will be the amount of foreign investment. According to Ang (2008), appreciation of the real exchange rate appear to discourage FDI inflows. In this case, our set hypothesis is:

H_2: Appreciation of BDT exchange rate will reduce FDI inflow.

5. Methodology and Data Analysis

5.1 Econometric Model

In this study the ordinary least square (OLS) estimation method is used to determine the relationship between foreign direct investment (FDI), and inflation rate (INF) & exchange rate (EXC). The multiple linear regression model is specified as:

$$FDI = f\,(INF, EXC) \qquad (1)$$

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

$$FDI_t = f\,(INF_t, EXC_t) \qquad (2)$$

In order to handle situations where a non-linear relationship exists between the independent and dependent variables, in a regression model, variables are often expressed in logarithmic form. For this reason, equation (2) is expressed in Cobb-Douglas form as:

$$FDI_t = \alpha\, INF_t^{\beta_1} EXC_t^{\beta_2} e^{\mu_t} \qquad (3)$$

After converting the data into logarithm form, the model can be represented as:

$$LFDI_t = L\alpha + \beta_1 LINF_t + \beta_2 LEXC_t + \mu_t \quad (4)$$

If we assume $L\alpha = \beta_0$, the model is simplified as:

$$LFDI_t = \beta_0 + \beta_1 LINF_t + \beta_2 LEXC_t + \mu_t \quad (5)$$

Where,

$LFDI_t$ = Natural logarithm of foreign direct investment at time t
$LINF_t$ = Natural logarithm of inflation rate at time t
$LEXC_t$ = Natural logarithm of exchange rate at time t
e = Base of natural logarithm
μ_t = Error term/ random residual term/ stochastic disturbance term
β_0 = Intercept/ Slope coefficient
β_1 , β_2 = coefficient parameters to be estimated.

5.2 Unit Root Test

Studies that involve time series analysis normally use historical data to establish relationships between variables in order to forecast the future. But if the variables are non-stationary and contain unit root, forecasting may not be appropriate. In such cases, estimation may lead to spurious results which have no economic meaning. In this study the Augmented Dickey-Fuller (ADF) test is applied to test for the stationarity in the variables. There are three basic regression models for ADF test:

$$\text{No constant, no trend}: \Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (6)$$

$$\text{Constant, but no trend}: \Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (7)$$

$$\text{Constant and trend}: \Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (8)$$

where Δ is the difference operator, Y_t is the variable of interest, p is the number of lags, ε_t is the stochastic error term, β_1 is the intercept and β_2 is the coefficient.

The null hypothesis is that the series is non-stationary against alternative hypothesis that the series is stationary. If the absolute value of the ADF test statistic is greater than the absolute critical values, we reject the null hypothesis and conclude that the series is stationary. On the other hand, if the absolute value of the ADF is less than the absolute critical values, we fail to reject the null hypothesis and conclude that the series is non-stationary.

5.3 Cointegration Test

The concept of cointegration was developed by Engle and Granger in 1987. Cointegration between two time series suggests that there exists a long run relationship between them. If the variables are integrated of the same order, then we can apply the cointegration test. This study employs the Johansen cointegration method (1988) to test for long run equilibrium relationships among variables because the Engle and Granger cointegration test works well for a single equation, but it does not extend well to a multivariate VAR model. The advantage of Johansen method is that it permits the identification of all cointegrating vectors within a given set of variables. Furthermore, the procedure has better asymptotic properties which yield more robust results. The Johansen-Juselius test employs two statistics to test for cointegration:

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

Null Hypothesis: The number of cointegrating vectors are less than or equal to r.
Alternative Hypothesis: The number of cointegrating vectors are more than r.

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

Null Hypothesis: The number of cointegrating vectors is r.
Alternative Hypothesis: The number of cointegrating vectors is (r+1)

Here r equals the number of cointegrating vectors, T equals the sample size and $\hat{\lambda}$ equals 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 alternative hypothesis is accepted, meaning that there is a long run relationship between dependent variable and independent variable(s). If there comes up a different result between trace statistic and maximum eigenvalue test, then maximum eigenvalue result is preferred.

