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Macroeconomic determinants of foreign direct investment in Bangladesh

Abstract

This paper investigates the impact of selected macroeconomic factors on Foreign direct investment through statistical analysis of time-series data over a period of thirty-three years, from 1990 to 2022 which has a significant impact on boosting Bangladesh's economy. The study has examined the short-run and long-run relationship between FDI and selected macroeconomic factors i.e., Gross Domestic Product growth as market size, exchange rate, inflation rate, corporate tax rate, real interest rate, trade openness and domestic credit to private sector as macroeconomic stability and institutional quality. The study utilized the ARDL test to examine short-term relationships and the Bound Co-integration test to investigate long-term relationships. Furthermore, the analysis included measurements of short-run vital correction to achieve convergence toward a long-term equilibrium relationship. It has been determined that a short-run disequilibrium should be rectified by 84.18% each year by an error correction model. The pandemic years have had a significant impact on the GDP and inflation data.

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1.1 Introduction

In Bangladesh, Foreign Direct Investment is a crucial element in promoting the country's overall development. For a developing nation to experience economic growth, it is necessary to have a strong industrial sector. In today's globalized world, exchanging opinions, concepts, finances, and human resources is crucial. The Bangladesh government is striving to establish an advantageous investment climate by implementing economic strategies, offering rewards to investors, encouraging privatization, and more. FDI has been identified by researchers as an important element in driving the economic prosperity and affluence of a nation. Furthermore, it serves as a gateway to generate employment opportunities, promote economic growth, foster a more competitive market, and increase productivity for the host country.

For the past 20 years, foreign direct investment exerted a substantial influence in modernizing Bangladesh's economy. FDI has facilitated the development of infrastructure, increased employment opportunities, improved the labour force's skills, and helped to assimilate the domestic economy with the global economy by transferring technological knowledge and managerial capabilities. Both developed

and developing countries are now drawn to Bangladesh because of its positive attributes. One such attribute is the availability of skilled labour at relatively low pay, which, along with a reasonably stable macroeconomic environment, makes Bangladesh an attractive end of the line for foreign investors. Bangladesh has the lowest pay rates among Asian countries, an admissible inflation rate, and investment-friendly customs regulations, which make it a favourable destination for foreign investors.

Bangladesh Board of Investment published that in the 1980s, the amount of foreign direct investment that came into Bangladesh was minimal and mainly concentrated in banking and a few other industries. However, since 1996, Bangladesh has been able to attract FDI in the energy and power sector due to appreciative policies for foreign investment, economic reform, and untapped gas and oil reserves. In 1972, the annual FDI inflow was only $0.09 million, but by 1996, it had increased to $231.61 million, and it rose substantially to $1086 million by 2008 and it was slightly decreased in 2020 due to the pandemic crisis.

The world faces a significant challenge in promoting growth and development in third-world countries, and a key principle in economics is that investment is necessary for economic growth. As a result, many underdeveloped countries have sought foreign investment from developed capitalist countries as a reliable source of capital inflow to drive growth and prosperity. To help policymakers in this area, it is important to understand the factors that determine foreign direct investment and the components that lead to some countries having better outcomes in attracting FDI than others.

By thoroughly examining the factors that influence FDI, this study aims to fulfil the current research gap in the Bangladesh economy and examine the significant long-run and short-run impact or both impact at the same time or no impact of the various factors on FDI. This research will contribute through updated analysis for a better understanding of the investment environment in Bangladesh and assist policymakers in formulating effective strategies to attract and retain foreign investment.

1.2 Background of the Study

FDI is a vital element in a nation's economy. Therefore, there has been done much research on it in the last few decades in many countries. However, additional information is required for an in-depth analysis specifically focused on the Bangladesh economy. The existing literature provides some insights into the determinants of FDI in Bangladesh. However, they need more comprehensive and recent data to capture the evolving dynamics of the country's investment environment. The World Bank's conviviality of doing business ranking in 2020 showed that Bangladesh is 168th out of 190 countries (below average). Because, in the case of transferring business titles and resolving commercial disputes, getting an electricity connection in Bangladesh is the longest critical matrix compared to most countries in the world.

1.3 Objectives of the Study

The objectives of this paper are:

1. To identify the key determinants of FDI.

2. To evaluate the short-run and long-run relationship between FDI and selected macro variables.
3. To investigate the disequilibrium adjustment speed to the long-run relationship.

2. A Glimpse of FDI in Bangladesh and Its Influencing Macroeconomic Factors

As a developing nation with limited industrialization, Bangladesh is significantly impacted by foreign direct investment. FDI involves an investor, company, or government from one country acquiring substantial ownership in a foreign business or project, typically to expand operations in a new region. Unlike purchasing foreign stocks without a controlling stake, FDI fosters lasting and stable economic ties between countries, playing a crucial role in global economic integration.

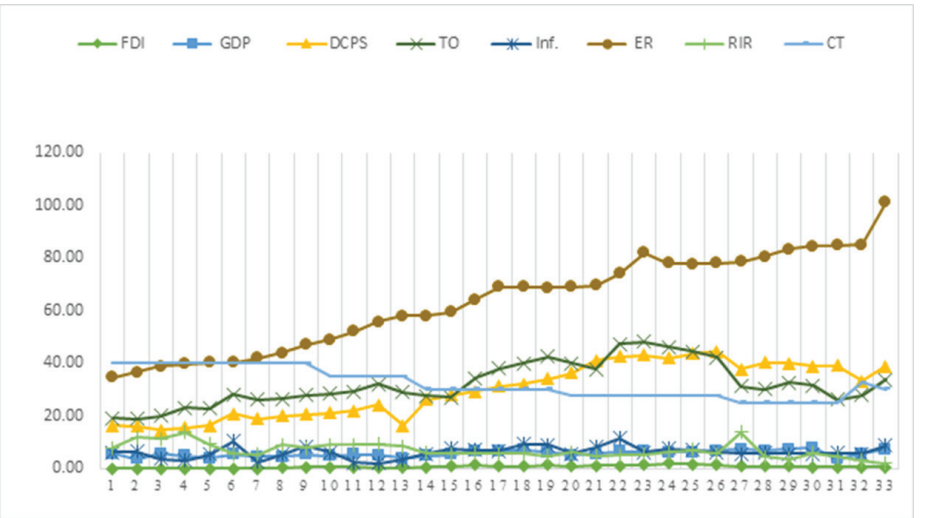

Figure 1: Graphical presentation of foreign direct investment and its influencing factors

