

Exchange Rate Volatility and Economic Growth: An ARDL Bound Test Approach

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Abstract

Case Studies

This study examined the impact of exchange rate volatility economic growth in Nigeria. The study looked at the volatility movement of the exchange rate and how it constitutes a headwind to the economic activity in the country and the eventual impact on productivity and economic growth. The study used ex-post facto research design where the researcher does not have control over the variables under review. The data span a period of 1986 to 2023 owing to data availability. The data used exhibited seemingly a mixed order of integration among the variables, the Johansen and Bound cointegration test were used to establish the long run relationship between the variables. Arising from the cointegration tests, the analysis which prompted the researcher to adopt the ARDL bound tests approach. The study found that exchange rate volatility impacts economic growth negatively and also that impact of foreign direct investment is not felt in the sectors that needed them most likewise external reserve in Nigeria. This study recommends that the government needs to facilitate uniform and appropriate pricing of foreign exchange rates, ensure efficient management of foreign exchange access, enhance domestic productivity to boost the foreign exchange availability, provide clarity and ensure transparency in market operations, and develop an efficient capital mobility framework.

Keywords: Exchange rate volatility, ARDL, Exchange rate, External reserve, Real GDP.

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1. INTRODUCTION

Exchange rate plays a significant role in directing the economic activities in any economy this can be attributed to the economic globalization and interdependence of economies. Exchange rate is the rate can be seen as how much of a nation's currency in relative to another nation, or the needed volume of units of a currency that can purchase a volume of units of another currency (Ugochukwu, 2015). Exchange rate is crucial to international trade, capital flows and price stability. The fluctuations of

exchange rate in Nigeria can be attributed to oil price shocks, inflation, foreign reserves and changes in policies. Exchange rate volatility is generally referred to as uncertainty associated with movements in exchange rate. This uncertainty has posed serious implication for the investment and growth in both developed and developing countries.

Exchange rate affects an economy by way of instability in her investment and production by discouraging both domestic and foreign investors. Meanwhile, inflationary pressures increase the costs

of importation goods thereby leading to cost push inflation. Exporters may in the short-run benefits from naira depreciation but in the long-run reduce trade competitiveness.

It is a growing concern that despite the series of economic reforms, exchange rate in Nigeria remains volatile which has been a serious issue on its effect on the macroeconomic stability and economic growth. This volatility which can be attributed to dependence on oil, inflation differentials, monetary and fiscal policies, speculation and capital flights, and external debts calls for concern.

Regime

1.1 Historical Background of the Nigerian Exchange Rate

Fixed exchange rate 1960- 1986

This period is tagged the oil boom period. At this period of 1970s, Nigeria pegged the naira to the British Pound and later to the US Dollar. By this the government was fully in control of the exchange rate and it was kept artificially strong. Later in the 1980s, the policy was unsustainable due to oil revenue falls.

Structural Adjustment Programm SAP 1986-1993

The Babangida SAP program adopted the market-determined exchange rate system. The second-Tier

Exchange Market (STEM) was initiated to allow naira depreciate and market orces of demand and supply to play a vital role.

Multiple Exchange Rate1993 -2016

At this period the Nigerian government operated several rates ranging from official, inter-banks to bureau de change. This system is characterized by distortions, arbitrage and foreign exchange shortages.

Managed Float Regime 2016- Date

For the period under review the Nigerian government has been operating a managed float exchange rate system. This is a system where the CBN periodically intervenes in the FOREX market in order to stabilize the naira. The also created several FOREX windows such as Official CBN rate, Investor’s and Exporter’s window and Bureau de Change.

Current Regime

Nigeria currently operates a unified and managed floating exchange rate system following 2023-2024 reforms of President Bola Tinubu’s administration. In this regime, the CBN allow the naira’s value to be largely determined by the market forces of demand and supply in the I&E windows. But government still intervenes to avoid extreme volatility.

