2026 Volume: 02 Issue: 01 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-33

MACROECONOMIC VARIABLES AND ECONOMIC GROWTH IN NIGERIA

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Article Received: 07 December 2025
Article Revised: 27 December 2025
Published on: 15 January 2026

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DOI: https://doi-doi.org/101555/ijrpa.9057

ABSTRACT

This study investigates the effect of selected macroeconomic variables on economic growth in Nigeria. The study was motivated by persistent instability in key macroeconomic indicators and their implications for economic performance. Annual time-series data were used to examine the relationship between economic growth and selected macroeconomic variables, including interest rate, inflation rate, exchange rate, and foreign direct investment. Real Gross Domestic Product (RGDP) was adopted as a proxy for economic growth. The Autoregressive Distributed Lag (ARDL) bounds testing approach and the Error Correction Model (ECM) were employed for data analysis. The results indicate a long-run relationship among the variables. Exchange rate and inflation rates were found to have adverse and significant effects on economic growth, whereas foreign direct investment had a positive and significant effect. Interest rate showed a positive but statistically insignificant relationship with economic growth. The study concludes that macroeconomic stability is essential for sustainable economic growth in Nigeria.

KEYWORDS: Economic growth; Macroeconomic variables; Exchange rate; Inflation rate; Foreign direct investment

1.INTRODUCTION

The trajectory of an economy is intrinsically shaped by the dynamics and policy decisions that govern its macroeconomic variables. Fundamental indicators, including interest rate,

inflation, exchange rate, and foreign direct investment (FDI), are pivotal in influencing economic outcomes globally, with Nigeria being a pertinent case (Adebayo & Gambiyo, 2020; Ahmed, 2010; Antwi et al., 2013; Chandra Majumder, 2016; Chekwa et al., 2025; Clement et al., 2025; Cookey & Eniekezimene, 2020; Hossain et al., 2012). Macroeconomic theory, drawing from neoclassical, Keynesian, and endogenous growth paradigms, identifies a constellation of factors, such as capital accumulation, technological progress, human capital development, and institutional policy frameworks, that collectively determine national economic progress (Alali, 2022; Ayomitunde , Aderemi Timothy et al., 2020; Chukwuemeka, 2024; J. Ditimi et al., 2011; Mishra et al., 2024; Ojo & S.T, 2018; Ridwannudin et al., 2025a, 2025b). The strategic deployment of monetary and fiscal policy instruments to modulate these variables is essential for fostering sustainable economic growth and development. In the Nigerian context, the Central Bank of Nigeria (CBN) has employed mechanisms such as the Monetary Policy Rate (MPR) and direct interventions in the foreign exchange market to mitigate recessionary trends, stabilize the national currency, and contain persistently high inflation (Ayomitunde et al., 2020; Bamaiyi & Dariyem, 2023; Emmanuel Adegoriola, 2018; Falade & Folorunso, 2015; Frederick & Benjamin, 2025; J. Ditimi et al., 2011; Okotori & Gbalam, 2020).

Notwithstanding these efforts, FDI inflows have remained subdued, mainly attributable to a challenging domestic business climate. A persistent paradox exists: despite extensive financial sector reforms enacted over preceding decades aimed at harmonizing macroeconomic aggregates, the Nigerian economy continues to experience pronounced instability, characterized by elevated inflation, exchange rate volatility, and interest rate fluctuations (Ayomitunde et al., 2020). This enduring condition has generated substantial academic inquiry, yet empirical investigations into the efficacy of these variables in resolving Nigeria's macroeconomic challenges have produced equivocal and often contradictory findings (Ilegbinosa & Moses, 1970; J. Ditimi et al., 2011; Onyeagba, 2015). This empirical ambiguity underscores a critical research gap and warrants renewed examination to elucidate the precise relationships between selected macroeconomic variables and economic growth in Nigeria, using contemporary data and robust methods.

The conceptual underpinnings of this inquiry are rooted in established economic literature. Macroeconomic variables are broadly defined as indicators reflecting the overall state of a national economy, including metrics such as interest rates, inflation, and FDI, which policymakers seek to stabilize to ensure efficient economic functioning (Abdullahi Sule, 2024; Efthimiou, 2024; Ismail & Suraya Ismail, 2021; Jaiswal & Kumar, 2024; Ulah, Farid;

Rauf, 2013). Economic growth is conventionally defined as a sustained increase in real per capita income or real Gross Domestic Product (GDP) over an extended period (Abdullahi Sule, 2024; Efthimiou, 2024; Jaiswal & Kumar, 2024). GDP, representing the aggregate market value of all final goods and services produced within a country's borders, serves as the primary barometer of economic performance (Kibria et al., 2014). Theoretical explanations for growth determinants are diverse. The Harrod-Domar growth model emphasizes the primacy of capital accumulation as the key driver of steady economic growth, highlighting the dual role of investment in creating both productive capacity and effective demand (Domar, 1946; Harrod, 1939). In contrast, the Neoclassical Growth Theory, notably advanced by (Solow, 1956, 1957), incorporates factors of production, labor, capital, and exogenous technological progress within a formal aggregate production function, allowing for substitution between inputs and convergence to a steady-state growth path driven ultimately by technology. The Keynesian theoretical framework diverges from the classical view by conceptualizing the interest rate as a reward for parting with liquidity preference rather than as the classical mechanism of saving-investment equilibrium, and by underscoring the determinative role of aggregate demand and investment (influenced by animal spirits and expectations) in driving short-run output and employment levels (Beckhart, 1936; Kahn, 2022; Keynes, 2018; Schumpeter & Keynes, 1936; Solimano, 2024).