Here, Figure 1 depicts the yearly scenario of all the variables that are used in this study from the perspective of Bangladesh. The variables are foreign direct investment, inflation, exchange rate, real interest rate, gross domestic product, corporate tax, trade openness and domestic credit to private sector. The graphical presentation clearly shows that the variables have a very influential relationship among them. Because when it increases or decreases then simultaneously the variables are changed individually in an expected order.

3. Literature Review

Many studies have tested the hypothesis of a significant correlation between market size and foreign direct investment where most of them didn't include several main factors of macroeconomics altogether. Andrašić et al. (2019) researched on FDI by "Evaluating the nature and sort of the relationship between macroeconomic factors and FDI in Southeastern European countries". The literature on the effect of macroeconomic factors on foreign direct investment is extensive and varied.

Some studies have found that macroeconomic factors such as exchange rate volatility, inflation, corporate tax, real interest rate and economic growth have a positive impact on FDI, while others have found that these factors have a negative impact. Another perspective proposes that FDI can only benefit the host country if it can absorb the investment and has appropriate levels of human resources, infrastructure as well as education, technology and political stability, Balasubramanyam et al. (1996); Sanchez-Ancochea (2003). In this literature review, we will explore the different macroeconomic factors that have been found to affect FDI and the different perspectives on how these factors impact FDI based on existing theoretical and empirical research. It also varies on the country type such as developed, developing or underdeveloped.

The Modernization Theory posits that "In less developed countries, foreign direct investment can contribute a positive role in boosting economic growth". This theory suggests that FDI can help meet the requirement for capital formation in these countries, which in turn can drive economic growth, as noted by Firebaugh (1992).

Borensztein et al. (1998) conducted a study to examine "The impact of foreign direct investment on economic growth using a cross-country regression framework". From industrial countries to 69 developing countries, they gathered data on FDI flows over the last two decades. The results of their study suggest that FDI plays a significant role in transferring technology and enhances economic expansion more than domestic investment. Additionally, they found that FDI is greater in efficiency than domestic investment when the host country has a certain level of human capital or the capability to absorb advanced technologies. They also found evidence of a "crowding-in effect" which means that an increase in the net inflow of FDI leads to an increase in total investment in the host economy but this relationship was not very strong.

Malik and Malik (2013) examined yearly time-series data ranging from 1971 to 2009 which pertained to key economic indicators. The results indicated that macroeconomic variables have a significant positive effect on foreign direct investment inflows such as Gross Domestic Product, inflation, and exchange rate.

Some studies and research are made on South Asian countries but we are looking forward to specifically those that include Bangladesh. Arif and Rawat (2019) have used time series data from 1996 to 2015 with unit root test, pooled mean group estimation and co-integration test. The research found that financial openness had a noticeable detrimental effect and trade openness had a substantial beneficial effect on the financial progress in South Asia. However, the findings showed that having both trade and financial sectors simultaneously open has a negative outcome for the South Asian region. Adhikary (2017) has examined the significant relationship between FDI with macroeconomic variables throughout the year 1990 to 2013 time series. The research indicated that several factors commonly impact foreign direct investment in multiple countries. It also assessed the connection between trade and financial sector openness and discovered that the determinants of FDI are unique to each country. Therefore, a tailored FDI policy is necessary and it would not be advisable to solely rely on the experiences of other economies

regarding FDI. Munir and Javed (2018) have studied on trade and financial sector openness relationship during the period 1990–2013 under the fixed effect model. They have used the Cobb-Douglas production function to analyze non-linear regression with horizontal and vertical diversification models. It resulted that financial openness has a negative impact and trade has a positive impact on financial development.

Rahman (2012) have explained the problem and prospects of FDI in Bangladesh and have examined the FDI's impact on economic expansion. Whereas the dependent variables are GDP, Export and Domestic Investment whereas the independent variable is FDI. The researcher used a simple linear regression model to find out whether "There is a relationship of the dependent variable distinctly with the independent variable". The regressions were tested from 1996 to 2010. The result emphasized that FDI has a significant and positive influence on the growth in the economy of the three variables individually. The findings attained in this research signify a negative correlation between FDI and economic growth. It could cause concern for the government of Bangladesh.

Rahman (2015) has analyzed the statistical connections between Foreign Direct Investment and its impact on important macroeconomic variables through simple linear regression. Where independent variables are GDP, Balance of Trade and Inflation Rate. Over 15 years (from 1999 to 2013), the data for the examination was collected. The researchers used Multiple Regression Analyses through Pearson correlation which determines the relationship between FDI as an independent variable and the macroeconomic indicators as dependent variables. The findings indicated that there is a negative correlation between FDI and economic growth and the relationship between FDI and GDP growth is not statistically significant, positive relationship between FDI and Inflation rate and a negative relationship between FDI and BOT (Balance of Trade) which could pose a worry for Bangladesh's government. Therefore, the government may need to implement reforms and policies to make foreign investment more advantageous. It is derived from the following descriptive study that due to the government and officials' limited bargaining power, Bangladesh has difficulty dealing with large international investors. They are unable to oversee huge investments made to improve the nation. The MNCs in Bangladesh are not yet interested in establishing their research and development focuses there, despite being aware that FDI encourages the development of much more advanced technologies, Bangladesh's technological development is insufficient to draw significant foreign investment.

