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Nexus between global financial integration and economic growth: An ARDL approach

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Abstract. *Scholars propose that global financial integration can boost foreign investment, technology transfer, and economic development, yet it presents challenges like inflation & financial risks. This study explores factors such as FDI, ODA, foreign assets, and external debt, shaping a country's economic growth. Focused on Bangladesh, it employs the ARDL approach for connecting financial integration and economic growth. Findings show significant impacts, with ODA & foreign assets benefiting while external debt & FDI have negative effects. These insights aid policy formulation to optimize foreign capital inflows and mitigate adverse consequences, fostering economic growth, unveiling the relationship between financial openness and development.*

Keywords: financial integration, globalization, economic development, ARDL model, external financing.

JEL Classification: O11, O19, O47.

1. Introduction

Historically global financial integration has emerged as a significant development source for the developing nations. Still it remains unsolved that global financial integration helps or hampers the economic growth of a developing country. Many scholars opine that integrating with the global financial system may stimulate foreign investment, project financing, technology spillovers, human capital formation, exports promotion, and create a competitive business environment, alleviate poverty and thus impact on economic development (Arestis and Caner, 2010: pp. 295-323). However, integrating with foreign currency sometimes mounts inflationary pressures and affects real wages in the poor nations (Shastri et al., 2022: pp. 1-13). It is pointed out that financial globalization also associates with different macroeconomic variables (Baharumshah, et al., 2017: pp. 245-257). Even when some countries are substantially benefited from equity/debt inflows in the short-run, they are also entail to face a greater risk of crisis (Henry, 2007: pp. 887-935; Rodrik and Velasco, 1999: pp. 1-22).

FDI is considered as one of the major factors of capital inflow in a capital scarce economy (Romer 1986: pp. 1002-1037, Lucas 1988: pp. 3-42). It promotes economic growth by increasing volume as well as efficiency of physical investment (Grossman & Helpman 1991: pp. 33-42, Barro & Salai-I-Martin 1995: pp. 12-17). Besides, FDI brings lasting capital, innovative technologies, and management prowess, driving economic growth by generating jobs, improving skills, diffusing technology, and promoting innovation (Asiedu, 2002: pp. 107-119). On the other hand, multiple studies reveal adverse effects of FDI on economic growth stemming from inadequate infrastructure, technological expertise, and absorptive capacity of the economy. For instance, Khobai et al., (2018: pp. 33-55) demonstrated that FDI inflows have a detrimental impact on South Africa's economic growth trajectory. Similarly, Brahimi (2022: pp. 399-403) concluded that FDI does not exert an influence on Albania's economic development based on a study that modeled the role of FDI in the country's economic progress.

Official development assistance (ODA) or foreign aid primarily constitutes the transfer of resources, taking the form of both grants and loans, from developed nations to those that are in the process of development (Berthélemy 2006: pp. 179-194). The fundamental goal of providing foreign aid to developing countries is to help advance their economic progress and well-being (Roodman, 2004: pp. 255-277). On the contrary, many academics and analysts have cast doubt on the significance of foreign aid in the context of development, presenting diverse political, economic, and strategic arguments to substantiate their stance. Boone (1996: pp. 289-329) highlighted that foreign aid becomes futile when countries lack the necessary technical or administrative capacity to effectively absorb and utilize it. Alesina and Dollar (2000: pp. 33-63) identified aid as ineffectual in fostering growth within the recipient countries, particularly in the African context.

Net Foreign Assets (NFA) refer to the difference between a country's external assets and its external liabilities. A positive net foreign asset position signifies that a country owns more assets abroad than it owes to foreign entities. A decline in the value of a country's external assets relative to its external liabilities (due to unfavorable exchange rate movements) can affect its net foreign asset position and, subsequently, impact economic growth prospects (Lane and Milesi-Ferretti, 2002: pp. 1049-1071). The accumulation of NFA has an impact on exchange rate movement and thus economic growth. Bleaney & Tian (2014) discovered a long-run positive relationship between NFA and real exchange rates. Chia et al., (2014: pp. 42-53) concluded that a country's net foreign asset position is critically sensitive to asset price valuation and exchange rate movements. They also concluded that net foreign assets have less influence on real exchange rate in case of developing countries.

External debt plays a crucial role in providing financial support for the growth of developing nations, aiding in the accumulation of capital, the development of infrastructure, and the nurturing of human resources (Ramzan & Ahmad, 2014: pp. 204-210). The injection of external funds into investments can potentially stimulate economic expansion within the receiving country. Nevertheless, Siddiqui and Malik (2001: pp. 677-688) found that the mismanagement of resources, global competitiveness issues, and macroeconomic imbalances stand as the primary contributors to elevated foreign debt levels and their negative impact on economic growth. Cholifihani (2008: pp. 68-81) also discovered that a detrimental association exists between external debt, debt servicing, and both short-term and long-term effects on Indonesia's GDP spanning the period from 1980 to 2005.