5.4 Vector Error Correction Model (VECM)

The vector error correction model (VECM) is a special case of vector autoregressive (VAR) model for variables that are stationary in their first differences. In the cointegration test, if the variables are found to be cointegrated, then VECM is used to estimate the long run causality and short run dynamics of a time series.

Conventional ECM for cointegrated series:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n}\beta_i \Delta y_{t-i} + \sum_{i=0}^{n}\delta_i \Delta x_{t-i} + \lambda ECT_{t-1} + \mu_t \quad (11)$$

where,

$$y_t = \beta_0 + \beta_1 x_t + \varepsilon_t \quad (12)$$

(long-run cointegrating regression)

$$ECT_{t-1} = y_{t-1} - \beta_0 - \beta_1 x_{t-1} \quad (13)$$

(cointegrating equation and long-run model)

The error correction term (ECT) relates to the fact that last period deviation from long-run equilibrium (the error) influences the short-run dynamics of the dependent variable. Thus, the coefficient of ECT, λ, is the speed of adjustment, because it measures the speed at which y returns to the equilibrium after a change in x.
From equation (1), the VECM model can be written as:

$$\Delta LFDI_t = \alpha + \beta(LFDI_{t-1} + \gamma_0 + \gamma_1 LINF_{t-1} - \gamma_2 LEXC_{t-1}) + \lambda \Delta LFDI_{t-1} + \sigma \Delta LINF_{t-1} + \delta \Delta LEXC_{t-1} + \varepsilon_t \quad (14)$$

The above equation is the error correction equation where Δ shows the changes of the variables, β is the adjustment parameter.

5.5 Residual Diagnostic Tests

The following tests are applied for residuals tests:
(1) Serial correlation → Breusch-Godfrey Test
(2) Heteroscedasticity → Breusch-Pagan Test
(3) Normality → Jarque-Bera Test

5.5.1 Breusch-Godfrey Test

The Breusch–Godfrey is a test for serial correlation in the errors in a regression model. This test allows you to measure correlation between error term and multiple lagged error terms at the same time to see if they are correlated.
Null Hypothesis: There is no serial correlation
Alternative Hypothesis: There is serial correlation
Therefore, if your p-value is 0.05 or below, this means your model suffers from serial correlation.

5.5.2 Breusch-Pagan Test

The Breusch-Pagan test, developed in 1979 by Trevor Breusch and Adrian Pagan, is used to test for heteroscedasticity in a linear regression model. It tests whether the variance of the errors from a regression is dependent on the values of the independent variables. In that case, heteroscedasticity is present.
Null Hypothesis: Residuals do not suffer from heteroscedasticity
Alternative Hypothesis: Residuals suffer from heteroscedasticity

It is a chi-squared test: the test statistic is distributed $n\chi^2$ with k degrees of freedom. If the test statistic has a p-value below an appropriate threshold (e.g. $p < 0.05$) then the null hypothesis is rejected and heteroskedasticity is assumed. One way to try and avoid this issue is to convert variables into logs – this will reduce impact of extreme values in data. Another is to use heteroscedasticity-consistent standard error estimates.

5.5.3 Jarque-Bera Test

Normality is one of the assumptions for many statistical tests. The Jarque–Bera test is a goodness-of-fit test to see whether the skewness and kurtosis of sample data matches a normal distribution. The test statistic is always non-negative. If it is far from zero, it signals the data do not have a normal distribution.
Null Hypothesis: Residuals are normally distributed
Alternative Hypothesis: Residuals are not normally distributed
If a p-value of 0.05 or less is obtained, than it means that null hypothesis has been rejected, i.e., residuals in the model are not normally distributed.

6. Empirical Results

6.1 Descriptive Statistics

From Table 2 it is seen that the standard deviation of each variable is low, the range of variation between maximum and minimum value is also reasonable. The coefficient of skewness of variable LFDI is less than -1 which means the distribution is highly skewed. But the coefficient of LINF and LEXC are between -1 and -0.5 which implies that the distributions are moderately skewed. Since the coefficient of kurtosis of all the variables are greater than zero, it indicates a leptokurtic distribution (heavier tails) for each variable.