Examining the specific variables, the interest rate is the price of money, serving a vital rationing function in the allocation of credit within an economy. This role is empirically supported by recent studies that demonstrate that interest rates fundamentally determine the cost of borrowing, thereby directly influencing consumption patterns and corporate investment decisions (Alafif, 2023). The rationing mechanism operates through the pricing of risk and the allocation of scarce financial capital. Research by (Kwak, 2025) provides quantitative evidence that credit-to-GDP ratios are significantly correlated with interest rate spreads, revealing how differential pricing effectively allocates credit across economic sectors, channeling funds toward areas deemed to offer higher productivity or lower risk. This regulatory capacity extends to broader macroeconomic stability. (Munir et al., 2025) further corroborate this function by illustrating how deliberate interest rate adjustments can serve as a dual-purpose instrument to manage inflationary pressures while concurrently modulating systemic financial risks within the banking sector.

The transmission of this rationing effect, however, is not instantaneous and is subject to inertia. (Duquerroy et al., 2020) documented that banks may absorb increases in funding costs of at least 30 basis points before adjusting their lending rates to the broader market,

highlighting the nuanced and occasionally delayed channel through which monetary policy rates ultimately influence credit availability in the real economy. This collective evidence reinforces the central role of interest rates as a critical allocative mechanism within the financial system. It manifests in various forms, including lending rates, deposit rates, and the monetary policy rate, each influencing economic decision-making (Agalega & Antwi, 2013). The postulated relationship with growth is frequently inverse; elevated interest rates can constrain investment and dampen economic expansion, whereas lower rates are typically associated with stimulative effects (Ma & Zimmermann, 2023; Shaukat et al., 2019). Inflation, defined as a persistent and generalized increase in the price level, is widely regarded as economically and politically costly, introducing uncertainty that can distort investment and savings decisions, thereby impairing long-term growth prospects (Andrés & Hernando, 1999; Barro, 1995; Bashir, 2022; Bruno & Easterly, 1998; Fischer, 1993; Gillman et al., 2004; Ma & Zimmermann, 2023; Ojomolade, & Oni, 2018; Shaukat et al., 2019). This detrimental effect arises because inflation erodes purchasing power, complicates long-term contracting, and can lead to inefficient resource allocation as economic agents divert effort toward hedging against price increases rather than productive activity. The exchange rate, the price at which one currency is exchanged for another, is a crucial determinant of a country's international trade competitiveness, capital flows, and overall external balance (Bussière et al., 2020; Rao, 2024; Shuabiu et al., 2021; Wang, 2025). It directly affects import costs and export revenue, thereby influencing domestic production, inflation, and investment decisions. Foreign Direct Investment (FDI) entails a long-term commitment reflecting a lasting interest and a significant degree of influence or control (typically evidenced by ownership of at least 10% of voting power) by a resident entity in one economy over an enterprise resident in another economy (Benz et al., 2011; OECD, 2008; Ragoussis et al., 2024). FDI is valued for its potential to transfer capital, advanced technology, and managerial expertise, thereby enhancing productive capacity, fostering innovation, and contributing to economic growth in host countries through spillovers, employment generation, and knowledge diffusion (Huynh, 2022; Osano & Koine, 2015). The interaction of these four variables: interest rate, inflation, exchange rate, and FDI, forms a complex web that defines a nation's macroeconomic environment and its growth potential.

Empirical investigations into these relationships within Nigeria and comparable economies present a complex and sometimes inconsistent picture. Recent scholarly work indicates the presence of non-linear or threshold effects; for instance, inflation and exchange rate depreciation may adversely affect economic growth only beyond specific levels, while

moderate rates could be supportive (Oyadeyi et al., 2025). The impact of FDI is generally found to be positive on growth through capital and technology channels, albeit with varying potency between the short and long term (Kolawole & Seyingbo, 2025). The influence of interest rates remains particularly contentious, with findings often showing insignificant or context-contingent effects (Goshit & Terese, 2022). Complementary research suggests that exchange rate stability or depreciation can attract FDI by enhancing export competitiveness and lowering asset costs for foreign investors, while prior or sustained GDP growth signals market potential and economic vitality, positively influencing inflows (Aderemi et al., 2020; Ogunbunmi, 2019; Salako & Adebusuyi, 2001). Conversely, high inflation introduces uncertainty and erodes real returns, deterring FDI, and elevated policy rates (high interest rates) increase borrowing costs and reduce profitability prospects for investors (Ogunbunmi, 2019; Ogwuru et al., 2025; Salako & Adebusuyi, 2001).

Earlier studies, such as those by (Egbunike & Okerekeoti, 2018; Jabaru & Jimoh, 2020), further illustrate the nuanced and sometimes contradictory dynamics between monetary policy, inflation, exchange rates, and real sector performance in Nigeria. This corpus of evidence highlights the context-dependent nature of macroeconomic interactions, underscoring the need for updated, methodologically sound analyses to disentangle these complex relationships in Nigeria's evolving economy.

Against this backdrop, the study's overarching objective is to critically examine the effects of selected macroeconomic variables on Nigeria's economic growth. The specific objectives include determining the impact of interest rates on economic development, exploring the influence of inflation rates on economic growth, assessing the effect of exchange rates on GDP, and investigating the role of foreign direct investment (FDI) in economic development. The study is guided by research questions and posits null hypotheses that assert the absence of significant relationships between economic growth and the specified variables: interest rates, inflation rates, exchange rates, and FDI. The analytical framework is based on a synthesis of the Keynesian IS-LM model, incorporating the dynamics of liquidity preference and investment, as well as growth theories emphasizing capital accumulation. This integrated approach enables examination of both the short-run demand-side effects of monetary variables and the long-run supply-side determinants of growth.