This research focuses on the impact of financial integration on the economic growth of Bangladesh. The study will explore whether integrating with the global financial system can promote the economic progress of a developing nation or not. It will also investigate the significance of financial globalization in perspectives of ARDL model and ECM. The paper aims to examine whether international financial instruments can significantly influence the economic growth of Bangladesh, especially investigating the factors linked to financial globalization. This implies that the relevant stakeholders, like the analysts & policy makers, will be guided regarding integrating the local financial market with the external world. The outcome of this research will be interesting to the financial policy maker, development economist and general global financial researchers to formulate the decision regarding opening up the local financial market. It will guide further research in this area by finding the extent of these different variables related to financial globalization.

2. Literature review

Chigbu et al., (2015: pp. 7–21) used foreign borrowing, FDI, and portfolio investment on economic growth in Ghana and Nigeria and found a positive impact of remittances on

economic growth. Klobodu and Adams (2016: pp 291-307), using ARDL and 1970-2014 data, noted negative impacts of aid, FDI, and external debt on Ghana's growth, with a positive but insignificant impact of remittances. Tahir et al., (2019: pp. 1-8) argued aid, trade, FDI, debt, and remittances significantly influence SAARC countries' growth, with positive effects from foreign aid and FDI, and negative implications from foreign debt and trade flows.

Twerefou et al., (2020: pp. 2-14) studied the influence of Foreign Direct Investment, Official Development Assistance, and Remittances on Sub-Saharan African economic growth using the GMM technique and data from 47 countries spanning 1995-2017. Results suggest that remittances and FDI positively impact growth, aligning with the Solow neoclassical model. Conversely, ODA hampers growth due to likely weak institutional quality.

Rehman & Ahmad (2016: pp. 191-202) examined the influence of foreign capital inflows on economic growth across 21 developing nations during 1990-2013. Findings reveal that net external debt and net ODA have notably negative effects on developing countries' economic growth, while net FDI and net remittances positively impact long-term growth. Kentor (1998: pp. 1024-1046) noted a negative long-term impact and short-term positive impact of foreign capital inflows. Earlier researchers like Berument and Dincer (2004: pp. 20-32), Ndambendia and Njoupouognigni (2010: pp. 39-45), and Karamelikli & Bayar (2015: pp. 33-40) also indicated positive effects of capital inflows on economic growth.

Edison et al., (2002: pp. 749-776) investigated the impact of international financial integration on economic growth based on 57 countries and explored the level of economic development, financial development, legal system development, government corruption, and macroeconomic policies. Gaiesa et al., (2020: pp. 56-67) analyzed the effects of financial globalization on economic growth in emerging and developing countries by two-step GMM system method on dynamic panel data and found exchange rate volatility has a negative impact on long-term growth. They also pointed out that financial globalization promotes growth not only directly but also indirectly.

Kose et al., (2008: pp. 554-580) identify a set of indirect benefits of financial openness and argue that these could have a positive impact on Total Factor Productivity (TFP) growth because they lead to more efficient resource allocation (Mishkin, 2006). Bonfiglioli (2007: pp. 337-355) analyzes the impact of overall financial integration on TFP Growth. Bhanumurthy & Kumawat (2020: pp. 31-57) studied financial globalization and economic growth in South Asian countries with the help of Panel VAR and Panel causality (in GMM framework) models. They recommended that domestic macroeconomic policies act as pull factors for foreign capital.

Gui-Diby (2014: pp. 248-256) employed SYS-GMM estimators to explore FDI's impact on African economic growth, revealing significant influence during two periods: negative

from 1980 to 1994, and positive from 1995 to 2009. Borensztein et al., (1998: pp. 115-135) emphasized FDI as a tech transfer vehicle, promoting growth more than domestic investment, contingent on host country absorptive capacity. Seyoum et al., (2014: pp. 402-421) found two-way Granger causality between FDI and growth in African countries. Esso (2010: pp. 168-177) supported FDI's positive long-term effect on growth in several Sub-Saharan nations. In a study, Shastri et al., (2022: pp. 1-13) examined the connection between FDI and poverty reduction in significant South Asian economies after the implementation of reforms. Their findings revealed that both FDI and external debt had no discernible impact on poverty reduction.

Were (2001: pp 1-34) and Frimpong and Oteng-Abayie (2006: pp 232-239) investigated Kenya's and Ghana's situations, respectively, revealing that external debt accumulation can hinder growth, while the latter also highlighted the role of debt servicing. This negative impact is echoed by Chowdhury (2001: pp. 4-13), Pattilo et al., (2002: pp. 2-19), and Ruiz-Arranz et al., (2005: pp. 1-55), attributed to poor resource allocation and government mismanagement. Recent research by Fincke and Greiner (2015: pp. 357-370), Turan and Yanikkaya (2021: pp. 319-341) and Hassan and Meyer (2021) delved into the complexities of external debt's hindrance to growth, considering optimal debt levels and the underlying mechanisms.