Tabassum and Ahmed (2014) tried to study in their paper to analyze the connection between foreign direct investment and the economic growth of Bangladesh for the years 1972-2011. It considers the most important factors impacting the country's economy, based on a review of previous literature, and analyzes this relationship using multiple linear regression with four models by examining the relationship among real GDP, FDI, domestic investment, and the openness of trade policies. The findings suggest that domestic investment has a positive effect on economic expansion while FDI and trade openness are less significant through F statistics.

Qamruzzaman (2015) examines the key factors influencing FDI inflows into Bangladesh from 2000 to 2013, focusing on trade and foreign exchange liberalization, infrastructure, and economic and political stability. The study is divided into two sections: an analysis of total FDI inflows and a specific focus on the manufacturing sector. Using multiple linear regression, the findings reveal that these factors significantly boost FDI inflows, particularly in manufacturing. The paper underscores the importance of trade and foreign exchange liberalization, alongside the need for infrastructure improvements and a stable political environment, as essential for sustaining and increasing FDI. It suggests that Bangladeshi policymakers should prioritize these areas to create a favourable environment for foreign investment.

Quader (2009) conducted a thorough examination of the time series data from the years 1990-1991 to 2005-2006 by using extreme bounds analysis. The author investigated the relationship between inward FDI (Dependent variable) inflow and different economic indicators in Bangladesh such as net export, trade openness, wage, GDP growth and tax rate along with assessing the long-term impacts of foreign investment. The result has a positive impact at a 95% significance level on FDI to enhance its inward FDI performance and attract foreign investors. Bangladesh must improve its infrastructure, enhance the quality of its services, further liberalize its investment policies, both locally and globally, and maintain macroeconomic and political stability.

Islam and Sahajalal (2019) have studied the relationship between FDI (Dependent variable) with selected macroeconomic variables (Independent variable) such as Real Gross Domestic Product, Real Exchange Rate (RER), Inflation rate (INF) and Interest rate (INT). The research used, "Descriptive statistics, Visual graph, Augmented Dickey-Fuller Test (ADF) Unit Root Test, Correlation analysis and Johansen Test for Co-integration". It resulted that the influence of GDP, RER and INF had a negative impact on FDI on the other side the INT had a positive impact on FDI from the CUSUM and CUSUM square test and the period out result was not stable.

Farooq et al. (2017) has examined the effects of India's and Pakistan's economic growth over the 1985-2014 time series yearly data. The dependent variable was FDI and independent variables included trade openness, financial liberalization index, human and physical capital. They have used the ARDL model for the ADF test, the bound test for co-integration, CUSUM and CUSUM squares to analyze the stability of the models for the chosen two countries. The research found that the effects of trade openness and financial liberalization significantly affect economic growth only positively in the long run for Pakistan and short run for India.

Rana (2014) has examined, the "Relationship between net foreign capital inflows and the trade openness of Bangladesh" over the period 1972–2011. The initial question asked, "Whether the cyclical volatility in trade openness can be explained by the volatility of capital inflows?". The additional question addressed, "The causal link between net capital inflows and international trade imbalances". The output of the analysis indicated that FDI and trade openness are co-integrated, and there is a unidirectional causality from FDI to trade openness.

Additionally, Sylwester (2005) argues that foreign direct investment has an impact on domestic investment, which in turn promotes the economic growth of the country in which it is invested.

The present research broadens the scope of previous studies by focusing on a specific country and contributing new knowledge to the existing body of literature. The competition to attract FDI is rising worldwide, however, evaluating the extent to which it can aid in the economic advancement of the receiving country requires analysis. To investigate the impact of important factors on FDI in developing economies such as Bangladesh, it is crucial to delve deeper into the literature review presented earlier. This research identifies the gap in the literature and seeks to fill it by analyzing the short-term and long-term elements that affect FDI in Bangladesh. This study aims to resolve these problems.

4. Research Methodology

4.1 Data Sources

To analyze the study the data has been used from 1990 to 2022 as yearly data (a total of 33 yearly observations from each variable). Variables are percentages of GDP as data of domestic credit to the private sector, trade openness, foreign direct investment, and annual inflation rate. All of the data was taken from previous records of Bangladesh Bank and World Bank development indicators. Here, the dependent variable is Foreign Direct Investment and the independent variables are Gross Domestic Product Growth, Exchange Rate, Inflation Rate, Corporate Tax Rate, Real Interest Rate, Trade Openness and Domestic Credit to Private Sector.

4.2 Research Methods

First, we have accumulated yearly data of all the dependent and independent variables from 1990 to 2022. The analytical and objective process for data collection, recording, and analyzing data has been used in this model. It has been tried to identify the issues and avoid distorting the effect of personal bias to find out the result of the hypotheses. At the end of the selection and evaluation of the course of action, the study is analyzed based on the secondary data. All of the raw data have been converted into log data for application in the different statistical tools. All the analyses are done by the author's own calculation through statistical data analysis tools i.e. STATA and EViews. The descriptive statistics for each of the variables are next to be analyzed. The raw data was then converted into natural logarithms to analyze the models. After that, stationarity examination is measured because Granger and Newbold showed that non-stationary data provides the wrong result. In order to include stationary data series, it is significant to examine the existence of unit roots in the data series. In this instance, the (Dickey-Fuller) ADF Test and (Phillips-Parron) PP Test are taken into account while applying the unit root test; both tests are taken for the accuracy of stationary. Then an ARDL model has been designed to measure the short-run impact of selected macroeconomic variables on FDI based on the above unit root test estimates and the appropriate lag length was selected by using VAR lag order selection criteria. For testing the fitness of ARDL, this paper conducts the correlation LM test, WALD test and Heteroskedasticity test. A standard formula has been framed to measure the bound test for the long-run impact of our selected macroeconomic variables on