Table 1.1 Nigeria Exchange Rate Regimes

PERIOD	TYPE	FEATURES
1960 -1986	Fixed	The naira was pegged to other currencies, strong currency and governmental control.
1986 – 1993	Market determined	SFEM introduction, and naira depreciation.
1993 -2016	Multiple rates	Official rates, inter-bank and bureau de change operation.

2016 – 2023	Managed float	There was multiple windows and CBN interventions
2023 – 2025	Unified managed float	Minimal CBN

Author’s computation, 2025

The main objective of this paper is to empirically investigate the impact of exchange rate on the economic growth in Nigeria and also to make policy recommendations from the empirical point of view.

2. LITERATURE REVIEW

2.1 Review of Related Literature

Kasman et al. (2011) investigates the effects of interest and exchange rate changes on Turkish bank’s stock returns and finds significant negative impact. Their results further indicate that interest and exchange–rate volatility are the major determinants of conditional bank stock return volatility.

Markov–switching models of conditional heteroscedasticity constitute another class of nonlinear models of volatility that provides an alternative way of modeling volatility process that contain breaks (see Lange & Rahbek, 2008). As already highlighted, recent advances in the modeling of volatility have focused on examining models that contain volatility breaks.

Hammoudeh & Li (2008) have analyzed sudden changes in volatility for five Gulf area stock markets and find that accounting for these large shifts in volatility in the GARCH (1,1) models significantly reduces the estimated persistence of the volatility of the Gulf stock markets.

Shaik & Gona (2020) examined the impact of the exchange rates on economic growth in India. From 1990 to 2017, the researchers employed the standard

least square and VECM Granger Causality methods of estimation. The study concludes that the extent of the exchange rate and its determinants determine the degree of growth rate in India. They advised that all sectors of the Indian economy be technologically oriented and that excessive budgetary deficit should be reduced to the barest minimum in order to avoid the ideal of foreign borrowing, which would inevitably result in external debt and services.

2.2 Theoretical Framework

The study adopted the purchasing power parity PPP theory, which proposes that the exchange rate between two currencies should equal the ratio of their prices. The implication is that if inflation is higher in one, its currency will depreciate.

3. METHODS

3.1. Data and Sources

This article investigated the impact of exchange rate volatility on the economic growth in Nigeria for the period 1986 to 2024. The period selected for the study was hinged on the data availability and shifts in the regimes from fixed exchange rate to unified exchange rate systems. The data used for the study are real gross domestic product (RGDP) and exchange rate volatility (ERV). Other variables are exchange rate (EXR), foreign direct investment (FDI), external reserve (ERE) , and inflation rate (IFR) which served as control variables for the study. All variables are sourced as contained in table 3.1 below.

Table: 3.1 Variable Descriptions and Source

S/N	Variable	Symbol	Measurement	Source
1	Real Gross Domestic Product	RGDP	Measured at constant 2010 prices.	CBN
2	Exchange Rate Volatility	ERV	The value of assets acquired minus the value of fixed assets disposed of.	CBN
3	Exchange Rate	EXR	A measure of a country’s external competitiveness by adjusting the nominal exchange rate for inflation	WDI
4	Foreign Direct Investment	FDI	It is calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured with respect to the base year 2000.	WDI
5	External Reserve	ERE		WDI
6	Rate of Inflation	INR		WDI

Source: Author’s computation, 2025.

3.2. Model Specification

In investigating the dynamics of volatility in exchange rate and economic growth, the study follows Mundell-Fleming IS-LM BOP Model approach proposed by Kandil (2004) and Yaqub,(2010) (Dickson, 2012) . This demand determined model captures the broad sectors of the economy and the mechanization of the exchange rate in the external sector as it affects other sectors of the economy hence. This implies that:

$$GDP = f(ERV, FDI, EXR, RES, INR) \tag{1}$$

In equation (1)

ERV is exchange rate volatility

FDI is foreign direct investment

EXR is exchange rate

ERE is external reserve

INR is interest rate

3.3 Estimation Techniques

The study used Autoregressive distributive lags (ARDL) estimation techniques in estimating our model. To avoid spurious estimates generated by the short span of our data, we followed the observation of Narayan & Smyth (2014), Maku *et al.*,(2023) Ishioro (2023), Maku & Ishioro (2023) that to solve the problem of short span data, the autoregressive distributed lags (ARDL) bounds tests of Pesaran *et al* (2001) should be applied.