Proponents of foreign aid suggest it spurs economic growth by addressing capital scarcity and aiding in physical and human capital development (Easterly et al., 2004: pp. 774–780; Clemens et al., 2012: pp. 590–617). Ang (2010: pp. 197-212) explored foreign aid's dual role in India, noting a direct negative influence on output but an indirect positive impact through financial liberalization. Konadu et al., (2016: pp. 248-261) identified corruption and high-interest payments on aid loans as contributors to Ghana's negative growth impact, mainly due to less cash flow-prone projects. Despite being a significant source of finance for growth and poverty reduction, Overseas Development Assistance (ODA) can have varying effects (Todaro and Smith, 2009: pp. 714- 749). Gebresilassie et al., (2023: pp. 1-19) found foreign aid negatively affects Ethiopia's growth in both short and long-run. Driffield and Jones (2013: pp. 173-196), Yiew & Lau (2018: pp. 21-30), and Phiri (2017: pp. 26-48) similarly found negative links between foreign aid and recipient countries' economic growth.

Rahman and Yusuf (2010: pp. 101-113) suggest that GDP growth in Bangladesh is an outcome of productivity growth as a result of capital deepening or labor inputs in the production process and input in TFP. Others claim that in addition to capital, labor and TFP, effective reforms towards economic liberalization and financial integration explain the positive shifts (Bashar and Khan, 2007: pp. 61-76). Bashar & Khan (2012: pp. 125–143) found long-run economic growth in Bangladesh is largely explained by investments in both physical and human capital, trade openness, and financial as well as capital account liberalization.

3. Methodology

This study analyzes the association between external financial inflow in a country and its GDP per capita, a proxy for economic development indicator (Bhanumurthy & Kumawat, 2020: pp. 31-57). For this study, foreign direct investment, official development assistance, net foreign assets and external debt stocks have been considered as factors of financial integration. This research focuses on the model provided by Kose et al., (2008: pp. 554-580) and Lucas (1988: pp. 3-42) to analyze the impact of financial integration on economic development. The empirical analysis uses the Autoregressive Distributed Lag (ARDL) model with Error Correction Model (ECM) to establish the impact of financial globalization on economic growth. The ECM confirms both the short-term and long-term impacts of independent variables on dependent one. While, other econometric analysis such as unit root test, lag order selection, multicolliniarity test, Bruesch–Godfrey serial correlation test, Jarque–Bera normality test, and Breusch–Pagan–Godfrey heteroske-dasticity test; and stability tests (i.e. Cusum and Cusum of the squares tests) are applied to validate the suitability of the estimated ARDL model. Besides, these tests provide a trustworthy econometric result for the study. Finally, the pairwise Granger causality test is used to verify the direction of causality among variables. The outcome of this research is to explore the impact of explanatory variables on explained variables to draw some insightful suggestions for policymakers. The econometric analysis of the data has been done by using E-views v12 [student edition]

4. Data description and model specification

4.1. Data Description

The study employs annual time series data of Bangladesh gleaned from the World Development Indicators Database (2023). Datasets were selected by considering the maximum availability of data of all the selected variables. Thus, the final dataset covers 35 years' period spanning from 1987 to 2021. The data on designated variables that include GDPC (Log of GDP per capita (current US$)), FDI (Foreign direct investment, net inflows (% of GDP)), ODA (Net Official Development Assistance received (% of GNI)), NFA (Log of Net Foreign Assets (current LCU)), EDS (External Debt Stocks (% of GNI)).

Descriptive Statistics

A Comprehensive details regarding the summary of descriptive statistics are succinctly provided in Table1.

Table I. *Descriptive Statistics*

	GDPC	C	FDI	ODA	NFA	EDS
Mean	2.774639	1.000000	0.558351	2.300839	11.25720	27.81481
Median	2.671281	1.000000	0.445961	1.725880	11.17069	26.92587
Maximum	3.390568	1.000000	1.735418	6.510653	12.49770	44.48178
Minimum	2.383447	1.000000	0.000861	0.910975	8.362974	14.96548
Std. Dev.	0.307161	0.000000	0.511453	1.551818	0.921613	8.604281
Skewness	0.667738	NA	0.619370	1.356934	-0.868294	0.366219
Kurtosis	2.191416	NA	2.324962	3.499883	4.154226	1.927059
Jarque-Bera	3.554397	NA	2.902308	11.10515	6.340796	2.461182
Probability	0.169111	NA	0.234300	0.003877	0.041987	0.292120
Sum	97.11236	35.00000	19.54229	80.52938	394.0021	973.5185
Sum Sq. Dev.	3.207828	0.000000	8.893850	81.87671	28.87858	2517.144
Observations	35	35	35	35	35	35

The descriptive statistics of dependent variables and four independent variables presents based on the observations of 35 years. Standard deviation of GDPC was lowest among all the variables, whereas EDS had highest deviation from mean. The Kurtosis value of GDPC, FDI and EDS was less than three, however, for ODA & NFA it became greater than three. The reasons may be a heavier tail than the normal distribution of the data. Practically speaking, the ODA and NFA value of Bangladesh was very low and sometimes insignificant after the independence of 1971. Moreover, due to lack of stable financial growth and economic uncertainty in the last decade of the 20s, the external financial flow does not seem to be a normal distribution.