Table 2. Descriptive Statistics

Measure	LFDI	LINF	LEXC
Mean	18.01400	1.933333	3.827553
Median	18.52986	1.985849	3.870850
Maximum	21.76630	2.733393	4.405043
Minimum	0.000000	0.646056	2.737872
Std. Dev.	3.729415	0.497817	0.452650
Skewness	-2.925347	-0.812189	-0.549557
Kurtosis	15.33409	3.165285	2.409775

Source: EViews output

6.2 Results of Multicollinearity Test

One popular method to Detect Multicollinearity is the bivariate correlation between two predictor variables. If the correlation coefficient between two variables is 0.80 or above, the rule of thumb says you have multicollinearity. Correlation matrix in Table 3 indicates no high correlation between any two independent variables and hence there is no problem of multicollinearity in this model.

Table 3. Correlation Matrix

Variables	LFDI	LINF	LEXC
LFDI	1.000000	-	-
LINF	-0.222200	1.000000	-
LEXC	0.662390	-0.423957	1.000000

Source: EViews output

6.3 Results of Unit Root Test

Table 4 reveals that all the variables are non-stationary at their levels but become stationary after first difference. At first difference, the calculated ADF test statistics and corresponding p-values clearly reject the null hypotheses of unit root at 5% significance levels. This suggests co-integration analysis to examine the long run relationship among the variables.

Table 4. Augmented Dickey-Fuller (ADF) Test Result

Var.	Test for Unit Root	Test Equation	ADF Test Statistic	Critical Values at 5% Level	P-Value	Inference
LFDI	Level	Constant	-3.7790	-2.9719	0.0081	Non-Stationary
		Con. & Trend	-4.6653	-3.5403	0.0034	
		None	-0.3876	-1.9501	0.5376	
	1st Difference	Constant	-6.6201	-2.9484	0.0000	Stationary
		Con. & Trend	-7.1025	-3.5875	0.0000	
		None	-9.9489	-1.9504	0.0000	
LINF	Level	Constant	-3.3234	-2.9434	0.0209	Non-Stationary
		Con. & Trend	-3.3604	-3.5366	0.0725	
		None	-1.0526	-1.9507	0.2583	
	1st Difference	Constant	-8.0235	-2.9484	0.0000	Stationary
		Con. & Trend	-8.0005	-3.5443	0.0000	
		None	-8.0700	-1.9507	0.0000	
LEXC	Level	Constant	-4.8277	-2.9434	0.0004	Non-Stationary
		Con. & Trend	-4.2229	-3.5366	0.0101	
		None	4.8442	-1.9501	1.0000	
	1st Difference	Constant	-3.8012	-2.9458	0.0064	Stationary
		Con. & Trend	-6.0027	-3.5443	0.0001	
		None	-2.9757	-1.9504	0.0040	

Source: EViews output

6.4 Johansen Co-integration Test Result

The first step of co-integration test is the selection of lag order. There are many methods that can determine optimal lag period for the VAR model. From Table 5 it is seen that all the five methods are suggesting lag 1. So, the optimal lag order for the VAR model is 1.

Both trace test (Table 6) and maximum eigenvalue test (Table 7) reject the null hypothesis of no co-integration at 5% significance level and both the test indicate 1 cointegrating equation at 5% significance level. Therefore, it can be concluded that a significant long-run relationship exists between dependent and independent variables.

Table 5. VAR Lag Order Selection Criteria

Endogenous Variables: LFDI LINF LEXC			Exogenous Variables: C			
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-118.6357	NA	0.209512	6.950612	7.083927	6.996632
1	-25.55830	164.8800*	0.001722*	2.146188*	2.679451*	2.330270*
2	-20.12055	8.700389	0.002139	2.349746	3.282955	2.671890
3	-11.61239	12.15451	0.002273	2.377851	3.711007	2.838056
* indicates lag order selected by the criterion						

Source: EViews output

Table 8 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, LINF has a negative impact on FDI. That is, an increase in LINF will lead to a decrease in LFDI. The equation also indicates that LEXC has a positive impact on FDI in the long run which means that an increase in LEXC will lead to an increase in LFDI.