The temporal scope of the study covers Nigeria from 1999 to 2020, a period marked by significant economic reforms and cycles, including the transition to democratic governance and varying episodes of oil price shocks and financial sector restructuring. It utilizes time-series data from the Central Bank of Nigeria's statistical bulletins, annual reports, and the

National Bureau of Statistics. By employing the Autoregressive Distributed Lag (ARDL) methodology, this study aims to contribute robust empirical evidence to existing literature, providing insights that can inform more effective macroeconomic policy formulation aimed at achieving price stability, managing exchange rates, enhancing FDI inflows, and ultimately fostering sustainable economic development in Nigeria. The ARDL approach is particularly suited to this analysis, as it can simultaneously estimate both short-term dynamics and long-term equilibrium relationships, even when the underlying variables are integrated of different orders, thereby offering a comprehensive understanding of the intricate linkages between Nigeria's macroeconomic policy environment and its growth performance.

2. METHODOLOGY

2.1 Research Design

A research design is a blueprint that guides researchers in their investigation and analysis (Dr Inaam Akhtar & Jamia Millia, 2016). This study will adopt an ex post facto research design (Carlos Nunes Silva, 2010). According to (Agbonifoh, B. A., & Yomere, 1999), the ex-post research design is a type of research in which the researcher lacks the ability or opportunity to vary or manipulate the independent variables. A good research design should be capable of generating data to answer the research questions and test the research hypotheses. This research design is appropriate for this study because it is not feasible to directly manipulate any variables.

2.2 Population of the Study

The population of this study consists of the Central Bank of Nigeria and the Nigerian Bureau of Statistics.

2.3 Sample and Sampling Techniques

The sample will cover the period 1999-2020 and employ a convenience sampling design. The primary sources of these data are the Central Bank of Nigeria's Statistical Bulletin and the Nigerian Bureau of Statistics, 2020.3.4.

2.4 Method of Data Collection

Data collection is the process of gathering information from relevant sources to address research questions, test hypotheses, and evaluate outcomes. Data collection can be primary or secondary. For this study, the data collection method will be secondary data. Secondary data are data generated from existing sources, such as bulletins, journals, and financial statements.

Secondary data is economical; it saves time and effort, and yet it is often criticized for its shortcomings. For the sake of this investigation, time series data would be obtained for interest rate, inflation rate, exchange rate, foreign direct investment, and Gross Domestic Product (GDP) from the National Bureau of Statistics reports, the World Bank, as well as the CBN Statistical Bulletin and Economic Reports for the relevant years under consideration.

3.5 Measurement of Variables

This study aims to investigate the effects of macroeconomic variables on Nigeria's economic growth. To achieve this, the following variables will be used in the study.

Independent variables

The independent variables are Interest Rate (INR), Inflation Rate (IFR), Exchange Rate (EXR), and Foreign Direct Investment (FDI), all of which are measures of direct taxation in Nigeria.

Dependent variable

The dependent variable is economic growth, measured by Nigeria's Gross Domestic Product (GDP).

3.6 Model Specification

To empirically investigate the relationship between macroeconomic variables and Nigeria's economic growth, we hypothesized that Gross Domestic Product (GDP) depends behaviorally on the interest rate (INR), Inflation Rate (IFR), Exchange Rate (EXR), and foreign direct investment (FDI). Thus, such a behavioral relationship can be given in the equation below:

$GDP_t = f(INR_t, IFR_t, EXR_t, FDI_t)$ (1)

Equation (1) can be re -specified in a stochastic form.

$GDP_t = B0 + B1\ INR_t + B2IFR_t + B3EXR_t + B4FDI + E_t$ (2)

B_0 = Intercept or average gross domestic product when other variables are not applied

B_1= Coefficient of the explanatory variable, INR

B_2 = Coefficient of the explanatory variable, IFR

B_3 = Coefficient of the explanatory variable, EXR

B_4 = Coefficient of the explanatory variable, FDI

INR = Interest Rate

IFR = Inflation Rate

EXR = Exchange Rate

FDI = Foreign Direct Investment

GDP = Gross Domestic Product

E_t = Error term capturing other explanatory variables not explicitly included in the model.

$_t$ = time period under study (1999-2020)

2.7 Method of Data Analysis

The two basic types of statistical techniques or analysis are descriptive and inferential statistics:

- **Descriptive Analysis:** Descriptive analysis involves procedures for organizing and summarizing information in a convenient and understandable form. In other words, descriptive analysis is concerned with the description of how things are.
- **Inferential Analysis:** Inferential analysis is concerned with the proper drawing of a representative sample and the making of generalizations about the population based on this analysis. In this study, both the descriptive and inferential analyses will be used. The study's hypotheses were tested using the Error Correction Model (ECM), given that cointegration was established via the bounds test.

Decision Rule:

The null hypothesis will be rejected if the p-value is less than 0.05; otherwise, it will be accepted.

3. DATA PRESENTATION, ANALYSIS, AND DISCUSSION OF FINDINGS

3.1 Data Presentation

This section of the research presents the data, analyzes the results, and interprets the findings. The first section presents data on Real Gross Domestic Product (RGDP), Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), and Inflation Rate (INFL) in Nigeria. Table 1 presents data collected from the Central Bank of Nigeria Statistical Bulletins.

Table 1: Data Presentation.

YEAR	RGDP N'billion	EXR N/1$	FDI US$' Million	INR %	IFR %
1999	23967.59	98.20	92.79	21.32	0.22
2000	25169.54	110.05	115.95	17.98	14.50
2001	26658.62	113.45	132.43	18.29	16.50
2002	30745.19	126.90	225.22	24.85	12.20
2003	33004.80	137.00	258.39	20.71	23.80
2004	36057.74	132.85	248.22	19.18	10.00

2005	38378.80	129.00	39.35	17.95	11.60
2006	40703.68	128.27	80.10	17.26	8.50
2007	43385.88	117.97	177.71	16.94	6.60
2008	46320.01	132.56	339.98	15.14	15.10
2009	50042.36	149.58	616.01	18.99	12.00
2010	54612.26	150.66	1881.18	17.59	11.80
2011	57511.04	158.27	1979.57	16.02	10.30
2012	59929.89	157.33	2051.32	16.79	12.00
2013	63218.72	157.26	2137.54	16.72	8.00
2014	67152.79	169.68	2229.51	16.55	8.00
2015	69023.93	197.00	2285.33	16.85	9.60
2016	67931.24	305.00	2360.27	16.87	18.60
2017	68490.98	306.00	2455.19	17.56	15.40
2018	69799.94	307.00	2627.99	19.33	11.40
2019	71387.83	307.00	2841.59	15.53	11.98
2020	70014.37	381.00	2584.79	12.32	15.75

Source: CBN Statistical Bulletins, 2020.