migration growth rate based on the above unit root test estimates. Moreover, to measure the error in the long-run impact of selected macroeconomic variables on FDI, an Error Correction Model (ECM) test has been designed based on the above-bound test estimates. In addition, the literature review has been done on the existing research and debates relevant to our research. Next, the findings of that particular research are to be explained. After that, we determined the research gap to formulate our research hypotheses for interpreting FDI in a new way. At last, the findings of our research will be pointed to improve the study in the next.

4.3 Model Specification

Descriptive statistics

Descriptive statistics are the statistical representation of an entire population or a sample. The primary objective of descriptive statistics is to summarize a sample and gauge its central tendency. Descriptive statistics constitute a significant aspect of all quantitative data analysis, accompanied by diverse graphical representations. There are many central tendency tools to measure the required output, such as Sum, Mean, Std. Dev, Min, Max, Skewness, Kurtosis.

Unit Root Test

(I) Augmented Dickey-Fuller Test

An augmented Dickey-Fuller test is used to determine the stationarity in a time series sample where the null hypothesis is that the series is stationary. A larger and more intricate set of time series models is tested using this method than the alternative hypothesis. In ADF(Dickey-Fuller) test we consider the AR (*p*) equation:

$$y_t = \alpha + \gamma t + \sum_{i=1}^{p} \beta_i y_{t-i} + \varepsilon_t \quad \text{.....(1)}$$

$$\Delta y_t = \mu + \gamma\, t + \alpha\, y_{t-1} + \sum_{i=1}^{p} \beta_i\, \Delta y_{t-i} + \varepsilon_t \quad \text{...(2)}$$

"Where α is a constant term, p for the lagged difference term, β_i represents the trend, $\Delta Y_t = Y_t - Y_{t-1}$ and $\mathcal{E}_t$ is a true white-noise term. The Null hypothesis and Alternative hypothesis of left-skewed. ADF are as under:

H_0: δ = 0 (unit root) and H_1: δ < 0 (stationary)"(Dickey-Fuller)

Phillips-Perron test statistic

The Phillips Person test is a unit root test that is used for time series analysis to test the null hypothesis of stationarity . It is another popular test for finding stationary of time series is Phillips Perron (PP) test. PP uses non parametric statistical methods to deal with serial correlations and heteroskedasticity in the error terms without adding lagged difference terms. The following equation is being used for this model analysis:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \mathcal{E}_t \quad \text{.....} \quad (3)$$

The hypothesis for PP is the same as shown above for ADF. In addition, H_0: δ = 1 (unit root) and H_1: δ <1 (stationary). For both ADF and PP tests, H_0 is tested based on the three different assumptions for each of the series: (1) with only intercept (2), with intercept and trend as shown above, or (3) without intercept and trend meaning that none option. If time series has a unit root at a level under any of the above three assumptions this study considers it as non-stationary data.

ARDL Model

The autoregressive distributed lag model, ARDL. It is a versatile tool in econometrics

and time series analysis, allowing for detailed study of relationships between variables with flexible lag structures. The notation of ARDL (p, q_1, q_2..... q_k) is typically used. Where p represents the number of lags in the dependent variable, q_1 represents the number of lags in the first independent variable and q_k represents the number of lags in the k-th independent variable.

$$y_t = \alpha + \sum_{i=1}^{p} \gamma_i y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_j} X_{j,t-i} \beta_{i,j} + \epsilon_t \quad \text{.....(4)}$$

Some of the explanatory variables, Xj, may have no lag terms in the model ($qj = o$). These variables are called static or fixed regressors. Explanatory variables with at least one lagged term are called dynamic regressors.

To specify the ARDL model, we must determine how many lags of each variable should be included (i.e., specify $pand$, $q1, \ldots\ldots, qk$). Fortunately, simple model selection procedures are available for determining these lag lengths. Since an ARDL model can be estimated via least square regression, standard Akaike, Schwarz, and Hannan-Quinn information criteria may be used for model selection. Alternatively, one could employ adjusted R^2 from the various least square regressions."

Bounds Co-integration Test

A method to determine if the ARDL model has a level or long-run connection between the independent and regressors has been outlined by Pesaran, Shin, and Smith (2001). The requirements for the bound test process may be represented by the following e quation:

$$\Delta y_t = -\sum_{i=1}^{p-1} \gamma_i^* \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \Delta X_{j,t-i} \beta_{i,j,i^*} - \rho y_{t-1} - \alpha - \sum_{j=1}^{k} X_{j,t-1} \delta_j + \epsilon_t \quad \text{..(5)}$$

Then, the test for level a relationship existence is simply a test of

$$\begin{matrix} \rho = 0 \\ \delta_1 = \delta_2 = \cdots = \delta_k = 0 \end{matrix} \quad \text{.....} \quad (6)$$

Critical values for the cases in which all regressors are I(0) and I(1) are provided by Pesaran, Shin, and Smith. It is proposed that these critical values be applied as boundaries for more common cases in which the regressors are a combination of I(0) and I(1).