Correlation Coefficient

Table II. *Correlation Coefficient*

	GDPC	FDI	ODA	NFA	EDS
GDPC	1.00				
FDI	0.57	1.00			
ODA	-0.70	-0.62	1.00		
NFA	0.87	0.65	-0.81	1.00	
EDS	-0.89	-0.75	0.83	-0.80	1.00

The Pearson correlation analysis reveals that all the variables have GDPC is statistically and significantly correlated with its predictor variables. According to Dancey & Reidy (2007: pp. 36-44), if the value is greater than 0.7 then the relationship seems to be strong. Among all the predictors, ODA and EDS have negative correlation with dependent variables and other two independent variables have positive correlation. NFA has a strong positive correlation with growth.

4.2. Model specification

This paper investigates the links between FDI, ODA, NFA & EDS and GDP per capita. The aim of this research is to establish the relations whether financial integration has an impact on the economic growth of Bangladesh. Accordingly, the study formulated an econometric model based on the empirical literature such as Prasad et al., (2007: pp. 153-230), Kose et al. (2008: pp. 554-580), (Mishkin, 2006), Billmeier and Nannicini (2007: pp. 17-20).

Thus, the econometric model is as follows:

$GDPC = \beta_o + \beta_1 FDI + \beta_2 ODA + \beta_3 NFA + \beta_4 EDS + \mu_t$

Wherein,

Variable	Explanation
GDPC	Log of GDP per capita (current US$)
FDI	Foreign direct investment, net inflows (% of GDP)
ODA	Net ODA received (% of GNI)
NFA	Log of Net foreign assets (current LCU)
EDS	External debt stocks (% of GNI)

The coefficients β_1, β_2, β_3, and β_4 signify the long-term elasticity projections of GDPC in relation to the FDI, ODA, NFA, and EDS, respectively. μ_t is the error term of the model.

5. Empirical findings and discussions

5.1. Unit Root Test:

Both the unit root tests showed the similar result. At first, the dataset was tested at Level by considering individual intercept as well as individual intercept & trend, if the data are not stationary at level, then 1st difference is used.

Table III. *Augmented Dickey-Fuller Test (1979: pp. 427-431) & Phillips-Perron Test Equation (1988: pp. 335-346)*

Variable	ADF			PP			*Decision*
	Level	1st Difference	*Status*	Level	1st Difference	*Status*	
GDPC	2.4234	-3.8316***	I(1)	2.1656	-3.8217***	I(1)	Stationary I(1)
FDI	-1.7943	-6.7281***	I(1)	-1.6866	-6.7427***	I(1)	Stationary I(1)
ODA	-3.1656**	-	I(0)	-7.0442***	-	I(0)	Stationary I(0)
NFA	-1.7838	-9.2729***	I(1)	-1.5863	-12.0741***	I(1)	Stationary I(1)
EDS	-0.8701	-4.2927***	I(1)	-1.1545	-4.0640***	I(1)	Stationary I(1)
*MacKinnon (1996) one-sided p-values, considering **intercept only***							
I(0) and I(1) are significant at Level and 1st Difference respectively.							
***, **, * *are variables are significant at 1%, 5% & 10% critical value*							

The ADF and PP result reveals that all the all the variables are non-stationary at the level but become stationary at the first difference, with an exception of the ODA which is stationary at level. None of the variables are stationary at second difference I(2), which confirms that the Autoregressive Distributed Lag (ARDL) model can be applied for the further analysis (Frimpong & Oteng-Abayie 2006).

5.2. Lag Order Selection

Selecting the appropriate lag order for a time series model is crucial to obtain reliable and accurate results from the ARDL model (Lütkepohl, 2006: pp. 75-88). The choice of lag order can significantly impact the model's performance in forecasting and capturing the underlying dynamics of the data.

Table IV. *Tests for Lag Order Selection*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-146.0221	NA	0.006497	9.152855	9.379599	9.229147
1	15.52622	264.3518*	1.69e-06*	0.877199*	2.237660*	1.334953*
2	37.53565	29.34592	2.26e-06	1.058445	3.552624	1.897661

* indicates lag order selected by the criterion

To find the lag order, five different lag order selection criteria have been used to select a suitable lag for the dependent and the independent variables of this research. In this study, all the measures suggest 1 lag order for robust and reliable information. Thus lag 1 reveals the co-integration relationship between the variables.

5.3. Diagnostic tests results

Following an examination of variable stationarity, the model's standard properties were assessed using diagnostic tests for stability. These tests encompassed the detection of serial correlation (Brush and Godfrey LM test), assessment of functional form (Ramsey's RESET), evaluation of normality deviations (Jarque-Bera test), and scrutiny for heteroscedasticity (Breusch-Pagan-Godfrey test).