The Autoregressive Distributive Lag (ARDL) bound model of equation 1 above can be specified as:

$$\begin{aligned}
 RGDP = & \sum_{i=1}^p \beta_{1i} \Delta RGDP_{t-1} + \sum_{i=0}^q \beta_{2i} \Delta ERV_{t-1} + \sum_{i=0}^q \beta_{3i} \Delta EXR_{t-1} + \sum_{i=0}^q \beta_{4i} \Delta ERE_{t-1} + \sum_{i=0}^q \beta_{5i} \Delta IFR_{t-1} \\
 & + \sum_{i=0}^q \beta_{6i} \Delta FDI_{t-1} + \pi_2 ERV_{t-1} + \pi_3 EXR_{t-1} + \pi_4 ERE_{t-1} + \pi_5 IFR_{t-1} + \pi_6 FDI \\
 & + \mu_{1t} \tag{2}
 \end{aligned}$$

The variables in the equation above are as described in equation 1, $\beta_1 - \beta_6$ are short-run coefficients; $\pi_1 - \pi_6$ are short-run and long-run coefficients respectively, and μ_1 is an error term.

Table 3.2.Descriptive Statistics

	GDP	ERV	FDI	EXR	ERE	IFR
Mean	40382.39	16.23786	657390.9	6426491.	657390.9	657390.9
Median	32205.45	10.75000	94754.15	2457005.	94754.15	94754.15
Maximum	77936.10	75.40000	6961789.	29000604	6961789.	6961789.
Minimum	16211.46	0.690000	203.2000	7201.200	203.2000	203.2000
Std. Dev.	21681.41	14.16262	1280969.	7375468.	1280969.	1280969.
Skewness	0.447543	2.225801	3.305968	1.126204	3.305968	3.305968
Kurtosis	1.560595	8.905184	15.49193	3.700657	15.49193	15.49193
Jarque-Bera	5.027866	95.70392	349.5905	9.737464	349.5905	349.5905
Probability	0.080949	0.000000	0.000000	0.007683	0.000000	0.000000
Sum	1696061.	681.9900	27610420	2.70E+08	27610420	27610420
Sum Sq. Dev.	1.93E+10	8223.777	6.73E+13	2.23E+15	6.73E+13	6.73E+13
Observations	39	39	39	39	39	39

Source: Author’s Computation using E-Views 10

Table 3.2 is a presentation of the descriptive statistics of all the variables used for the study. All the variables are in their base form. Exchange rate volatility (ERV) is captured using the volatility series from the estimation of a GARCH model. FDI, EXR, and ERE are percentage shares of the nominal GDP,

while the IFR is the percentage change in the consumer price index. Apart from ERE, which has slight differences in mean, median minimum, and maximum, all other variables have high divergence. The skewness test showed that ERV, ERE, INF and EXR experienced more positive changes than

negative ones. The Kurtosis and Jargue-Bera test suggest normality in distribution for ERV, FDI, ERE and INF.

3.3. Results of Unit Root Tests

	Unit Root Test				
	Levels		1 st Difference		
	ADF	PP	ADF	PP	Decision(5%)
GDP (C)	- 1.7793	-1.2357	-3.6110	-3.6021.	1(1)
GDP (C/T)	3.1621	-0.3515	-3.9210	-3.9021	1(1)
FDI (C)	-3.1056	-3.3192	-7.2137	-9.4720	1(0)
FDI (C/T)	-3.0383	-3.1263	-7.2880	-10.0510	1(1)
EXR (C)	-0.8345	-0.8234	-6.6120	-6.6210	1(1)
EXR (C/T)	-2.1334	-2.2141	-6.5065	-6.5520	1(1)
ERE (C)	-0.9155	-0.8430	-5.5315	-5.8081	1(1)
ERE (C/T)	-2.7019	-2.4041	-5.5030	-5,9010	1(1)
IFR (C)	-3.0303	-2.8970	-5.9020	-10.6002	1(1)
IFR (C/T)	-4.1092	-2.9911	-5.8259	-10.7540	1(1)
ERV (C)	-0.2329	-2.1543	-4.0240.	-4.5022	1(1)
ERV (C/T)	-0.7244	-0.9042	-4.4501.	-5.7057	1(1)