5. Analysis and Discussion

5.1 Descriptive Statistics

In this study, descriptive statistics for FDI and various macroeconomic indicators in Bangladesh between 1990 and 2022 are presented in Table I. The mean value of the selected variables for the period is calculated as the average of each variable. This tool is utilized to determine the central tendency value of a collection data by analyzing its median and mode The data shows that FDI has a value of 0.599 as a mean of the entire series with a standard deviation of 0.501% of GDP, and has a positively skewed and platykurtic distribution. GDP has an average percentage of 5.603 with a standard deviation of 1.153, and DCPS has an average of 29.779 with a standard deviation of 10.278 where both have a negatively skewed and platykurtic shape. TO, which represents global trading as a percentage of GDP, has an average of 32.126 with a standard deviation of 8.215 and Inf has an average percentage of 6.175 with a standard deviation of 2.219, both are positively skewed and slightly leptokurtic distribution. ER has an average percentage of 62.405 with a standard deviation of 17.968 and is negatively

skewed. RIR and CT are presented has an average percentage of 6.841 and 32.121 with a standard deviation of growth rates of 2.826 and 5.663 respectively. Both are positively skewed but RIR is leptokurtic whereas the CT is platykurtic.

Table 1: Descriptive Statistics of FDI and Selected Macroeconomic Factors

Descriptive Statistics							
Variables	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**
FDI	33	0.599	0.501	0.004	1.735	0.577	2.332
GDP	33	5.603	1.153	3.448	7.882	-0.043	2.243
DCPS	33	29.779	10.278	14.55	44.41	-0.092	1.480
TO	33	32.126	8.215	18.89	48.111	0.391	2.255
Inf	33	6.175	2.219	2.01	11.4	0.107	2.948
ER	33	62.405	17.968	34.569	85.084	-0.035	1.909
RIR	33	6.841	2.826	3.076	13.741	0.856	3.261
CT	33	32.121	5.663	25	40	0.338	1.601

Source: Authors' own calculation estimates

5.2 Unit Root Test

The results of the stationarity test are displayed in Tables II and III, which show the application of two distinct unit root tests. Those are the ADF test and the PP model test. This step is crucial for qualifying the variables to apply the ARDL model. Because ARDL is the best econometric method compared to others and can be applied when the stationary places in order of integration zero and one combinedly ie. I(0) and I(1).

In Table II, the ADF test shows that GDP, INF and RIR as variables are stationary at the level and rests are ie. FDI, ER, TO, CT and DCPS are stationary at first difference. Therefore, it can be amplified for ARDL.

Table 2: Augmented Dickey-FullerTest

Variables	**I(0)**		**I(1)**		**Order of Integration**
	t-Stat	Prob.	t-Stat	Prob.	
FDI	-1.8324	0.4250	-6.2874	0.0000	I(1)
GDP	-3.7633	0.0200	-9.2852	0.0000	I(0)
INF	-4.1397	0.0051	-7.5140	0.0000	I(0)
RIR	-4.2862	0.0032	-8.4916	0.0000	I(0)
ER	-0.9826	0.7260	-4.7941	0.0005	I(1)
TO	-1.7226	0.4104	-4.7604	0.0007	I(1)
CT	-1.4508	0.5446	-3.8918	0.0050	I(1)
DCPS	-1.4300	0.7001	-6.8723	0.0000	I(1)

Source: Authors' own calculation estimates

Table III shows the results of the Phillips-Perron (PP) square root test, similar to those obtained from the augmented Dickey-Fuller (ADF) test. The findings show that the GDP, INF and RIR variables remain at a certain level, while the

other variables (FDI, ER, TO, CT and DCPS) remain at the first difference. The autoregressive distribution lag (ARDL) model is selected based on these results to analyze the short-run relationship between FDI and related macroeconomic variables. The next step is to determine the optimal lag length for the ARDL model, which is important for accurate analysis. Based on Table: A in the Appendix, which shows the VAR lag order selection criteria, a length of 2 is considered optimal. This length of lag is used to control the model to ensure that the results are robust and reliable

Table 3: Phillips-Perron Test

Variables	I(0)		I(1)		Order of Integration
	t-Stat	*Prob.*	t-Stat	*Prob.*	
FDI	-1.7693	0.4509	-6.4193	0.0000	I(1)
GDP	-3.8736	0.0059	-15.782	0.0000	I(0)
INF	-4.1254	0.0051	-18.216	0.0001	I(0)
RIR	-4.2913	0.0011	-24.001	0.0001	I(0)
ER	-1.9163	0.4826	-5.4062	0.0001	I(1)
TO	-2.4360	0.3901	-4.7213	0.0006	I(1)
CT	-1.5160	0.5903	-3.8002	0.0050	I(1)
DCPS	-1.3152	0.6640	-7.0163	0.0000	I(1)

Source: Authors' own calculation estimates

5.3 Auto Regressive Distributed Lag

Table IV represents the relationship between FDI and selected macro variables in the short run based on optimal lag which is lag 2 which is examined from Table:A in Appendices. The table shows that the coefficient of ER is positively related to FDI and it is statistically significant at the 5% significance level. Eventually, the coefficient of INF and coefficient of RIR at level have a negative relation with FDI and these two are statistically significant at 10% significance level, but they are not statistically significant at 5% significance level. Besides, the coefficient of TO has a negative relation and at first difference has a positive relation with FDI but both are not statistically significant. Thus, TO lag 2 has a positive relation with FDI and it is statistically significant. After that CT and DCPS at level have a negative relation with FDI and it is statistically significant at 1% significance level. Also, DCPS at lag 1 has a negative relation with FDI but it is statistically significant at 5 % significance level.