Table 6. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value (at 0.05 level)	Prob.
None *	0.507156	40.06862	29.79707	0.0023
At most 1	0.274016	14.59633	15.49471	0.0680
At most 2	0.081696	3.068162	3.841466	0.0798
Trace test indicates 1 cointegrating equation(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level				

Source: EViews output

Table 7. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value (at 0.05 level)	Prob.
None *	0.507156	25.47229	21.13162	0.0115
At most 1	0.274016	11.52817	14.26460	0.1297
At most 2	0.081696	3.068162	3.841466	0.0798
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level				

Source: EViews output

Table 8. Cointegrating Equation

Normalized cointegrating coefficients (standard error in parentheses)		
LFDI	LINF	LEXC
1.000000	0.332691 (1.00074)	-8.940348 (1.20972)

Source: EViews output

6.5 Result of Vector Error Correction Model (VECM)

From Vector Error Correction Estimates (Table 9) we obtain,

The cointegrating equation (long-run model):

$$ECT_{t-1} = 1.000000 LFDI_{t-1} + 0.332691 LINF_{t-1} - 8.940348 LEXC_{t-1} + 15.75501 \quad (15)$$

Where ECT is the error correction term. We obtain from equation (15),

$$LFDI_{t-1} = ECT_{t-1} - 0.332691 LINF_{t-1} + 8.940348 LEXC_{t-1} - 15.75501 \quad (16)$$

Equation (16) is similar to the cointegrating equation produced by Johansen method (Table 7). We may interpret equation (16) as follows: A one unit increase in inflation rate leads to a 0.33 unit decrease in FDI in Bangladesh. Similarly a one unit increase in exchange rate will increase FDI by 8.94 unit. The lower part of Table 9 contains 3 columns for error correction estimates of 3 dependent variables namely D(LFDI), D(LINF) and D(LEXC). Among these 3 variables, our target dependent variable is D(LFDI). So we obtain the estimated VECM with D(LFDI) as target variable:

$$\Delta LFDI_t = -\ 0.966535 ECT_{t-1} - 0.006746 \Delta LFDI_{t-1} + 0.180107 \Delta LINF_{t-1} + 26.45242 \Delta LEXC_{t-1} - 1.043793 \qquad (17)$$

Where ECT_{t-1} is defined in equation (15). Equation (15) is the numerical representation of the vector error correction model equation (14). As an interpretation it can be said that a unit increase in FDI of lag 1 is associated with a 0.006746 times decrease in FDI on average. Again, the coefficient of $\Delta LINF_{t-1}$ is 0.180107 which means that a unit increase in inflation rate of lag 1 is associated with a 0.180107 times increase in FDI.

Table 9. Vector Error Correction Estimates

Cointegrating Eq:	CointEq1		
LFDI(-1)	1.000000		
LINF(-1)	0.332691		
LEXC(-1)	-8.940348		
C	15.75501		
Error Correction:	D(LFDI)	D(LINF)	D(LEXC)
CointEq1	-0.966535	-0.027490	0.007421
D(LFDI(-1))	-0.006746	0.018721	-0.005183
D(LINF(-1))	0.180107	-0.113149	0.011978
D(LEXC(-1))	26.45242	-0.170965	0.365193
C	-1.043793	-0.024495	0.026181

Source: EViews output

As we see in Table 9, the coefficient of error correction term of FDI is -0.966535 which means that about 96.65% of disequilibrium corrected each year by changes in FDI. That is, the previous periods deviation from long-run equilibrium is corrected in the current period as an adjustment speed of 96.65%. It confirms the stability of the system. The coefficient of error correction term of inflation rate is -0.027490. It implies that any divergence from equilibrium due to changes in inflation rate is corrected in the current period at a speed of 2.75%. It means that the speed of adjustment of inflation rate towards equilibrium is slow one. Similarly, the speed of adjustment towards equilibrium of exchange rate is 0.74%.

6.6 Long-run Causality

In Table 9, 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. By being negative, it tells us if there is a departure in one direction, the correction would have to be pulled back to the other direction so as to ensure that equilibrium is retained. Positive error correction coefficient is not a good sign for a model because it implies that the process is not converging in the long-run and that could be perhaps due to some instabilities in the model. So, when that happens it might actually mean that there are some specification problem with the model and/or may be there are some data issues that you need to actually look into. In our model, the value of C(1) is -0.966535 and the corresponding p-value is 0.0000. That is, C(1) is negative in sign and statistically significant.

So, there is a long-run causality running from LINF and LEXC to LFDI. The value of C(1) in our model also tells us that about 96.65% of departures from long-run equilibrium is corrected each period.

