African Economic and Management Review (AEMR)
DOI: 10.53790/aemr.v5i1.116 | **ISSN:** 2814-3418 | Vol 5| Issue 1| Pages 21-33

Exchange Rate and Total Factor Productivity in Nigeria

Chidinma J. Obula[1†*]; Edy-Ewoh Uduakobong[1†]

[1] Economics Department, Babcock University, Ilishan, Remo, Nigeria.
[†] Authors contributed equally.
* Corresponding Author: Obula0241@pg.babcock.edu.ng

Article History

Submitted: April, 2025
Revised: June, 2025
Accepted: August, 2025

Keyword

Economic growth, Exchange rate, Technological Progress, Total Factor Productivity, Trade Openness

Abstract

This study investigates the relationship between exchange rate and Total Factor Productivity (TFP) in Nigeria from 1981 to 2022, recognizing TFP as vital to industrialization, trade, competitiveness, and economic growth. While prior studies have explored exchange rate dynamics, limited attention has been paid to its direct impact on TFP. Using an ex-post facto design and data from the World Development Indicators (WDI) and FRED, the study applies the ARDL model to assess both long- and short-run effects. Results show that exchange rate fluctuations significantly reduce TFP in both time frames, underscoring the need for exchange rate stability to support productivity. A unidirectional causality from exchange rate to TFP is also identified, emphasizing the importance of macroeconomic policies. The study recommends adopting a managed exchange rate regime, bolstering foreign reserves, and pursuing structural reforms to enhance productivity and competitiveness.

Cite as: Obula, J. C., Uduakobong, E. (2025). Exchange rate and total factor productivity in Nigeria. *African Economic and Management Review, 5(1), 21-33*

1. Introduction

Nigeria faces a dynamic economic landscape where exchange rates play a crucial role in shaping productivity and growth. Among the key indicators of economic progress, Total Factor Productivity (TFP) stands out as a measure of how efficiently resources such as labour, capital, and technology are utilized in production. **Hall and Jones (1998)** described TFP as the efficiency with which labour and capital are utilized. Similarly, **Hulten (2001)** emphasized its link to innovation, institutional quality, and technological progress. Higher TFP signifies technological advancement, innovation, and resource optimization, enabling economies to achieve greater output without proportionate increases in inputs (**Rodriguez et al., 2020; Comin, 2006**). Meanwhile, exchange rate stability is critical to fostering an environment conducive to productivity growth. Studies have shown that stable exchange rates contribute to TFP growth in export-driven economies, such as Japan, where yen depreciation boosted competitiveness in key industries (**Krugman & Obstfeld, 2017; Dornbusch, 1980**). By implication, stable exchange rates reduce uncertainty and encourage long-term investments in technology and infrastructure (**Obstfeld & Rogoff, 1995; Edwards & Yeyati, 2005**). On the other hand, exchange rate volatility can disrupt trade competitiveness, inflate production costs, and hinder resource allocation. For instance, depreciating currencies raise the cost of imported inputs, negatively impacting production efficiency and, consequently, TFP (**Mishkin, 2016; Goldberg & Knetter, 1997**).

In the Nigerian context, TFP trends have been erratic, shaped by macroeconomic policies, institutional factors, and external shocks such as oil price volatility

(**World Bank, 2019; Adegbite & Olayemi, 2021**). This inconsistency highlights the need for effective policies that address the underlying factors influencing productivity, particularly exchange rate dynamics. Exchange rate fluctuations significantly affect economic activities. For instance, the stability of the Naira influences the cost of imports as well as exports, consequently impacting the competitiveness of local goods in global markets and productivity across sectors (**Obansa et al., 2013; Udoh & Egwaikhide, 2008**). The relationship between exchange rates and TFP is particularly critical in a trade-dependent economy like Nigeria, where exchange rates have been found to impact investment decisions, resource allocation, and technology adoption (**Ayinde et al., 2022**; **Feenstra et al., 2015**; **Ajakaiye & Fakiyesi, 2009**). It is also capable of lowering inflationary pressures, enhancing trade competitiveness, and creating incentives for investment in productivity-enhancing technologies (**Adeniyi, 2012; Mordi, 2006; Eichengreen, 2008**).