Table 4: ARDL Test (Short-run) Estimates between FDI and Selected Macroeconomic Factors

Dependent Variable: ln(FDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ln(FDI(-1))	0.850210	0.201672	5.012311	**0.0011**
ln(FDI(-2))	-0.573891	0.240342	-2.701351	**0.0220**
ln(GDP)	0.690244	0.959034	0.726916	0.4832
ln(GDP(-1))	0.390267	0.980126	0.390123	0.7190
ln(GDP(-2))	-1.359021	1.050025	-1.208595	0.2231
ln(INF)	-0.037093	0.474003	-0.075017	0.9409
ln(INF(-1))	0.707901	0.415008	1.707023	0.1145
ln(INF(-2))	0.840115	0.466004	1.818009	0.0953
ln(RIR)	-1.131009	0.607004	-1.860082	0.0869
ln(RIR(-1))	-0.716014	0.562196	-1.273097	0.2273
ln(ER)	10.552008	4.862169	2.171903	**0.0409**
ln(ER(-1))	-5.230986	4.766901	-1.099099	0.2940
ln(TO)	-0.609072	1.830925	-0.330164	0.7490
ln(TO(-1))	0.698006	2.238861	0.311909	0.7611
ln(TO(-2))	5.375001	1.844092	2.913025	**0.0134**
ln(CT)	-4.020309	1.486135	-2.705165	**0.0196**
ln(DCPS)	-4.950531	1.771403	-2.798010	**0.0165**
ln(DCPS(-1))	-3.002170	1.278021	-2.347024	**0.0371**

Source: Authors' own calculation estimates

Here, 5% significance level is used as a preference significance level rather than 1% and 10%. Therefore, the probabilities are highlighted which belong to the 5% significance level as a significant value in the probability distribution.

Here, coefficients of INF, ER and TO have differences in sign and size between current and lagged values. Since a negative coefficient for the current inflation rate indicates that higher current inflation is associated with lower FDI. A positive coefficient for lagged inflation might suggest that past inflation rates have a different impact on FDI, potentially due to expectations or adjustments. After that, a higher Exchange rate indicates higher FDI which is reflected in the current year. But in lagged rates, the investors are reacting to past currency fluctuations which might have been unfavorable for FDI, possibly due to perceived instability or increased risk. However, this could be the case if the strength of the currency is perceived as a sign of a stable and strong economy, which can be attractive to investors. At last, the negative coefficient for the current year's

trade openness may indicate short-term adjustment costs, uncertainty, or immediate economic disruptions. Conversely, the positive coefficients for lagged values suggest that trade openness brings long-term benefits once the economy has adjusted to the new conditions.

The extension of the ARDL model is to check its fitness through four vital and most popular econometric tools. To measure whether the serial correlation exists or not in the ARDL model, usually "Breusch-Godfrey Serial Correlation LM"(Dickey-Fuller) test is used. Table B in Appendices presents this test where it assumes its null hypothesis is that no serial correlation in the regression. As per the result, the p-value of F statistic ie. 0.6793 is greater than 0.05 or 5% significance level. Therefore, it implies that the variables have no serial independence in the regression as the p-value fails to reject the null hypothesis. Again, we checked the existence of joint statistical significance through the WALD test in Table C in Appendices where the null hypothesis is, that there is no joint statistical significance with the variables. Here, the p-value is less than 0.05 and it means that there is joint statistical significance as the null hypothesis fails to reject. The third diagnostic test for the existence of heteroskedasticity in the ARDL model. Table D in Appendices shows the result of heteroskedasticity at 5% significance level where the null hypothesis of no heteroskedasticity exists. Here the p-value is greater than 0.05 so that the null hypothesis fails to accept and it implies that the model is free from heteroskedasticity (HSK). The fourth and final diagnosis is to check the stability in the model through a cumulative sum control chart (CUSUM) test. The upper and lower lines are the boundary of 5% significance level and the chart of Table E in Appendices depicts that the variables rely upon the area of stability. Therefore, it is assured that the model is stable in the CUSUM test at 5% significance level.

In precis, the ARDL model diagnosis tests are providing positive results and the model is overall statistically significant and stable.

5.4 Bound Test

In Table V, the I1 is the upper bound and I0 is the lower bound for the ARDL bound test. Here at 5% level of significance , the F-statistic is higher than the I1 or upper bound. Therefore, the test is failed to accept the null hypothesis that "No long run relationship" exists. It can be simplified that there is the existence of a long -run relationship or co-integration between FDI and selected macro variables at a level of 5% significance.

Table 5: Bound Test Estimates between FDI and Selected Macroeconomic Factors

Critical Value Bounds			**Null Hypothesis**: No long-run relationships exist		
Significance	I0 Bound	I1 Bound	Test Statistic	Value	k
10%	1.68	2.72			
5%	**1.95**	**3.09**			
2.5%	2.26	3.44			
1%	2.49	3.86	F-statistic	4.675201	7

Source: Authors' own calculation estimates

5.5 Long Run Co-integration Test

In 2001 Pesaran, et al., introduced the long-run cointegration test to identify the data consistency. In Table VI, LOGFDI is employed as the dependent variable, with the analysis conducted using the Least Squares method. The equation for the long-run cointegration is:

Cointeq = ln(FDI) + (0.3680*ln(GDP) + 1.8339*ln(INF) - 2.2368*ln(RIR) + 6.4313*ln(ER) + 6.6160*ln(TO) - 4.8661*ln(CT) - 9.6338*ln(DCPS))

It is found that GDP and INF have a positive insignificant relationship with FDI. Along with RIR, CT and DCPS have a negative relationship with FDI but at 5% significance level, these variables are significant. On the other hand, ER and TO have a positive relationship with FDI and these independent variables are significant at 5% significance level.