5.3.1. Multicolliniarity Test

Multicolliniarity is the situation in which independent variables are highly correlated with each other and create a paradoxical effect (Gujarati, 2004). To examine the Multicolliniarity, the Variance Inflation Factor (VIF) test, proposed by Farrar and Glauber (1967: pp. 92-107), has been employed among independent variables. The VIF measures the inflation in the variances of the estimated coefficients due to multicollinearity. High VIF values, typically above 10, indicate potential multicollinearity issues in the model.

$VIF = \frac{1}{1-R_j^2}$ where, R_j^2 is the coefficient of determination for the explanatory variable, j = 0,1,2,…….,m

Table V. *Multicolliniarity Test Using VIF*

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.127800	734.9122	NA
FDI	0.001588	5.168402	2.320942
ODA	0.000295	12.92929	3.962422
NFA	0.000733	537.9024	3.479620
EDS	1.19E-05	57.75708	4.912351

From the outcome of the multicollinearity test, based on VIF values, it is found that all the VIF values are below the threshold (e.g., 10) in the model. It confirms that there is no evidence of multicollinearity among the selected explanatory variables of the model. Thus, the result confirms that the variables are truly independent and insightful for the predictors of GDPC.

5.3.2. Autocorrelation or Serial Correlation Test

Autocorrelation or serial correlation justifies the reliability of the regression analysis and its output. To justify the autocorrelation, the Breusch–Godfrey serial correlation LM test is used. As the probability value of the test is greater than 0.05, the study fails to reject the null hypothesis and confirms that the data are free from serial correlation.

Table VI. *Breusch–Godfrey Serial Correlation LM Test*

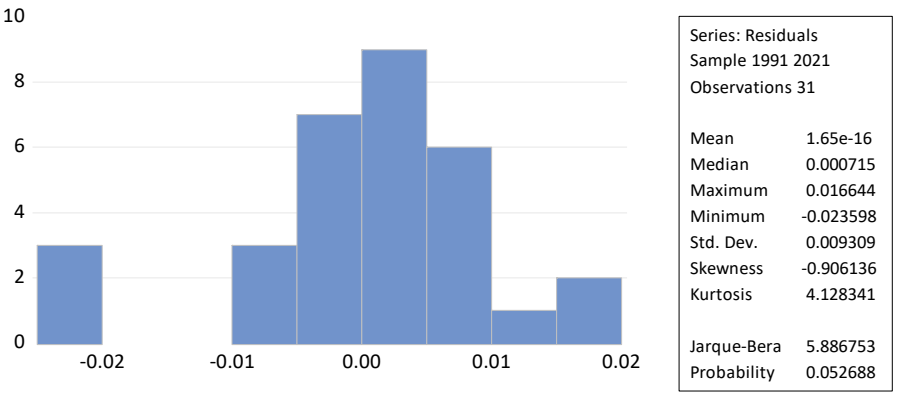
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.089271	Prob. F(1,29)	0.7672
Obs*R-squared	0.107410	Prob. Chi-Square(1)	0.7431

As the p-value is greater than the threshold level (e.g., 0.05), the null hypothesis can't be rejected. This indicates that there is no significant evidence of serial correlation in the residuals, which is desirable for a regression model.

5.3.3. Normality Test or Residual Analysis

Figure 1. *Breusch–Godfrey Serial Correlation LM Test*



Residual Analysis confirms the data rationalization by Jarque–Bera normality test by taking lag 4. From the summary of above analysis, it can be summarized that the p-value is slightly higher than 0.05 critical value. Therefore, the null hypothesis cannot be rejected, thus, population residuals are normally distributed and have a good regression line.

5.3.4. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroscedasticity means data are "differently scattered", or data are not homoscedastic or centered to the line. Breusch–Pagan–Godfrey heteroscedasticity test is a common test to verify whether there exists any heteroskedasticity problem in the residuals or not.

Table VII. *Heteroskedasticity Test: Breusch-Pagan-Godfrey*

Null hypothesis: Homoskedasticity

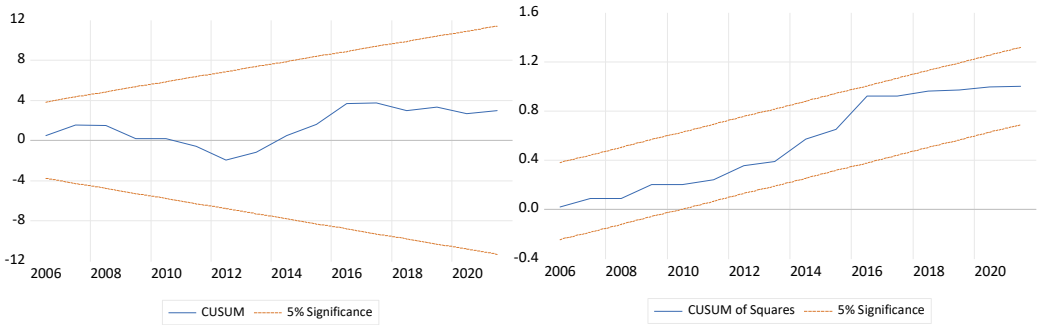
F-statistic	0.710643	Prob. F(14,16)	0.7368
Obs*R-squared	11.88558	Prob. Chi-Square(14)	0.6155
Scaled explained SS	4.952462	Prob. Chi-Square(14)	0.9865