Table 10. Results of Ordinary Least Square Estimates

Dependent Variable: D(LFDI)				
Method: Least Squares (Gauss-Newton / Marquardt steps)				
D(LFDI) = C(1)*(LFDI(-1) + 0.332690812656*LINF(-1) - 8.94034843323*LEXC(-1) + 15.7550145667) + C(2)*D(LFDI(-1)) + C(3)*D(LINF(-1)) + C(4)*D(LEXC(-1)) + C(5)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.966535	0.201619	-4.793873	0.0000
C(2)	-0.006746	0.153383	-0.043981	0.9652
C(3)	0.180107	1.002075	0.179734	0.8585
C(4)	26.45242	10.24646	2.581616	0.0148
C(5)	-1.043793	0.644300	-1.620042	0.1154
R-squared	0.565113	Akaike info criterion	4.939484	
Adjusted R-squared	0.508998	Schwarz criterion	5.159417	
F-statistic	10.07070	Hannan-Quinn criter.	5.016247	
Prob(F-statistic)	0.000024	Durbin-Watson stat	2.072386	

Source: EViews output

6.7 Short-run Causality

In Table 10, C(3) and C(4) are the short-run coefficients associated with LINF and LEXC respectively. To know whether LINF and LEXC have a short-run causality with LFDI, we need to run the Wald Test for coefficients C(3) and C(4).

Table 11. Wald Test Results

Null Hypothesis	Test Statistic	Value	Probability	Inference
C(3) = 0	t-statistic	0.179734	0.8585	Accepted
	F-statistic	0.032304	0.8585	
	Chi-square	0.032304	0.8574	
C(4) = 0	t-statistic	2.581616	0.0148	Rejected
	F-statistic	6.664743	0.0148	
	Chi-square	6.664743	0.0098	

Source: EViews output

From Table 11 it is seen that p-value of chi-square for null hypothesis C(3) = 0 is 0.8574 (85.74%) which is more than 5%. That is, we cannot reject the null hypothesis. So, there is no short-run causality running from LINF to LFDI. In other word, LINF 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(4) = 0 is 0.0098 (0.98%) which is less than 5%. So, we can reject the null hypothesis. This means that, there is a short-run causality running from LEXC to LFDI. Since the value of C(4) is 26.45242 and corresponding p-value is 0.0148 (Table 10), it can be said that LEXC has a significant positive relationship with FDI in the short-run.

6.8 Results of Residual Diagnostic Tests

From Table 12 we see that p-value of chi-square is 0.3669 (36.69%) which is more than 5%. Therefore we cannot reject the null hypothesis. So, there is no serial correlation in the model.

Table 12. Breusch-Godfrey Serial Correlation Test Result

F-statistic	0.694158	Prob. F(1,30)	0.4113
Obs*R-squared	0.814151	Prob. Chi-Square(1)	0.3669

Source: EViews output

Table 13. Breusch-Pagan Heteroskedasticity Test Result

F-statistic	0.913424	Prob. F(6,29)	0.4993
Obs*R-squared	5.722056	Prob. Chi-Square(6)	0.4550

Source: EViews output

We see from Table 13 that p-value of chi-square is 0.4550 (45.5%) which is more than 5%. Therefore we cannot reject the null hypothesis. So, there is no heteroskedasticity in the model.