3.2 Descriptive statistics

The descriptive statistics summarize the central tendency, dispersion, and distributional shape for each variable in the study. Table 2 presents the descriptive statistics for the variables over the specified time period, detailing the characteristics of both the dependent and independent variables included in the model. For the period from 2000 to 2020, the analysis reveals that the mean value of Real Gross Domestic Product (RGDP) is 50613.96, while the mean values for Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), and Inflation Rate (IFR) are 180.5468, 1261.838, 17.76091, and 11.99318, respectively. These central tendency measures can be contextualized by comparing them to the maximum values recorded for each variable: Real Gross Domestic Product (RGDP) reached a peak of 71387.83, Exchange Rate (EXR) attained a maximum of 381.0000, Foreign Direct Investment (FDI) peaked at 2841.590, Interest Rate (INR) had a maximum of 24.85000, and Inflation Rate (IFR) reached a high of 23.80000.

Skewness, which measures the asymmetry of a distribution around its mean, provides further insight into the data's shape. The results indicate that Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), and Inflation Rate (IFR) each exhibit positive skewness. This positive skewness indicates that the distributions of these variables are asymmetric, with longer right tails, suggesting that the observations for EXR, FDI, INR, and IFR are concentrated toward lower values, with fewer instances of very high values. In contrast, the Real Gross Domestic Product (RGDP) of Nigeria demonstrates a negative

skewness, indicating a distribution with a longer tail extending to the left, where observations are more concentrated towards higher values.

Kurtosis measures the "tailedness" of the probability distribution, with a value of 3 representing a normal, mesokurtic distribution. Table 2 further shows that EXR, INR, and IFR each have kurtosis greater than 3, indicating leptokurtic distributions. This leptokurtic characteristic suggests that these variables have distributions with heavier tails and a sharper peak than a normal distribution, implying a higher likelihood of extreme values. However, RGDP and FDI exhibit kurtosis values less than three, indicating that their distributions are platykurtic. This platykurtic nature suggests that the distributions of RGDP and FDI have lighter tails and a flatter peak than a normal distribution, implying a lower probability of extreme observations.

Table 2: Group Descriptive Statistics.

	RGDP	EXR	FDI	INR	INFL
Mean	50613.96	180.5468	1261.838	17.76091	11.99318
Median	52327.31	150.1200	1248.595	17.41000	11.89000
Maximum	71387.83	381.0000	2841.590	24.85000	23.80000
Minimum	23967.59	98.20000	39.35000	12.32000	0.220000
Std. Dev.	16739.11	82.26511	1100.066	2.474252	4.730651
Skewness	-0.213937	1.201088	0.075737	0.753956	0.082258
Kurtosis	1.566332	3.005566	1.176133	4.975255	4.282167
Jarque-Bera	2.051940	5.289610	3.070317	5.660816	1.531766
Probability	0.358449	0.071019	0.215422	0.058989	0.464923
Sum	1113507.	3972.030	27760.43	390.7400	263.8500
Sum Sq. Dev.	5.88E+09	142118.5	25413048	128.5604	469.9603
Observations	22	22	22	22	22

3.3 Unit Root Test

To determine the characteristics of time-series variables, a preliminary analysis is conducted to assess whether the series is stationary. In other words, this initial analysis is performed to test for the presence of a unit root in the series. The Augmented Dickey Fuller (ADF) unit root test was applied, and the results are shown in Table 3.

Table 3: Summary of the Augmented Dickey Fuller Unit Root Test

Variable	ADF Stats	5% Critical Level	Remarks
RGDP	-4.061736	-3.012363	Stationary
EXR	0.489324	-3.012363	Non-Stationary
FDI	-1.096009	-3.012363	Non-Stationary
INR	-2.013035	-3.012363	Non-Stationary

INFL	-13.40999	-3.012363	Stationary
D(EXR)	-3.591191	-3.020686	Stationary
D(FDI)	-3.840700	-3.020686	Stationary
D(INR)	-4.344403	-3.029970	Stationary

The empirical results from the Augmented Dickey Fuller (ADF) unit root test, conducted at the 5 percent significance level, are presented in Table 3. The analysis indicates that the variables Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), Real Gross Domestic Product (RGDP), and Inflation Rate (IFR) are stationary at their levels. This outcome suggests that the variables exhibit mixed integration, comprising both zero- and first-order integrated series. The conclusion regarding the stationarity properties of these variables was reached by systematically comparing the calculated Augmented Dickey Fuller test statistics against the established critical values as provided by (Mackinnon, 1996) Given that the variables exhibit different orders of integration, this empirical characteristic offers a suitable basis for proceeding with the Auto-regressive Distributed Lag (ARDL) bounds testing approach. This methodological step is necessary to determine whether a stable, long-run equilibrium relationship exists among the variables under investigation.

Table 4: ARDL Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	33.52462	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

The results of the bounds test for cointegration provide critical evidence regarding the long-term relationship among the variables under study. Since the calculated F-statistic of 33.52462 substantially exceeds the essential value of the upper bound for the I(1) series, which is 3.49 as indicated in Table 4, we conclusively reject the null hypothesis of no cointegration. This statistical evidence supports the conclusion that the variables in the model are cointegrated. In practical terms, this finding indicates the presence of a stable, long-run equilibrium relationship among Exchange Rate (EXR), Foreign Direct Investment (FDI),

Interest Rate (INR), Real Gross Domestic Product (RGDP), and Inflation Rate (IFR) over the studied period. The establishment of this cointegrating relationship supports proceeding with an Error Correction Model (ECM) specification to investigate further both the short-run dynamics and the speed of adjustment toward the long-run equilibrium.