Table 6: Cointegrating Test (Long-Run) Estimates between FDI and Selected Macroeconomic Factors

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ln (GDP)	0.368012	2.313521	0.158914	0.8768
ln (INF)	1.833915	1.113192	1.646051	0.1262
ln (RIR)	-2.236843	1.069816	-2.089852	**0.0502**
ln (ER)	6.431303	2.392012	2.688901	**0.0218**
ln (TO)	6.616027	1.632815	4.052113	**0.0021**
ln (CT)	-4.866153	1.024519	-4.749702	**0.0006**
ln (DCPS)	-9.633816	3.256917	-2.958015	**0.0112**

Source: Authors' own calculation estimates

After that, we have done four tests to diagnose the long-run cointegration test. Firstly, Table F in Appendices presents the Breusch-Godfrey Serial Correlation LM test where the F-statistic p-value is less than 5% significance level. Thus, it fails to accept the null hypothesis that there is no serial correlation between FDI and selected macro variables. Secondly, Table G in the appendix represents the WALD test to analyze the existence of joint statistical significance. The result is less than 0.05 and it is significant at 5% significance level. Therefore, it concludes that the model is free from joint statistical significance. Thirdly, Table H in the Appendix shows the Heteroskedasticity test and it implies that the model is free from heteroskedasticity. The fourth and final test is the CUSUM test to check the stability of the long-run cointegration model. The CUSUM test shows that the model is stable as the variable line appears within the area of 5% significance level. In sum of all the diagnosis tests, it is assured that the long-run cointegration test is overall stable and statistically significant.

5.6 Error Correction Model

Since this model represents co-integration, an error correction model (ECM) should be applied to evaluate short-run and long-run effects. Table VII shows the regression model between FDI and selected macroeconomic variables. The

error correction coefficient ie. CoinEq(-1) is calculated as -0.841802. This shows that each year approximately 84.18% of the previous year's balance is corrected, so that the system returns to equilibrium balance.

Table 7: Error Correction Model between FDI and Other Macroeconomic Factors

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ln(FDI(-1)))	0.635471	0.156799	4.052765	0.0016
D(ln(GDP))	0.674664	0.589556	1.144359	0.2748
D(ln(GDP(-1)))	1.340429	0.582674	2.300478	0.0402
D(ln(INF))	-0.036047	0.237632	-0.151691	0.8820
D(ln(INF(-1)))	-0.841439	0.224044	-3.755685	0.0027
D(ln(RIR))	-1.130765	0.400344	-2.824481	0.0153
D(ln(ER))	10.55247	2.648892	3.983728	0.0018
D(ln(TO))	-0.605957	1.094976	-0.553397	0.5902
D(ln(TO(-1)))	-5.374087	1.190915	-4.512569	0.0007
D(ln(DCPS))	-4.957684	1.079607	-4.592118	0.0006
CointEq(-1)*	**-0.841802**	0.105712	-7.816116	0.0000

Source: Authors' own calculation estimates

6. Findings

This study describes the empirical findings of selected macro variables' impact on FDI. As the variables are stationary so that the result would be spurious. There are various elements in the economy which affect FDI, But the paper finds 7 key determinants that affect the FDI most. In the model, inflation has a negative relation in the short run but it has a positive relation in the long-run co-integration with foreign direct investment as well as the variable is significant at 95% significance level. Though GDP has a positive relation with FDI in every possible test in Bangladesh but the result expressed it as insignificant at 5% significance level. Furthermore, the Trade openness effect should be positive in a country's FDI inflows but Bangladesh has a negative impact on it. In these circumstances, these facts should be diminished to enhance the progress of Bangladesh's FDI. The intercept is positively significant at level and at first difference based on 5% significance level but it got negatively significant at 95% significance level when it reached at lag 2. Also, inflation got positively significant at 5% significance level at lag 2 means the two previous period data adjusted with current data though it has a positive significance at 95%. It emphasized that gross domestic product and inflation has huge fluctuations because of the pandemic crisis. Comprehend that if anybody follows another model specification then the result may go wrong. Thus, the study determined that all the specified variables are not correlated with FDI as much as we expected. Therefore, any short-run disequilibrium in FDI would be corrected by approximately 84.18% annually, emphasizing the robustness of the long-run relationship.

The size of a coefficient reflects the strength of the relationship between the variable and FDI. Variables with larger coefficients have a stronger effect on FDI. Differences in magnitude could arise from how sensitive FDI is to changes in each variable. For example, FDI might be more responsive to changes in trade openness compared to exchange rates or inflation.

7. Recommendations

FDI plays an important role in the Bangladesh economy. To attract and sustain higher levels of FDI, it is recommended that Bangladesh focuses on maintaining macroeconomic stability, particularly by controlling inflation and ensuring a favourable exchange rate. Additionally, the government should continue to improve the investment climate by reducing corporate tax rates, enhancing trade openness, and providing better access to credit for the private sector. Strengthening policies and ensuring political stability are key to strengthening Bangladesh's economic growth. If Bangladesh gets rid of corruption, then the foreign direct investment inflows will be increased tremendously. The country should liberalize its investment policy to enlarge the platform of money inflow. By implementing these initiatives, the disequilibrium is expected to diminish in the upcoming days, fostering greater stability and alignment with long-term objectives.

It is recommended that additional impactful macroeconomic indicators such as unemployment rate, earnings rate, gross fixed capital formation, purchasing power parity, and rate of poverty be taken into account in future studies. When research will use more variables, then it will make an impact on foreign direct investment with a big data set so that the results will be more feasible and empirical evidence will be more feasible. Moreover, international organizations can make Bangladesh more advantageous in investment to macroeconomic well-being.