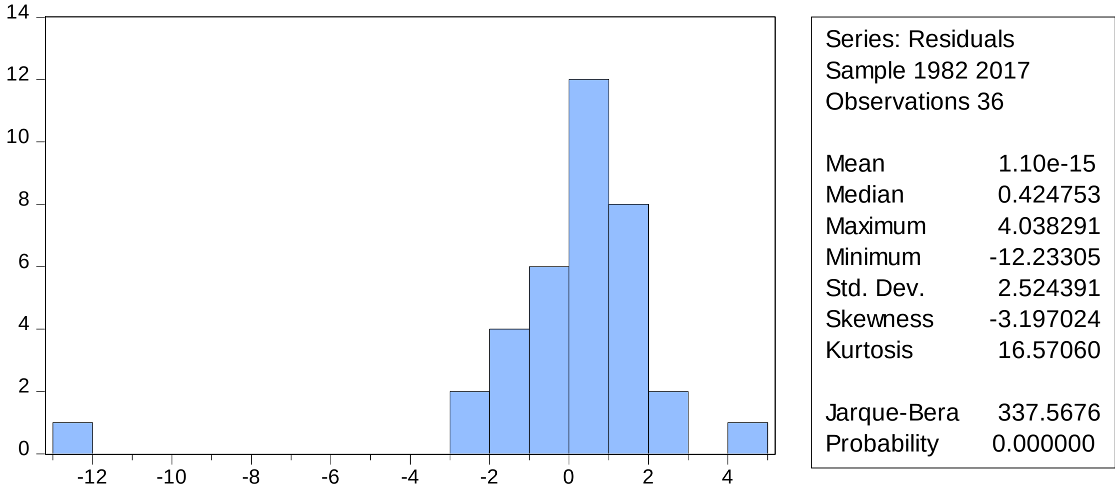

Figure 1. Jarque-Bera Normality Test Result

Figure 1 shows that the P-Value of Jarque-Bera is 0.00% 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 0.565113 which means that the model explains only 56.51% of the variations of LFDI. The p-value of F-statistic (0.000024) is less than 5% which is also a good sign for the model. We, therefore, can conclude that the model has a moderately good fit.

7. Conclusion

The objective of this study was to examine the impacts of two macroeconomic variables namely inflation rate and exchange rate on foreign direct investment (FDI) in Bangladesh by using time series data for the period of 1980 - 2017. For estimation purpose the study employs different econometric techniques such as Augmented Dickey Fuller test (ADF), Johansen Co-integration Test, Vector Error Correction Model (VECM) etc. Empirical results of the study indicate that inflation rate has a significant negative impact on FDI in the long-run. This means that low inflation will lead to an increase in FDI flows in Bangladesh. The result is consistent with the findings of Onyeiwe and Shreshtha (2004), Demirhan and Masca (2008), Azam (2010), Andinuur (2013), Kaur and Sharma (2013), Wani and Rehman (2017), Ali et al. (2018), Chol (2020), and Jahan (2020); but in contrast with the findings of Ho and Rashid (2011), Jadhav (2012), Saleem et al. (2013), and Faroh and Shen (2015). However, no significant effect of inflation rate on FDI is found in the short-run. The results also show that exchange rate has a significant positive relationship with FDI both in the long-run and short-run. That is, an increase in exchange rate will raise FDI inflows. Alhough this result conflicts with our hypothesis, this finding corroborates the findings of Cuyvers et al. (2008), Osinubi and Amaghionyeodiwe (2009), Omankhanlen (2011), Ho and Rashid (2011), Faroh and Shen (2015), and Pattayat (2016); but negates the findings of Chakrabarti (2001), Grosse and Trevino (2005), Walsh and Yu (2010), Uwubanmwen and Ajao (2012), Kaur and Sharma (2013), and Miskinis and Juozenaite (2015).

8. Policy Implications

According to IMF data, in the 39 years from 1980 to 2018, the average inflation rate in Bangladesh was 7.63% with a minimum of 1.91% in 2001 and a maximum of 15.39% in 2011. In 2018, the inflation rate in Bangladesh was 5.61% which is much higher than the average inflation of 154 countries in 2018 which is 3.4%. From this, the issue of high inflation in Bangladesh is easily conceivable. The negative relationship between inflation and FDI indicates that high inflation hinders FDI in Bangladesh. Therefore, it is essential to take necessary measures to control inflation in order to increase the flow of FDI in Bangladesh. Since independence, Bangladeshi taka (BDT) has always been depreciated against the US dollar, except once or twice. Bangladesh adopted floating exchange rate regime since May 31, 2003. In both the fixed exchange rate and floating exchange rate systems, the value of the dollar against taka has been shown to increase continuously. Sometimes this increase was too much which was unanticipated. Our study findings indicate that depreciation of Bangladeshi taka against US dollar induces FDI flows in Bangladesh. Therefore, in order to encourage the flow of FDI in Bangladesh, necessary steps must be taken to prevent the devaluation of oreign currencies against Bangladeshi taka.

References

Alba, J. D., Peiming, W. and Donghyun, P. (2009). The Impact of Exchange Rate on FDI and The Interdependence of FDI Over Time. *Economics Working Papers (ADB)*. Available: http://hdl.handle.net/11540/1815 (June 13, 2019).