Despite the importance of exchange rate stability in fostering productivity growth, existing studies have largely focused on developed economies or generalized findings without specific reference to Nigeria's economic structure. While research has examined exchange rate impacts on macroeconomic variables like inflation and trade balance, limited empirical evidence exists on how exchange rate directly affects TFP in Nigeria. This study fills that gap by providing a comprehensive analysis of how exchange rate influences productivity in Nigeria's unique economic setting.

Moreover, the poor TFP growth in Nigeria since the early 2010s, coupled with worsening exchange rate following the collapse of global oil prices in 2014, has negatively affected economic growth (**World Bank, 2019; IMF, 2021**). This underscores the fragility of Nigeria's growth model and the need for policies that stabilize exchange rates to improve productivity. Understanding the relationship between exchange rates and TFP is crucial for policymakers seeking to enhance the country's economic resilience. Addressing exchange rate dynamics should remain a priority in Nigeria's broader strategy to improve productivity and achieve long-term economic development. The study contributes to the literature by providing empirical evidence on the direct impact of exchange rate on TFP, a dimension that has been largely unexplored in the Nigerian context. The findings will be instrumental in guiding policy decisions on exchange rate management and productivity enhancement strategies. Given Nigeria's status as one of the largest economies in sub-Saharan Africa, the study also offers valuable insights for policymakers beyond Nigeria. By bridging the research gap on exchange rate-TFP linkages in a developing economy, this study provides a foundation for future research on the subject.

The structure of the remaining sections of the study follows. Section 2 presents a review of related literature. Section 3 outlines the econometric methodological approach, while Section 4 discusses the empirical findings. Finally, Section 5 concludes the study by summarizing key insights and policy implications.

2 Empirical Review

2.1 Theoretical Framework

The relationship between exchange rate dynamics and total factor productivity (TFP) can be analysed through several economic theories. The Balassa-Samuelson hypothesis (Balassa, 1964; Samuelson, 1964) posits that differences in productivity growth between tradable and non-tradable sectors influence real exchange rate movements. In economies like Nigeria, where productivity disparities exist across sectors, exchange rate fluctuations can significantly impact resource allocation and overall TFP. Additionally, the Purchasing Power Parity (PPP) theory suggests that exchange rate adjustments reflect differences in price levels between countries, affecting cost competitiveness and productivity (**Cassel, 1918**). The Endogenous Growth Theory (**Romer, 1990; Lucas, 1988**) emphasizes the role of innovation, human capital, and knowledge spillovers in driving productivity growth, which exchange rate stability can facilitate by fostering a conducive investment climate. These theoretical perspectives provide a foundation for understanding how exchange rate movements influence Nigeria's TFP.

2.2 Empirical Literature Review

The relationship between exchange rate dynamics and TFP in Nigeria has been extensively studied, with diverse findings across different contexts and methodologies.

Agbarha and Peter (2017) found that exchange rate stability and competitiveness are key drivers of productivity, particularly in the context of Nigeria's integration into the global economy.

Focusing on exchange rates, **Akram and Rath (2018)** explored the effects of real exchange rate (RER) misalignment on TFP growth in 15 emerging market

economies from 1990 to 2014. Their findings, based on dynamic ordinary least squares (DOLS) and panel cointegration techniques, indicated a negative relationship between RER misalignment and TFP growth, suggesting that reducing exchange rate distortions could enhance productivity.

Garzarelli and Limam (2019) used stochastic frontier analysis to examine output growth drivers in 36 sub-Saharan African countries from 1996 to 2014. Their findings revealed that physical capital accumulation played a more significant role than TFP in 22 of the countries studied, highlighting the relative importance of capital deepening.

Egbuna and Udeh (2020) emphasized the benefits of a managed float exchange rate regime, which allows policymakers the flexibility to enhance macroeconomic stability and productivity. However, these studies do not thoroughly investigate sector-specific impacts or potential nonlinear relationships. **Shen and Valdmanis (2022)** adopted a robust nonparametric approach to analyse TFP growth in selected African countries during 1980–2017, identifying productivity gains through tailored economic structures. While these studies emphasize capital accumulation, they provide limited insight into exchange rate effects on TFP. **Aiteh et al. (2022)** noted that high exchange rates and associated economic challenges diminish the productivity and profitability of multinational manufacturing firms.