Source: Author’s Computation using E-Views 10

The unit root test results presented here are based on the Augmented Dickey-Fuller (ADF) test and Philip Perron test, which is a statistical test used to determine whether a time series is stationary or has a unit root. A stationary time series has a constant mean and variance over time, which is critical for making reliable statistical inferences in time series analysis. Non-stationary series, or those with a unit root, can lead to misleading correlations and

regressions. In economic analysis, stationarity implies that shocks to the system will be temporary and will dissipate over time, whereas non-stationarity suggests that shocks have a permanent effect. The unit root tests showed that all the variables used in the study are integrated of order one 1(1) except for FDI which is integrated at order zero 1(0) with constant but integrated of order one 1(1) with constant and intercept.

Table 3.3. Cointegration Test

Johansen Cointegration Test					
No. of CE(s)	Eigenvalue	Trace		Max-Eigen	
		Statistics	Probability**	Statistic	Probability**
None*	0.76615	180.4011	0.00000	60.15810	0.0004
At most 1*	0.628221	123.9210	0.00000	45.23605	0.0057
At most 2*	0.60114	75.40000	0.00410	35.98652	0.0082
At most 3	0.32539	39.73700	0.09050	15.98760	0.4145
At most 4	0.30442	20.40561	0.12560	12.65400	0.2055
At most 5	0.15056	7.987705	0.23540	8.987700	0.2436
ARDL Bound Test					
F-statistic	10.3106***	10%	5%	2.50%	1%
1(0) Bound		2.15	2.53	2.90	3.20
1(1) Bound		3.20	3.67	4.00	4.51

Source: Author’s Computation using E-Views 10

The F-Bounds Test result presented here assesses whether a stable, long-term relationship (also known as cointegration) exists between the variables in the model. In this context, the test helps us determine if the variables are bound together over time, even if they may vary in the short term.

The calculated F-statistic for this test is **10.31**. This value is crucial because it determines whether we can reject the null hypothesis, which states that there is no long-term relationship between the variables. The F-statistic is compared against a set of critical values that represent different levels of statistical significance (1%, 2.5%, 5%, and 10%).

These critical values are given in two ranges:

1. The **I(0) bound** assumes that the variables are stationary (do not have a unit root).
2. The **I(1) bound** assumes that the variables are integrated of order 1, meaning they have

a unit root but can be made stationary by differencing once.

In simple terms:

- **If the F-statistic is below the lower bound I (0)**, it means there’s no evidence of a long-term relationship.
- **If the F-statistic is above the upper bound I (1)**, it indicates a strong likelihood of a long-term relationship.
- **If it falls between the two bounds**, the test result is inconclusive, and further analysis might be needed.

Given that the F-statistic is much higher than the upper bounds at all levels of significance, we have **strong evidence** of a long-term relationship among the variables in this model. Despite possible short-term fluctuations, the variables tend to align over

time, following a common trajectory or trend. This suggests that changes in one variable will, in the long

run, be associated with changes in the others, reflecting a stable interdependence.

Results of the ARDL Test

Table 3.2. Estimation of the ARDL model

	Coefficient	t-Statistic	Prob.
LGDP(-1)	0.7405***	65.5544	0.0000
ERV	-0.0051***	-2.9815	0.0005
FDI	-0.0112*	-1.7425	0.0507
FDI(-1)	0.0201***	3.3500	0.0031
IFR.	-0.0121**	-1.8535	0.0566
IFR(-1)	0.0021***	3.7756	0.0005
ERE	-0.006	-1.2565	0.2103
EXR	-0.0057	-0.7610	0.3210
EXR(-1)	0.00161***	3.0076	0.0050
C	0.3753**	2.4218	0.0220
	Long Run	Adjustment	Parameters
	-0.00855		-0.552551
	Long Run	Coefficients	
ERV	-0.2811	-2.1055	0.0543
FDI	-0.5765	-0.7750	0.3165
IFR	0.3540	0.6865	0.3565
ERE	0.1105	1.0250	0.3158
EXR	0.4530	1.0310	0.3013
C	21.0402**	2.2422	0.0189