As the p-value of the test is higher than 0.05 critical value, we fail to reject the null hypothesis which means that residuals are homoscedastic. The p-value is greater than 0.05, and thus, confirms no heteroscedasticity problem among the residuals of the model.

5.4. Stability Diagnostic Test: Recursive Estimate

Cumulative sum (CUSUM) and CUSUM of squares (CUSUMSQ) tests are used to identify the stability of the model (Brown et al., 1975: pp. 149-163).

Figure 2. *Stability diagnostic-Cusum and Cusum of squares tests result*



As the line graphs of both Cusum and Cusum of squares tests are distributed within the two red lines (within the 5% significant level) (Pesaran & Shin 1999: : pp. 371 – 413; Pesaran et al.,2001: pp. 289–326), therefore, the estimates are stable and the parameters of the model do not suffer from any structural instability. Thus, the model appears to be stable in estimating long-run and short-run relationships between variables (Gebresilassie et al., 2023). The model does not require adding any other variable to prove the significance of independent variables on dependent variables. Hence, based on the above test results, it is certain that the ARDL model can be applied on the selected dataset for further study.

5.5. ARDL Bound Test

ARDL bounding test is used to determine whether a long-run relationship exists between two or more variables in a time series setting. The aim of this test is to accommodate different integrating orders of the variables stationary at different levels (Narayan, 2004: pp. 46-55). For the bound test, the null hypothesis is assuming “no cointegration” among the variables [$H_0 = a_1 = a_2 = a_3 = a_4 = 0$]. The critical value for the ARDL bound test is

higher than the upper bounds value I(1), therefore, cointegration exists among the study variables.

Table VIII. *ARDL Bounding Test*

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	29.78186	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

The Bound Test represents that the value of F-statistics is much higher than critical bound values (Pesaran & Shin 1999: pp. 371 – 413) and rejects the null hypothesis. Thus, the result indicates a long-run relationship exists among study variables. Therefore, a long-run relationship among economic growth and variables exists in the model. Thus, it suggests that an Error Correction Model (ECM) needs to be used for a long run model.

5.6. Wald Test

Table IX. *Wald Test*

Test Statistic	Value	df	Probability
F-statistic	139.2938	(5, 16)	0.0000
Chi-square	696.4689	5	0.0000

Null Hypothesis: C(1)=C(2)=C(3)=C(4)=C(5)=0

As p-value is less than 0.05, we reject the null hypothesis which means there is presence of short run causality.

5.7. ARDL Model

The bound test for co-integration test, model stability, and diagnostic test results indicates that there is an existence of a long-run relationship between GDPC and independent variables of the study (Gebresilassie et al., 2023). The ARDL is commonly used for examining the short-run and long-run association in empirical studies (Nguyen & Bui 2019: pp. 290-332; Phuc and Duc 2021: pp. 5-20). The similar test also has used in the study of Adams Jr, (2016: pp. 15-17), Qamruzzaman & Wei (2018: pp. 1-30).

Following the ARDL model developed by Nasrullah et al., (2021: pp. 2256-2270), this paper has construct the following ARDL model:

$$\Delta GDPC_t = \alpha_2 + \sum_{k=1}^{n} \alpha_1 \Delta GDPC_{t-k} + \sum_{k=1}^{n} \alpha_2 \Delta FDI_{t-k} + \sum_{k=1}^{n} \alpha_3 \Delta ODA_{t-k} + \sum_{k=1}^{n} \alpha_4 \Delta NFA_{t-k} + \sum_{k=1}^{n} \alpha_5 \Delta EDS_{t-k} + \lambda_1 GDPC_{t-1} + \lambda_2 FDI_{t-1} + \lambda_3 ODA_{t-1} + \lambda_4 NFA_{t-1} + \lambda_5 EDS_{t-1} + \epsilon_t$$

The study uses the Akaike information criterion (AIC) for choosing the lag length. After finding the long-run association existing between variables, the study uses the error correction model (ECM) to find the short-run dynamics.

$$\Delta GDPC_t = \alpha_2 + \sum_{k=1}^{n} \alpha_1 \Delta GDPC_{t-k} + \sum_{k=1}^{n} \alpha_2 \Delta FDI_{t-k} + \sum_{k=1}^{n} \alpha_3 \Delta ODA_{t-k} + \sum_{k=1}^{n} \alpha_4 \Delta NFA_{t-k} + \sum_{k=1}^{n} \alpha_5 \Delta EDS_{t-k} + \emptyset ECM_{t-1} + \epsilon_t$$

Where, α_0 represents the constant while α_1 to α_5 are the coefficients of respective variables, t represents the time period from 1987 to 2021, k is the optimum lag length, ε_t represents the error term, Δ is shows the first difference, λ_1 to λ_5 is the coefficients of respective variables, Ø is the coefficients of ECM for short-run dynamics which shows the speed of adjustment in long-run equilibrium after a shock in the short run.