Ali, K. H., Faki, S. M. and Suleiman, S. H. (2018). Determinants of Foreign Direct Investment Inflows in Southern African Development Community (SADC) Member Countries. *International Journal of Science and Business*, 2(4), pp. 616-623.

Alshamsi, K.H., bin Hussin, M. R. and M. Azam M. (2015). The impact of inflation and GDP per capita on foreign direct investment: the case of United Arab Emirates. *Investment Management and Financial Innovations* 12 (3), pp. 132-141.

Andinuur, J. Inflation, Foreign Direct Investment and Economic Growth in Ghana, MPhil thesis, University of Ghana, 2018. Available: http://ugspace.ug.edu.gh/handle/123456789/ 5334 (June 08, 2019)

Ang, J. B. (2008). Determinants of foreign direct investment in Malaysia. *Journal of Policy Modeling*, 30, pp. 185-189.

Anna, C., Karambakuwa, R. T., Webster, D., Felex, T., Zivanai, O., Lovemore, M. and Mudavanhu, V. (2012). The impact of interest rates on foreign direct investment: A case study of the Zimbabwean economy (February 2009-June 2011). *International Journal of Management Sciences and Business Research*, (5), pp.1-24.

Azam, M. (2010). Economic Determinants of Foreign Direct Investment in Armenia, Kyrgyz Republic and Turkmenistan: Theory and Evidence. *Eurasian Journal of Business and Economics*, 3(6), pp. 27- 40.

Beer, F.M. and Cory, S. N. (1996). The Locational Determinants of US Foreign Direct Investment in the European Union. *Journal Of Financial And Strategic Decisions* 9(12), pp. 43-53.

Bilawal, M., Ibrahim, M., Abbas, A., Shuaib, M., Ahmed, M., Hussain, I. and Fatima, T. (2014). Impact of Exchange Rate on Foreign Direct Investment in Pakistan. *Advances in Economics and Business*, 2(6), pp. 223-231.

Chakrabarti, A. (2001). The Determinants of Foreign Direct Investment: Sensitivity Analyses of Cross-Country Regressions. *Kyklos*, 54(1), pp. 89-114.

Chol, P. K. M. (2020). The Location Determinants of FDI in Sudan. Time Series - Empirical Analysis From 1980-2018. *International Journal of Science and Business*, 4(7), pp. 26-45.

Cuyvers, L., Plasmans, J., Soeng, R. and den Bulcke, D. V. (2008). Determinants of Foreign Direct Investment in Cambodia: country-specific factor differentials. CAS Discussion Paper No.61. Available: https://www.researchgate.net/publication/4904216 (June 18, 2019)

de Mello Jr. and Luiz, R. (1997). Foreign Direct Investment in Developing Countries and Growth: A Selective Survey. *The Journal of Development Studies*, 34(1), pp. 1-34. Available: http://dx.doi.org/10.1080/00220389708422501 (June 20, 2019)

Demirhan, E. and Masca, M. (2008). Determinants of Foreign Direct Investment Flows to Developing Countries: A Cross-Sectional Analysis. *Prague Economic Papers*, 4, pp. 365-366.

Faroh, A. and Shen, H. (2015). Impact of Interest Rates on Foreign Direct Investment: Case Study Sierra Leone Economy. *International Journal of Business Management and Economic Research (IJBMER)*, 6 (1), pp. 124-132.

Fornah, S. and Yuehua, Z. (2017). Empirical Analysis on the Influence of Interest Rates on Foreign Direct Investment in Sierra Leone. *International Journal of Research in Business Studies and Management*, 4(12), pp. 28-35.

Froot, K. A. and Stein, J. C. Exchange Rates and Foreign Direct Investment: An Imperfect Capital Markets Approach. *Quarterly Journal of Economics*, 106(4), pp. 1191-1217.

Grosse, R. and Trevino, L. J. (2005). New Institutional Economics and FDI Location in Central and Eastern Europe. *Management International Review*, 45(2), pp. 123-145.

Hasan, M. K. and Nishi, N. N. (2019). An Analysis of the Impact of GDP, Trade openness, Inflation rate and Market size in Attracting Inward FDI in Bangladesh Based on Empirical Analysis. *International Journal of Science and Business*, 3(3), pp. 278-291.