Abdullahi and Wali (2023), found that depreciation encourages a shift from imports to domestic production, boosting productivity and growth. These findings indicate that the impact of exchange rates on TFP may depend on economic structure and policy environment. In the agricultural sector, **Eniekezimene et al. (2023)** revealed an asymmetric impact, where exchange rate appreciation exerts a stronger positive effect on agricultural productivity compared to depreciation. **Ogwuche and Obiaje (2023)** also emphasized that favourable exchange rates, within the framework of effective monetary policy, can significantly enhance economic growth and productivity. These findings suggest that different sectors experience varied responses to exchange rate fluctuations, necessitating targeted policies. Further, **Okoroigwe (2023)** explored the interplay between fluctuating exchange rates, inflation, and interest rates, emphasizing the adverse impact of exchange rate volatility on GDP. Similarly, **Okoroigwe et al. (2023)** corroborated these findings, suggesting the detrimental effects of exchange rate fluctuations on GDP over the period 1986 to 2021. Examining different exchange rate regimes, **Subair (2023)** analyzed the impact of fixed and flexible exchange rates using the FMOLS estimation technique and concluded that fixed exchange rate regimes are unlikely to foster long-term economic growth. These findings raise questions about the optimal exchange rate policy framework for enhancing productivity. In contrast, **Ugwu et al. (2023)** found that exchange rates, interest rates, and trade openness significantly enhance the manufacturing sector's contribution to economic growth. Their results emphasize the importance of exchange rate management in driving productivity in this pivotal sector.

Several studies have analysed the broader macroeconomic implications of exchange rate dynamics on productivity. **Orisdare and Olofin (2024)** highlighted the adverse effects of exchange rate volatility, emphasizing its significant negative impact on TFP. **Nyeche (2024)** observed that exchange rate depreciation positively influences economic growth, closely linked to productivity improvements. Also, **Iliyasu et al. (2024)** employed advanced econometric techniques, including BARDL/ARCH and GARCH models, to investigate the link between monetary policy and exchange rate volatility, highlighting the necessity of a coordinated fiscal and monetary policy mix to achieve exchange rate stability.

Despite the substantial empirical evidence on exchange rate dynamics and TFP, several gaps remain. First, many studies focus on exchange rate without examining potential nonlinearities or asymmetries in its impact on productivity. Second, sector-specific effects of exchange rate remain underexplored, particularly in Nigeria's manufacturing and agricultural sectors. Third, while macroeconomic studies discuss exchange rate regimes broadly, limited research evaluates the effectiveness of Nigeria's exchange rate policies in mitigating productivity losses. Additionally, there is a lack of consensus on whether exchange rate depreciation unequivocally benefits productivity, with conflicting findings depending on methodological approaches and sectoral variations. Addressing these gaps will provide deeper insights into how exchange rate dynamics shape productivity growth in Nigeria's unique economic environment.

3 Data and Methodology

3.1 Data and Data Sources

This study employs annual time series data spanning from 1981 to 2022, sourced from the Federal Reserve Economic Data (FRED) and the World Bank. The dataset includes the following key variables:

- Total Factor Productivity (TFP): A measure of the efficiency of all inputs in the production process, sourced from the Federal Reserve Economic Data (FRED).
- Exchange Rate (EXR): The annual average nominal exchange rate (local currency per USD), obtained from the World Bank Development Indicator (WDI)
- Inflation (INFR): The annual percentage change in the consumer price index (CPI), retrieved from the World Bank database.
- Foreign Direct Investment (FDI): Net inflows of foreign direct investment as a percentage of GDP, sourced from the World Bank.
- Human Capital Index (HCI): A composite index measuring the contribution of education and health to workforce productivity, obtained from the World Bank's Human Capital Project.
- Labour Force: The total number of economically active individuals, sourced from the World Bank's World Development Indicators.
- Technological Progress: Proxied by "medium and high-tech exports (% of manufactured exports)," sourced from the World Bank.
- Trade Openness: It is the measure of the extent to which a country is engaged in the global trading system, sourced from the World Bank.

By analysing the historical trends over 42 years, this research aims to uncover the dynamic interactions between exchange rates, productivity, and economic indicators in Nigeria.