Table X. *ARDL Test Result*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDPC(-1)	0.722872	0.095250	7.589233	0.0000
FDI	-0.037978	0.014089	-2.695662	0.0159
FDI(-1)	-0.007091	0.014402	-0.492364	0.6291
FDI(-2)	-0.015879	0.012402	-1.280338	0.2187
FDI(-3)	0.033014	0.012424	2.657354	0.0172
FDI(-4)	-0.032481	0.012249	-2.651639	0.0174
ODA	0.001842	0.010251	0.179744	0.8596
ODA(-1)	0.012600	0.009247	1.362554	0.1919
ODA(-2)	-0.000123	0.008298	-0.014785	0.9884
ODA(-3)	-0.015924	0.007773	-2.048542	0.0573
ODA(-4)	0.014107	0.005903	2.389937	0.0295
NFA	0.133735	0.035437	3.773854	0.0017
EDS	-0.009925	0.002261	-4.390704	0.0005
EDS(-1)	0.004381	0.002026	2.162626	0.0461
C	-0.579361	0.127016	-4.561318	0.0003

After applying ARDL model based on the Akaike Info Criterion (AIC), the short-run result of independent variables present one lag period for dependent variable, four lags for periods FDI & ODA, one lag period for EDS, on the other hand, NFA is a lag free variable.

Therefore, the ARDL model confirms that the optimum lag length is (1,4,4,0,1) for this study.

The short-run result of ARDL shows that FDI has negative influence on economic growth at level and four lagged periods, however, it becomes significantly positive at three lagged periods. Based on Wald test, FDI at all the lagged periods can jointly influence economic growth. ODA becomes positively significant at the fourth lagged period whereas NFA has a positive influence on economic growth at level. EDS has negative impact at level and positive impact at first lagged on per capita GDP of Bangladesh.

The adjusted R-squared is quite high (0.999) and p-value of F-statistics 1166.085 (p=0.00) is significant, which represents that the whole model is significant in the short-run.

Estimation Equation:

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GDPC = C(1)*GDPC(-1) + C(2)*FDI + C(3)*FDI(-1) + C(4)*FDI(-2) + C(5)*FDI(-3) + C(6)*FDI(-4) + C(7)*ODA + C(8)*ODA(-1) + C(9)*ODA(-2) + C(10)*ODA(-3) + C(11)*ODA(-4) + C(12)*NFA + C(13)*EDS + C(14)*EDS(-1) + C(15)

Table XI. *Long-run Coefficients for ARDL Approach*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI	-0.218004	0.056717	-3.843719	0.0014
ODA	0.045117	0.023372	1.930420	0.0715
NFA	0.482575	0.053905	8.952386	0.0000
EDS	-0.020007	0.005626	-3.556317	0.0026
C	-2.090591	0.683295	-3.059573	0.0075

EC = GDPC - (-0.2180*FDI + 0.0451*ODA + 0.4826*NFA -0.0200*EDS - 2.0906)

All the variables have a long-run relationship with economic growth as they are significant at 1% critical value except ODA, which is significant at 10% critical value.

The relationship shows that FDI is a negative relationship with economic growth of Bangladesh. The result is similar to the findings by Borenztein et al., (2001), Tait et al., (2015: pp. 3-50) and Makori et al., (2015: pp. 1140-1149) and Alfaro (2003: pp. 1-31). Moreover, Schoors et al., (2001: pp. 2-35) also supported that FDI can have a negative impact on domestic economies because of repatriation of profit and market stealing effect. Similarly, Gorg and Greenwood (2002: pp. 2-37) also concluded that negative relationships may happen because of spillover effects. EDS has also shown negative correlation with economic growth of Bangladesh.

5.8. ECM Regression

Table XII. *ECM result*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI)	-0.037978	0.007847	-4.840091	0.0002
D(FDI(-1))	0.015346	0.007901	1.942225	0.0699
D(FDI(-2))	-0.000533	0.007855	-0.067823	0.9468
D(FDI(-3))	0.032481	0.007987	4.066874	0.0009
D(ODA)	0.001842	0.005432	0.339176	0.7389
D(ODA(-1))	0.001939	0.004877	0.397601	0.6962
D(ODA(-2))	0.001816	0.004645	0.391059	0.7009
D(ODA(-3))	-0.014107	0.004052	-3.481912	0.0031
D(EDS)	-0.009925	0.001047	-9.482923	0.0000
CointEq(-1)*	-0.277128	0.018096	-15.31444	0.0000

R-squared	0.895095	Mean dependent var	0.029706
Adjusted R-squared	0.850136	S.D. dependent var	0.028742
S.E. of regression	0.011127	Akaike info criterion	-5.903262
Sum squared resid	0.002600	Schwarz criterion	-5.440686
Log likelihood	101.5006	Hannan-Quinn criter.	-5.752474
Durbin-Watson stat	1.505765		

* p-value incompatible with t-Bounds distribution.