3.4: Test of Hypotheses

To empirically test the research hypotheses formulated in this study, an analytical framework was implemented utilizing the Error Correction Model (ECM). This methodological approach was implemented using EViews 10.0 statistical software. The primary objective of this analytical procedure was to determine the extent and nature of the influence exerted by the independent variables, Exchange Rate, Foreign Direct Investment, Interest Rate, and Inflation Rate, on the dependent variable, which is the Real Gross Domestic Product of Nigeria. The ECM specification is particularly appropriate given the previously established cointegrating relationship among the variables, as it allows simultaneous estimation of both short-run dynamics and the long-run equilibrium relationship, including the speed of adjustment toward that equilibrium.

Table 5: Impact of macroeconomic variables on the economic growth in Nigeria.

Dependent Variable: D(RGDP)				
Method: Least Squares				
Date: 12/19/22 Time: 01:15				
Sample (adjusted): 2000 2020				
Included observations: 21 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
ECT (-1)	-0.606172	0.189610	3.196947	0.0060
D(EXR)	-0.327361	0.092529	-3.537913	0.0030
D(FDI)	0.128037	0.023364	5.480036	0.0001
D(INR)	0.136885	0.191667	0.714184	0.4861
D(IFR)	-0.207295	0.081544	-2.542123	0.0225
C	9.188540	0.744956	12.33435	0.0000

R-squared	0.944689	Mean dependent var	10.80441
Adjusted R-squared	0.926251	S.D. dependent var	0.343978
S.E. of regression	0.093413	Akaike info criterion	-1.668618
Sum squared resid	0.130890.	Schwarz criterion	-1.370183
Log likelihood	23.52049	Hannan-Quinn criter.	-1.603850
F-statistic	51.23834	Durbin-Watson stat	1.928678
Prob(F-statistic)	0.000000		
*Note: p-values and any subsequent tests do not account for the model selection.			

H0$_1$: There is no significant relationship between the interest rate and the economic growth of Nigeria.

Table 5 shows the regression of the Error Correction Model (ECM) result of the study. According to the results, the coefficient on Interest Rate (INR) is positive (0.136885) but insignificant (p = 0.4861). The interpretation of the positive coefficient on Interest Rate (INR) indicates that a 1-unit increase in the interest rate will lead to a 13.7% increase in Nigeria's Real Gross Domestic Product (RGDP), all else being equal.

Since the p-value for the interest rate (INR) is 0.4861, which exceeds the 5% significance level, the null hypothesis is accepted, and we conclude that there is no significant relationship between interest rates and economic growth in Nigeria.

H0$_2$: The inflation rate does not significantly impact the economic growth of Nigeria.

According to the ECM results in Table 5, the inflation rate (IFR) has a negative coefficient of -0.207295, which is significant at the 0.0225 level. The interpretation of the negative coefficient on the inflation rate (IFR) indicates that a 1% increase in the inflation rate will lead to a 20.73% decrease in Nigeria's Real Gross Domestic Product (RGDP), all else being equal.

Since the p-value for the inflation rate (IFR) of 0.0225 exceeds the 5% significance level, the null hypothesis is rejected, and we conclude that the inflation rate has significantly affected Nigeria's economic growth.

H0$_3$: Changes in the exchange rate do not significantly affect the performance of Nigeria's economy.

According to the ECM results in Table 5, Exchange Rate (EXR) has a negative coefficient of -0.327361, which is significant at the 0.0030 level. The interpretation of the negative coefficient on the exchange rate (EXR) indicates that a 1-unit increase in the exchange rate will lead to a 32.74% decrease in Nigeria's Real Gross Domestic Product (RGDP), all else being equal.

Since the probability value of the Exchange Rate (EXR) of 0.0030 is less than the 5% level of significance, the null hypothesis is hereby rejected, and we conclude that changes in the exchange rate significantly affect the performance of Nigeria's economy.

$H0_4$: Foreign direct investment has no significant impact on Nigeria's economic growth.

According to the ECM results in Table 5, Foreign Direct Investment (FDI) has a positive coefficient of 0.128037, which is statistically significant at the 0.0001 level. The interpretation of the positive coefficients on Foreign Direct Investment (FDI) indicates that a unit increase in FDI will lead to about a 12.8% increase in Nigeria's Real Gross Domestic Product (RGDP), all else being equal.

Since the p-value for foreign direct investment (FDI) is 0.0001, which is less than the 5% significance level, the null hypothesis is rejected, and we conclude that foreign direct investment has a significant impact on Nigeria's economic growth.

3.5 Model Summary

The model's goodness of fit, as indicated by the Adjusted R-Squared value of 0.926251, demonstrates that approximately 92.63% of the systematic variations in the dependent variable, Real Gross Domestic Product (RGDP), over the observed period are jointly explained by the independent variables: Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), and Inflation Rate (INFL). The remaining 7.37% of the variation in RGDP is attributable to other determinants not captured by the specified model. The overall statistical significance of the model is supported by the F-statistic, which yields a p-value of 0.00000. Since this value is less than the 0.05 significance threshold, it indicates that the independent variables collectively have a statistically significant effect on RGDP and that this effect is not attributable to chance. Furthermore, the Durbin-Watson statistic of 1.92 suggests the absence of first-order autocorrelation in the model's residuals, supporting the reliability of the estimated parameters.