3.2 Model Specification

$$\Delta tfp_t = \partial tfp_{t-1} + \theta_0 + \delta_i X_{t-1} \sum_{j=1}^{r} \pi_j \Delta tfp_{t-j} + \sum_{j=0}^{s} \eta_j \Delta X_{t-j} + \varepsilon_t \quad (1)$$

where tfp_t denotes the total factor production expressed in natural logs specified period t; X_{it} is a $k \times 1$ vector of the explanatory variables – exchange rate (exr), inflation (inf), foreign direct investment (fdi), human capital index (hci), trade openness (to), technological progress (tp) and labour force (lf) –; θ_0 is the intercept; Δ indicates the first difference operator and ε_t connotes stochastic disturbance term. Furthermore, the short-run impact of the individual explanatory variables on total factor production is η_j, $-\delta_i / \partial_i$ measures the long-run effect. A principal feature of cointegrated variables is their responsiveness to any deviation from long-run equilibrium. This attribute infers an error correction model in which the short-run dynamics of the variables in the system are influenced by the deviation from equilibrium (Blackburne III & Frank, 2007).

The corresponding error correction form for equation (2) is specified as:

$$\Delta tfp_t = \partial e_{t-1} + \sum_{j=1}^{r} \pi_j \Delta tfp_{t-j} + \sum_{j=0}^{s} \eta_j \Delta X_{t-j} + \varepsilon_t \quad (2)$$

where $e_{i,t-1}$ is the error correction term and the speed of adjustment factor is ∂_i which measures how long it takes the system to revert to the original equilibrium where it is confronted with shocks. In other words, if $\partial_i = 0$, then there would be no evidence for a long-run relationship; however, for long-run equilibrium to exist, the parameter is expected to be significantly negative. The closer the value of this parameter to one in absolute terms, the quicker the adjustment of inflation to long-run equilibrium after a change in the independent variable(s) – computed as $\left(\frac{1}{e_{i,t-1}}\right)$–; otherwise, the speed of adjustment to equilibrium will be slow, and therefore, it will take a longer period for the long-run equilibrium to be realized.

4 Econometric Result and Discussion

4.1 Descriptive Statistics

The study summarized the variables; total factor productivity (TFP), exchange rate (exr), inflation (inf), foreign direct investment (fdi), human capital index (hci), trade openness (to), technological progress (tp) and labour force (lf) in the form of mean, median, minimum, maximum, standard deviation, kurtosis, skewness, and observations (N). The detailed interpretation of this table is explained in Table 1 as follows. Table 1 presents the descriptive statistics of key macroeconomic variables, offering insights into Nigeria's economic landscape. The total factor productivity (TFP) exhibits moderate stability with an average value of 0.7826 and low variability, indicating relatively steady productivity levels over time. However, the exchange rate (EXR) shows

significant fluctuations, with a high standard deviation of 126.26, reflecting considerable volatility in Nigeria's currency value. Such instability can deter foreign investment and complicate long-term business planning (**Adjei, 2019**). Foreign direct investment (FDI) also demonstrates high variability, with instances of disinvestment, as indicated by the negative minimum value. This suggests that economic and policy uncertainties may have discouraged sustained foreign capital inflows (**Kausar & Zulfiqar, 2017**). Human capital development, as measured by the Human Capital Index (HCI), remains relatively low, with a mean of 0.2383 and limited fluctuations, pointing to slow progress in skill acquisition and education, which are essential for productivity growth (**Asongu & Odhiambo, 2023**). Inflation (INF) exhibits significant variability, with a mean of 18.95% and a maximum of 72.83%, indicating episodes of severe price instability. The high positive skewness and kurtosis suggest periods of extreme inflationary pressures, which can erode purchasing power and hinder economic growth. Meanwhile, the labour force (LF) has grown steadily, averaging 44.9 million workers, though inefficient labour market structures may limit its contribution to productivity enhancement.