8. Conclusion

Foreign direct investment is pivotal for national economic growth. This study employs ARDL and Bound Co-integration tests to assess short- and long-term relationships between FDI and key macroeconomic variables in Bangladesh. Results reveal varying sensitivity across variables, with ER, RIR, TO, CT, and DCPS notably influencing FDI fluctuations. The pandemic exacerbated declines, particularly in GDP, distorting the findings due to limited data. A stable economic climate is essential for attracting FDI, and Bangladesh's efforts to optimize resources and bolster its global stance have enhanced its appeal to investors, fostering sustainable growth. Further research is recommended for deeper insights. This report primarily focuses on the interplay between financial development and economic growth, employing a variety of tools and techniques to conduct rigorous research. However, there remains significant scope for further evaluation which are recommended, as previous studies have uncovered numerous areas that warrant deeper investigation.

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Appendices

Table 1: VAR Lag Length Criteria

Endogenous Variables: LOGFDI LOGGDP LOGINF LOGRIR LOGER LOGDTO LOGCT LOGDCPS

Lag	LogL	LR	FPE	AIC	SC	HQ
0	44.5249	NA	1.21e-11	-2.4349	-2.0613	-2.3154
1	177.9381	186.7784	1.38e-13	-7.0625	-3.6996*	-5.9867
2	282.5342	90.6499*	2.66e-14*	-9.7689*	-3.4168	-7.7368*

Source: Authors' own calculation estimates

* Indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2: Breusch-Godfrey Serial Correlation LM Test for ARDL

F-statistic	0.3953	Prob. F(2,19)	0.6793
Obs*R-squared	1.2384	Prob. Chi-Square(2)	0.5389

Source: Authors' own calculation estimates

Table 3: Wald Test for ARDL

Null Hypothesis: C(2)=0, C(3)=0, C(4)=0, C(5)=0,C(6)=0, C(7)=0, C(8)=0

Test Statistic	Value	df	Probability
F-statistic	3.9926	(7, 11)	0.0235
Chi-square	26.1825	7	0.0004

Source: Authors' own calculation estimates

Table 4: Heteroskedasticity Test-Breusch-Pagan-Godfrey for ARDL

F-statistic	2.0639	Prob. F(9,21)	0.4928
Obs*R-squared	10.0128	Prob. Chi-Square(9)	0.3806
Scaled explained SS	5.7806	Prob. Chi-Square(9)	0.8001

Source: Authors' own calculation estimates

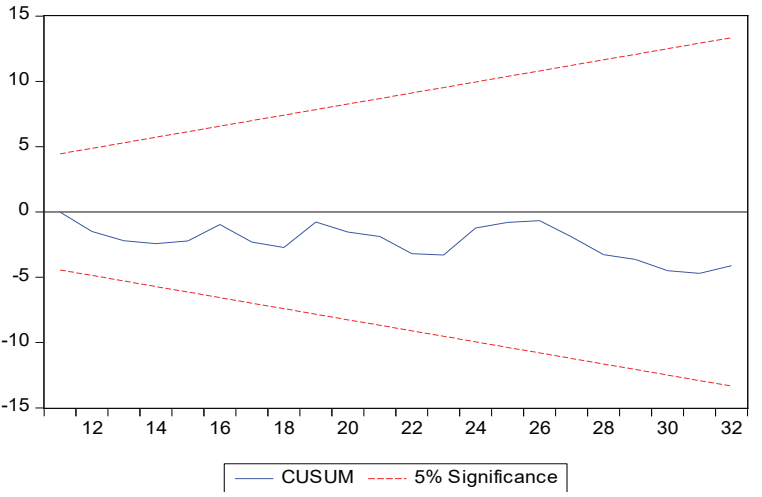

Figure A: CUSUM Test for ARDL

Table 5: Breusch-Godfrey Serial Correlation LM Test for Long Run

F-statistic	2.7006	Prob. F(2,12)	0.2460
Obs*R-squared	10.8296	Prob. Chi-Square(2)	0.0012

Source: Authors' own calculation estimates

Table 6: Wald Test for Long Run Model

Null Hypothesis: C(2)=0, C(3)=0, C(4)=0, C(5)=0,C(6)=0, C(7)=0, C(8)=0

Test Statistic	Value	df	Probability
F-statistic	2.9268	(7, 11)	0.0244
Chi-square	27.8901	7	0.0002

Source: Authors' own calculation estimates

Table 7: Heteroskedasticity Test-Breusch-Pagan-Godfrey for Long Run Model

F-statistic	0.9266	Prob. F(15,14)	0.5163
Obs*R-squared	15.7982	Prob. Chi-Square(15)	0.4728
Scaled explained SS	4.9990	Prob. Chi-Square(15)	0.9909

Source: Authors' own calculation estimates

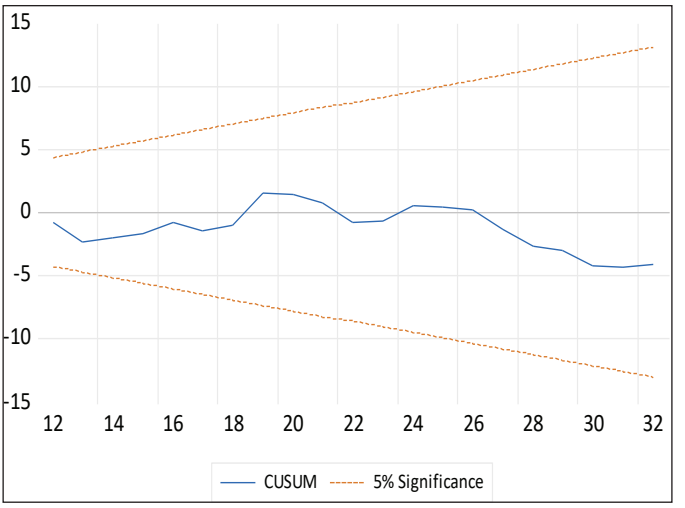

Figure B: CUSUM Test for Long Run