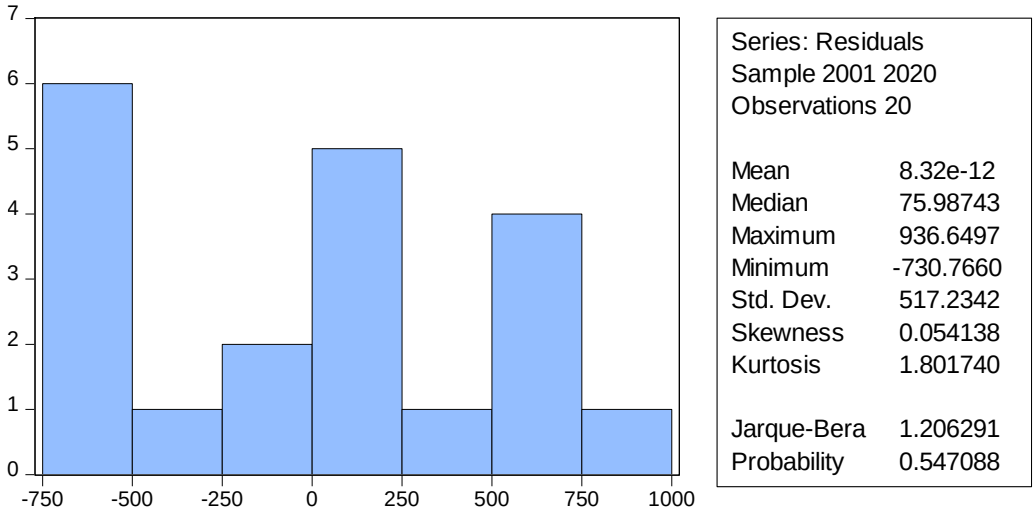
Table 4 also presents the results for the Error Correction Term (ECT), which is negative and statistically significant, evidenced by a P-value of 0.0060. This confirms the existence of a stable long-run equilibrium relationship among the variables, as established by the earlier

cointegration test. The coefficient of the ECT, which is -0.606172, represents the speed of adjustment. This value indicates that approximately 60.62 percent of any short-run deviation of Gross Domestic Product from its long-run equilibrium path is corrected within one year, demonstrating a moderately rapid adjustment process toward equilibrium.

3.6 Normality Test

The Normality Test is a statistical procedure used to assess the distributional properties of data within a dataset or for specific variables. The primary objective of this test is to determine whether the data follows a normal distribution or deviates from it. This test is helpful in determining whether the collected sample data originate from a normally distributed population. Establishing normality is a fundamental assumption underlying many parametric statistical techniques, as the validity of their inferences often depends on this condition.

Table 7: Normality Test



The assessment of normality is performed using the Jarque-Bera statistic and its associated p-value. The decision rule stipulates that the null hypothesis (H0) of normally distributed residuals is accepted if the p-value is less than 0.05. In this analysis, the calculated p-value of the Jarque-Bera statistic is 0.547088. Since this probability value substantially exceeds the 0.05 significance threshold, we fail to reject the null hypothesis. This result provides statistical evidence that the residuals from the estimated ARDL model are normally distributed. The fulfillment of the normality assumption supports the validity of the standard errors and the statistical inferences drawn from the hypothesis tests conducted within the model.

3.7 Diagnostic Test

The Serial Correlation test and the Heteroskedasticity test were conducted to assess the reliability of the estimated results.

3.8 Autocorrelation Test

Autocorrelation refers to the correlation between observations in a time series, a characteristic of concern in time series analysis. The presence of autocorrelation in a regression model has significant implications for the reliability of the estimation results. Specifically, it causes the estimated variance of the residuals to be lower than its actual value. This underestimation subsequently inflates the coefficient of determination (R^2), making it appear higher than its actual value. Furthermore, the presence of autocorrelation undermines the validity of standard hypothesis-testing procedures. Conducting tests using t-statistics and F-statistics under conditions of autocorrelation yields misleading results, as the standard errors of the coefficients are biased, potentially leading to incorrect conclusions regarding the significance of the explanatory variables.

Table 8: Serial Correlation Test.

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.537943	Prob. F(2,9)		0.2664
Obs*R-squared	5.094261	Prob. Chi-Square(2)		0.0783

The Breusch-Godfrey Serial Correlation LM Test indicates the absence of serial correlation, as the p-value for the F-statistic exceeds the 5% significance level.

Table 9: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	0.371037	Prob. F(8,11)		0.9151
Obs*R-squared	4.250051	Prob. Chi-Square(8)		0.8339
Scaled explained SS	0.515375	Prob. Chi-Square(8)		0.9999

The results of the Heteroskedasticity test indicate that the null hypothesis is rejected, and we conclude that the residuals are not heteroskedastic, as the p-values for the F-statistic and the Chi-square statistic exceed 5%.

3.9 DISCUSSION OF FINDINGS

This study assessed the impact of selected macroeconomic variables on Nigeria's economic growth from 1999 to 2020, focusing on four key explanatory variables: Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), and Inflation Rate (IFR). The empirical findings provide nuanced insights into the nature of these relationships within the Nigerian context. The results indicate that the Exchange Rate (EXR) exhibits a negative and statistically significant relationship with economic growth in Nigeria. This finding suggests that exchange rate depreciation, as modeled, has a detrimental effect on economic performance in Nigeria. Depreciation typically raises import costs in an import-dependent economy, fuels inflationary pressures, reduces real incomes, undermines investor confidence, and disrupts planning for trade and investment (Aliyu, 2010; Oyadeyi et al., 2025). This outcome aligns with and corroborates the results of prior studies, including (Jabaru & Jimoh, 2020) and (Iliyasu et al., 2024), which similarly concluded that exchange rate fluctuations significantly impact the Nigerian economy. The finding is also consistent with broader international evidence, such as (Chowdhury et al., 2019), which found that selected macroeconomic variables, including exchange rates, significantly affect economic growth in Bangladesh.