The error correction model (ECM) measures the speed of adjustment towards long run equilibrium from any short run shocks (Islam, 2020: pp.1301-1309). It also shows short-run dynamic coefficient estimation. It should have a negative sign and is statistically significant.

The R-squared value indicates that approximately 85% of the fluctuations in GDP per capita can be accounted for by changes in the explanatory variables within the short-term model.

According to the ECM model, FDI is significant at level & at third lagged period, ODA is only significant at third lagged period and EDS is viable at level in short-run. The ECM model represents both the short-run coefficients and long-run adjustment. The long-run adjustment (CointEq) is negative or less than 1, which shows that the model will adjust monotonically.

For long-run coefficients, the ARDL error correction model is used. Error Correction Coefficient (CointEq) is negative and statistically significant, which confirms that the model has long-run causality. CointEq also represents the speed of the adjustment of any equilibrium towards a long run equilibrium state. In the above model, the speed of the adjustment is 0.2771 * 100 = 27.71% each year, which indicates that the deviation from the long term in economic growth is corrected by 27.71% in the next year. Thus, the speed of the adjustment is low. Meaning that it required almost 3.61 years to come back to the long-run equilibrium position. Thus, a causality test is required.

5.9. Ganger causality test:

Table XIII. *Ganger causality test*

NFA does not Granger Cause ODA	33	2.68599	0.0857
ODA does not Granger Cause NFA		4.43890	0.0212
EDS does not Granger Cause ODA	33	0.99912	0.3810
ODA does not Granger Cause EDS		2.70928	0.0840
EDS does not Granger Cause NFA	33	2.06610	0.1456
NFA does not Granger Cause EDS		4.37556	0.0222

As the p value of "ODA does not Ganger Cause NFA" is less than 5% critical value we can reject this hypothesis and state that ODA Ganger Cause NFA. Similarly, NFA Ganger Cause EDS at 5% critical value.

At 10% critical value, ODA Ganger Cause EDS. All other relations (null hypothesis) are statistically insignificant and can't be rejected. Now, as causality exist, Wald test is done to view the degree of causality.

5.10. Fully Modified OLS (Cointegrated Tests)

Table XIV. *Fully Modified OLS*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI	-0.204123	0.032789	-6.225294	0.0000
ODA	0.095408	0.015969	5.974625	0.0000
NFA	0.243772	0.022299	10.93198	0.0000
EDS	-0.035537	0.002969	-11.96865	0.0000
C	0.918308	0.294844	3.114557	0.0041
R-squared	0.937597	Mean dependent var		2.786144
Adjusted R-squared	0.928990	S.D. dependent var		0.304028
S.E. of regression	0.081017	Sum squared resid		0.190348
Long-run variance	0.004118			

This test shows similar results of the ARDL model, even canonical cointegrated models also represent similar results and same variables remain significant. R-squared also remains high in this model.

T-statistics: absolute t value is more than the 2 > variable is significant as the p value is less than 5% critical value. EDS and FDI are found negatively significant. This finding is in line with Islam (2020: pp.1301-1309).

6. Conclusion

This study utilized the ARDL approach for co-integration, focusing on both long-term and short-term connections between global financial integration and economic growth. The findings revealed that 85% of the variability in GDP per capita could be explained by exogenous variables. The bounds test results confirmed the presence of a log-run relationship between the variables, a conclusion reinforced by the highly significant and appropriately signed error correction term. The research observed a moderate speed of convergence toward long-term equilibrium. Furthermore, the findings revealed that all variables, except for ODA, played a significant role in explaining economic growth both in the short term and the long term within the context of Bangladesh.

The findings indicate that Official Development Assistance (ODA) and foreign assets serve as effective tools for stimulating long-term economic growth, as they exhibit positive and substantial effects on GDP per capita. In contrast, external debt and Foreign Direct Investment (FDI) have a detrimental impact on economic growth. The negative sign of the error correction term signifies the trend towards long-term equilibrium, with the error correction coefficient indicating a significant yet slow speed of convergence to equilibrium.

To investigate both long-term and short-term economic growth models, the study employed an Autoregressive Distributed Lag (ARDL) approach covering the years from 1987 to 2021. This choice was made because the ARDL method provides dependable estimates, even when dealing with endogenous variables. It can be applied whether the predictor variables are stationary at I(0), I(1), or exhibit mixed stationarity. Additionally, it is particularly reliable and efficient when dealing with small sample sizes, as is the case in this study.

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