Ho, C. S. F. and Rashid, A. H. M. (2013). Panel Analysis of FDI in Fast Emerging ASEAN Countries. *Terengganu International Finance and Economics Journal*, 3(2), pp. 1-12. Available: http://myjms.mohe.gov.my/index.php/tifej/article/view/1622 (May 12, 2019)

Jadhav, P. (2012). Determinants of foreign direct investment in BRICS economies: Analysis of economic, institutional and political factor. *Procedia - Social and Behavioral Sciences*, 37, pp. 5 - 14.

Jahan, N. (2020). Determinants of Foreign Direct Investment: A Panel Data Analysis of the 24 Emerging Countries. *International Journal of Science and Business*, 4(5), pp. 57-73.

Kaur, M. and Sharma, R. (2013). Determinants of foreign direct investment in India: an empirical analysis. *Decision*, 40, pp. 57-67.

Miskinis, A. and Juozenaite, I. (2015). A Comparative Analysis of Foreign Direct Investment Factors. *Economika*, 94(2), pp. 7-27.

Obwona, M. B. (2001). Determinants of Foreign Direct Investments and their Impact on Economic Growth in Uganda. *African Development Review*, 13(1), pp. 46-81.

Omankhanlen, A. E. (2011). The Effect of Exchange Rate and Inflation on Foreign Direct Investment and Its Relationship with Economic Growth in Nigeria. *Economics and Applied Informatics*, 17(1), pp. 5-16. Available: https://core.ac.uk/download/pdf/27168280.pdf (June 16, 2019)

Onyeiwu, S. and Shrestha, H. (2004). Determinants of Foreign Direct Investment in Africa. *Journal of Developing Societies*, 20(1-2), pp. 89-106. Available: http://journals.sagepub.com/doi/abs/10.1177/0169796X04048305 (June 16, 2019)

Osinubi, T. S. and Amaghionyeodiwe, L. A. (2009). Foreign Direct Investment and Exchange Rate Volatility in Nigeria. *International Journal of Applied Econometrics and Quantitative Studies*, 6(2), pp. 83-116.

Pattayat, S. S. (2016). Examining the determinants of FDI inflows in India. *Theoretical and Applied Economics*, 23(2), pp. 225-238.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), pp. 289-326.

Quader, S. M. (2009). Foreign Direct Investment in Bangladesh: An Empirical Analysis on its Determinants and Impacts. *MPRA Paper* No. 26134. Available: http://mpra.ub.uni-muenchen.de/26134 (July 10, 2019)

Saleem, F., Zahid, A., Shoaib, B., Mahmood, M. and Nayab, S. (2013). Impact of Inflation and Economic Growth on Foreign Direct Investment: Evidence from Pakistan. *Interdisciplinary Journal of Contemporary Research in Business*, 4(9), pp. 236-241.

Sharif-Renani, H. and Mirfatah, M. (2012). The Impact of Exchange Rate Volatility on Foreign Direct Investment in Iran. *Procedia Economics and Finance*, 1, pp. 365-373.

Uwubanmwen, A. E. and Ajao, M. G. (2012). The Determinants and Impacts of Foreign Direct Investment in Nigeria. *International Journal of Business and Management*, 7(24), pp. 67- 77.

Walsh, J. P. and Yu, J. (2010). Determinants of Foreign Direct Investment: A Sectoral and Institutional Approach. *IMF Working Paper* No.10/187. Available: https://www.imf.org/external/pubs/ft/wp/2010/wp10187.pdf (June 08, 2019)

Wani, N. U. H. and Rehman, N. (2017). Determinants of FDI in Afghanistan: An Empirical Analysis. *MPRA Paper* No. 81975. Available: https://mpra.ub.uni-muenchen.de/81975 (June 08, 2019)

Cite this article:

Muhammad Mahmud Mostafa (2020). Impacts of Inflation and Exchange Rate on Foreign Direct Investment in Bangladesh. *International Journal of Science and Business, 4*(11), 53-69. doi: https://doi.org/10.5281/zenodo.4114319
Retrieved from http://ijsab.com/wp-content/uploads/610.pdf

Published by

IJSAB International