Conversely, the analysis reveals that Foreign Direct Investment (FDI) is positively and statistically significantly associated with Nigeria's economic growth. This result supports the theoretical expectation that FDI inflows contribute positively to host economies by supplementing domestic capital, facilitating technology transfer, and enhancing productivity. The significant positive coefficient underscores the potential role of FDI as a catalyst for growth within the studied period. Regarding the Interest Rate (INR), the findings present a positive but statistically insignificant relationship with economic growth. This implies that, although the relationship is positive, the effect is not sufficiently robust to be considered a reliable determinant of growth variation in the model. This outcome aligns with the findings of Udu (2015), who also reported a positive relationship between interest rates and Real Gross Domestic Product (RGDP), highlighting a recurring yet weak linkage in the empirical literature.

Finally, the Inflation Rate (IFR) demonstrates a negative and statistically significant relationship with economic growth. This finding confirms the conventional economic view that high inflation acts as a drag on long-term financial performance by creating uncertainty, distorting price signals, and eroding real incomes. This result is consistent with a body of prior research, including the works of (Ayomitunde et al., 2020; Bangura & Omojolaibi, 2024; Barro, 1995; Bawa & Abdullahi, 2012; Fischer, 1993; Olugbenga Adaramola & Dada, 2020; Oyadeyi et al., 2025), all of which identified a negative relationship between inflation and economic growth in Nigeria and other comparable economies.

4. SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATION

4.1 Summary of findings

This study investigated the impact of key macroeconomic variables on Nigeria's economic growth. The analysis employed the Augmented Dickey-Fuller (ADF) unit root test and the Auto Regressive Distributed Lag (ARDL) Bounds testing approach on annual time-series data spanning 2000 to 2020. The long-run relationship was estimated using the Error Correction Model (ECM). The dependent variable, economic growth, was proxied by Real Gross Domestic Product (RGDP). In contrast, the independent variables comprised Exchange Rate (EXR), Foreign Direct Investment (FDI), Interest Rate (INR), and Inflation Rate (IFR). Based on the empirical analysis conducted, the following findings were established and are summarized as follows:

- Interest Rate (INR): The estimated coefficient for Interest Rate is positive (0.136885) but statistically insignificant, as indicated by a p-value of 0.4861. This suggests that, according to the model, a one-unit increase in the interest rate is associated with approximately a 13.7% increase in Nigeria's Real Gross Domestic Product (RGDP), *ceteris paribus*. However, the lack of statistical significance indicates that this positive relationship is not sufficiently robust to be considered a reliable determinant of growth variation during the sample period.

- Inflation Rate (IFR): The coefficient is negative and statistically significant (-0.207295; p = 0.0225). This finding indicates that a one-unit increase in the inflation rate is associated with an approximately 20.73% decrease in Nigeria's Real Gross Domestic Product (RGDP), holding other factors constant. The significance of this result confirms that inflation is detrimental to economic growth in Nigeria.

- Exchange Rate (EXR): The coefficient for Exchange Rate is negative (-0.327361) and statistically significant, supported by a p-value of 0.0030. This result implies that a one-unit increase (depreciation) in the exchange rate is associated with an approximate 32.74% decrease in Nigeria's Real Gross Domestic Product (RGDP), ceteris paribus*. This underscores the adverse effect of exchange rate depreciation on economic performance.

- Foreign Direct Investment (FDI): The coefficient is positive and statistically significant (0.128037; p-value < 0.001). This finding suggests that a one-unit increase in FDI inflows is associated with an approximately 12.8% increase in Nigeria's Real Gross Domestic Product (RGDP), holding all else constant. This result affirms the positive contribution of foreign investment to the nation's economic growth.

4.2 CONCLUSION

The study was conducted to ascertain the effect of macroeconomic variables on the economic growth in Nigeria. The study aims to assess the impact of the exchange rate (EXR), foreign direct investment (FDI), Interest Rate (INR), and Inflation Rate (IFR) on economic growth in Nigeria. The data used in the study were extracted from the Central Bank of Nigeria Statistical Bulletins. The trend analysis results indicated that the Exchange Rate (EXR) has a negative and significant effect on economic growth in Nigeria. Hence, this study concludes that there is a substantial relationship between the exchange rate and economic development in Nigeria.

Foreign Direct Investment (FDI) was also found to have a positive and significant impact on Nigeria's economic growth. Hence, this study concludes that there is a substantial relationship between Foreign Direct Investment (FDI) and economic development in Nigeria. Interest Rate (INR) was found to have a positive but insignificant relationship with the economic growth in Nigeria. Therefore, this study concludes that there is no significant relationship between the interest rate (INR) and the economic growth in Nigeria. The findings from this study also revealed that the inflation rate (INFL) has a negative and significant relationship with economic growth in Nigeria. Based on the findings, the study concludes that there is a substantial relationship between the inflation rate and economic development in Nigeria.

4. 3 RECOMMENDATION

Based on the key findings and conclusions derived from this study, the following recommendations are proposed to enhance macroeconomic management and foster sustainable economic growth in Nigeria:

- Enhanced Exchange Rate Management: The study's finding of a significant negative relationship between exchange rate depreciation and economic growth underscores the need for proactive management. It is recommended that the monetary authority, in collaboration with the federal government, strengthen its surveillance and regulatory framework for the foreign exchange market. This includes closely monitoring the activities of commercial banks and other authorized dealers to minimize speculative practices and excessive exchange-rate volatility. Implementing policies that promote exchange rate stability is crucial for reducing uncertainty, curbing imported inflation, and creating a more predictable environment for long-term investment planning, thereby positively influencing economic growth.

- Adoption of a Tight, Credible Fiscal Stance: Given the empirically established adverse effect of inflation on economic growth, there is a pressing need for the government to reinforce its commitment to price stability. It is recommended that the government retain and consistently implement tight fiscal policies. This entails exercising greater discipline in public expenditure, improving the efficiency of revenue collection, and reducing fiscal deficits that are often monetized, thereby fueling inflationary pressures. A credible and predictable budgetary policy is essential to anchor inflation expectations, complement the Central Bank's monetary efforts, and create a foundation for sustainable growth.