Author’s computation using E-Views 10

4. ANALYSIS OF FINDINGS

The table above presents the ARDL results of the findings of the relationship between exchange rate volatility and economic growth in Nigeria. It shows the short and long run impacts of exchange rate

volatility on economic growth and other control variables in the model. The long run adjustment parameter is negative as expected theoretically from the model, it is statistically significant suggesting the nonexistence of a long run relationship in the model.

This could be attributed to lack of statistical significance of all the variables in the long run estimate except exchange rate volatility.

The findings from the ARDL analysis established that exchange rate volatility negatively economic growth in Nigeria in the short run, with a significance level less than one percent. This suggests that as exchange rate volatility increases, GDP is constrained, resulting to a decreased productivity in the economy. Also, in the long run exchange rate volatility has a negative impact on GDP at 5% level of significance with a severe impact than in the short run. This is a testament of the present reality in Nigeria economy. With the country's overreliance on imports for almost all raw materials and intermediate goods, the impact of the volatility of the exchange rate now seems persistent and enduring on productive activities in the country. This militates against the smooth operation of businesses and constrained their performance. This finding is in consonance with the work of Aghion et al (2019).

With respect to the other variables of interest, foreign direct investment was used to capture financial inflow. The result shows that financial inflow impacts productivity negatively in the short run, with a significance level of 10%. Meanwhile, the long-run relationship is not statistically significant. This emphasizes that FDI has less-developed nature and inability to support productivity due to the unstable exchange rate. With the market interest rate in the capital ranging between 25% and 35%, the cost of capital becomes terminal to businesses. The finding, however, contradicts that of Aghion et al.(2019), who is the pioneer study on the role of financial sector development in the relationship between exchange rate volatility and productivity.

In the immediate short run, external reserve does not impact productivity in Nigeria. Moreover, with a period lag, the analysis revealed that the impact of external reserve becomes positive on productivity. This suggests a time lag in transmitting external reserve to economic activities. In the long run, the result suggests no evidence of a long-term relationship between external reserve and GDP, making external reserve a short-term phenomenon in economic activities.

Meanwhile, the inflation rate is an additional variable that captures the real sector. The result shows that inflation immediately impacts productivity but without a lagged or long-run impact. This emphasizes how the price rise can motivate productivity in the short term. Though not supported statistically, the result shows that a persistent rise in inflation becomes inimical to productivity.

5. CONCLUSION AND RECOMMENDATIONS

Exchange rate volatility in Nigeria can be described as a major toxin to economic growth in the country. This can be attributed to its impact on costs of production in firms and other sectors of the economy as the economy rely heavily on importation of both finished and intermediate goods and services. Hence, this article attempts to investigate the impact of exchange rate volatility on productivity in Nigeria. The analysis is based on the ARDL model following a mixed order of integration among the variables considered. The findings from the study revealed that exchange rate volatility has a negative impact on gross domestic product in both the short run and the long run. Meanwhile, external reserve to the private sector used to capture financial development impacts gross domestic product negatively, emphasizing Nigeria's less developed financial system. The findings emphasize that monetary policy exhibits lags in its impact on economic activities, while the persistence of fiscal deficit can become perilous for productivity. However, the inflation rate positively impacts productivity in the short run.

Having established a negative relationship between exchange rate volatility and gross domestic product in Nigeria, this study recommends that the government needs to facilitate uniform and appropriate pricing of foreign exchange rates, ensure efficient management of foreign exchange access, enhance domestic productivity to boost the foreign exchange availability, provide clarity and ensure transparency in market operations, and develop an efficient capital mobility framework.

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