- Strategic Focus on FDI-Attracting Policies: The significant positive impact of Foreign Direct Investment (FDI) on economic growth underscores its role as a critical lever of growth. Consequently, it is recommended that the government intensifies efforts to create a more attractive and conducive environment for FDI. Policymakers should prioritize reforms that improve the ease of doing business, ensure policy consistency, protect investor rights, and develop critical infrastructure. Furthermore, domestic and international investors should strategically align their investment decisions with sectors and policies that are prioritized for FDI inflows, as these are likely to benefit from associated spillovers and growth-enhancing effects.

- Strengthened Monetary Policy Transmission and Banking Oversight: While the interest rate showed an insignificant relationship with growth in this model, ensuring the effectiveness of monetary policy and the integrity of the financial system remains paramount. It is recommended that the Central Bank of Nigeria (CBN) enhance its oversight of the banking sector to curb unethical practices that may lead to undue fluctuations in lending rates and hinder the smooth transmission of monetary policy. This involves enforcing existing regulations more rigorously, implementing real-time monitoring systems, and imposing stricter penalties on banks that engage in practices that distort interest rates or undermine financial stability. A more transparent and efficient financial intermediation process will ensure that policy signals are effectively transmitted to the real economy.

4.4. Limitations of the Study

While this study provides valuable insights, it is essential to acknowledge its inherent limitations, which also present opportunities for future research. First, the scope of the data is constrained by its reliance on secondary sources, specifically covering the period from 1999 to 2020. Consequently, the findings reflect the economic dynamics of this particular era and may not be fully generalizable to other periods characterized by different structural or global financial conditions.

Second, the analysis is limited to four macroeconomic variables: Interest Rate (INR), Inflation Rate (IFR), Exchange Rate (EXR), and Foreign Direct Investment (FDI). Numerous other potentially significant variables, such as money supply, government expenditure, terms of trade, or unemployment, were excluded from the model. Their omission, while necessary to maintain a focused analysis, means the model does not capture the full spectrum of factors influencing economic growth.

Finally, the study focuses explicitly on economic growth, measured by changes in Real Gross Domestic Product (RGDP). It does not address the broader, more multifaceted concept of economic development, which encompasses improvements in welfare, income distribution, education, health, and institutional quality. Therefore, the implications of these macroeconomic variables for Nigeria's holistic socio-economic development remain a vital area for subsequent investigation.

4.5 Suggestion for Further Studies

Building upon the findings and limitations of this research, several avenues for future scholarly inquiry are recommended to deepen the understanding of macroeconomic dynamics in Nigeria.

First, subsequent studies should expand the scope of analysis by incorporating a broader range of macroeconomic variables. Investigating the influence of factors such as the money supply (M2), government capital expenditure, unemployment rates, oil prices, and remittance inflows could yield a more comprehensive model of the determinants of economic growth and provide refined policy insights.

Second, to address the distinction highlighted in this study's limitations, future research should explicitly explore the impact of these macroeconomic variables on economic development indicators beyond GDP. This includes analyzing their relationships with metrics such as the Human Development Index (HDI), poverty rates, the Gini coefficient (income inequality), and employment elasticity to understand their effects on broader socioeconomic welfare.

Finally, as a specific and critical area for investigation, it is suggested that future research examine the effect of macroeconomic variables on the performance of key sectors, particularly the manufacturing sector. A sectoral analysis would elucidate how fluctuations in interest rates, exchange rates, inflation, and FDI inflows directly affect industrial output, capacity utilization, and competitiveness, providing targeted guidance for industrial policy.

Conducting similar analyses using more recent data or employing alternative econometric methodologies, such as Vector Error Correction Models (VECMs) or panel data analysis across multiple developing economies, would further strengthen the robustness and generalizability of findings in this field.

APPENDIX

Dependent Variable: D(RGDP)				
Method: Least Squares				
Date: 12/19/22 Time: 01:15				
Sample (adjusted): 2000 2020				
Included observations: 21 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*

ECT(-1)	-0.606172	0.189610	3.196947	0.0060
D(EXR)	-0.327361	0.092529	-3.537913	0.0030
D(FDI)	0.128037	0.023364	5.480036	0.0001
D(INR)	0.136885	0.191667	0.714184	0.4861
D(IFR)	-0.207295	0.081544	-2.542123	0.0225
C	9.188540	0.744956	12.33435	0.0000
R-squared	0.944689	Mean dependent var		10.80441
Adjusted R-squared	0.926251	S.D. dependent var		0.343978
S.E. of regression	0.093413	Akaike info criterion		-1.668618
Sum squared resid	0.130890.	Schwarz criterion		-1.370183
Log likelihood	23.52049	Hannan-Quinn criter.		-1.603850
F-statistic	51.23834	Durbin-Watson stat		1.928678
Prob(F-statistic)	0.000000			
*Note: p-values and any subsequent tests do not account for model				
Selection.				

Null Hypothesis: LOG(RGDP) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.061736	0.0055
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LOG(EXR) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			0.489324	0.9820
Test critical values:	1% level		-3.788030	

	5% level		-3.012363	
	10% level		-2.646119	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LOG(EXR)) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.591191	0.0158
Test critical values:	1% level		-3.808546	
	5% level		-3.020686	
	10% level		-2.650413	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LOG(FDI) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.096009	0.6973
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LOG(FDI)) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.840700	0.0093
Test critical values:	1% level		-3.808546	
	5% level		-3.020686	

	10% level		-2.650413	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LOG(INR) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.013035	0.2793
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	
	10% level		-2.646119	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LOG(INR)) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.699297	0.0015
Test critical values:	1% level		-3.808546	
	5% level		-3.020686	
	10% level		-2.650413	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LOG(INFL) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=2)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-13.40999	0.0000
Test critical values:	1% level		-3.788030	
	5% level		-3.012363	

	10% level		-2.646119	
*MacKinnon (1996) one-sided p-values.				

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