Table 1
Descriptive Statistics

Variables	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera Probability	Obs.
TFP	0.7826	1.0921	0.4889	0.1931	0.1872	1.5378	0.1362	42
EXR	120.5214	460.0000	0.6400	126.2598	1.1044	3.4593	0.4106	42
FDI	388560.7	1441246	-85924.52	466744.9	0.8174	2.2787	0.0612	42
HCI	0.2383	0.3783	0.1329	0.0751	0.3418	1.8567	0.2117	42
INF	18.9466	72.8355	5.3880	16.4550	1.8771	5.4371	0.0000	42
LF	44903068	73272344	25215185	13710869	0.3494	2.0609	0.3015	42
TO	0.3158	0.5102	0.0303	0.1228	-0.7018	3.0361	0.1782	42
TP	40.4111	81.5428	7.4750	22.1447	0.4265	1.9344	0.1959	42

Table 2: Stationarity Tests

	Level		First Difference	
Variable	ADF	PP	ADF	PP
tfp	-0.2514	-0.1255	5.3876***	-5.3533***
lexr	-2.0757	-2.6692	-5.9023***	-5.9023***
lfdi	-1.4083	-1.3841	-8.0086***	-.8.0086***
hci	-4.5517***	5.9103	-2.6439*	-3.1294**
infr	-3.6815***	-2.9169*	-2.9873***	-10.6638***
llf	-1.4602	-0.0255	-7.0435***	-3.5758**
to	-2.5862	-2.7086*	-6.1344***	-6.1342***
tp	-3.3631**	-2.8236*	-6.4483***	-11.1139***

Notes: * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Trade openness (TO) displays a slightly negative skewness, suggesting that Nigeria has experienced periods of restricted trade, potentially due to protectionist policies. While trade liberalization can enhance economic growth, excessive restrictions may stifle competitiveness and limit foreign market access (**Alegwu et al., 2018**). Lastly, technological progress (TP) shows moderate variability, highlighting the uneven advancement in innovation and infrastructure development. Limited investment in research and development may explain the inconsistent trajectory of technological progress, underscoring the need for policies that foster sustained technological growth (**Adjei, 2019**).

Overall, the descriptive statistics reveal key macroeconomic challenges, including exchange rate instability, inflation volatility, and inadequate human

capital development, which may hinder productivity growth. However, foreign investment and trade openness remain crucial factors in driving economic performance. Addressing issues such as inflation control, exchange rate stability, and workforce development can enhance Nigeria's productivity and foster sustainable economic growth.

Precursory to the estimation of the ARDL model, we checked for the stationarity properties of the series using the augmented Dickey-Fuller (ADF) and Philip Perron (PP) tests to determine the integrating order of each variable, and Table 2 is the output of the estimates.

Table 2 presents the results of the stationarity tests using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The stationarity analysis is crucial in determining the order of integration of the variables, ensuring appropriate econometric modelling. The results indicate that at the level form, most variables are non-stationary, as their test statistics fail to reject the null hypothesis of unit root at conventional significance levels. However, after first differencing, all variables become stationary, with significant test statistics at the 1%, 5%, or 10% levels.

Total factor productivity (TFP) is non-stationary at levels in both ADF and PP tests but becomes stationary at the first difference, confirming an integration order of I(1). Similarly, the exchange rate (EXR), foreign direct investment (FDI) and trade openness (TO) are integrated at I(1), suggesting that these variables exhibit long-term trends and require differencing to ensure stationarity (**Adjei, 2019**). On the other hand, inflation (INF), and human capital index (HCI) are found to be stationary at levels, indicating an integration order of I(0). This implies that these variables do not exhibit unit root behaviour and are mean reverting in the short run (**Kausar & Zulfiqar, 2017**). The mixture of I(0) and I(1) variables justifies the application of the autoregressive distributed lag (ARDL) model, which accommodates regressors of different integration orders. The results also suggest that shocks to variables like exchange rates and inflation may have persistent effects, reinforcing the importance of macroeconomic stability for sustainable productivity growth (**Asongu & Odhiambo, 2023**).

Overall, the stationarity tests confirm that an appropriate econometric estimation technique must account for the different orders of integration, ensuring robust and reliable inference in subsequent analyses.

The results from the ARDL model (see Table 3) reveal significant short- and long-run relationships between key macroeconomic factors and total factor productivity (TFP). The exchange rate (EXR) exhibits a significant negative effect on TFP in both the short run (-0.030, $p < 0.05$) and the long run (-0.233, $p < 0.05$), suggesting that excessive currency depreciation may undermine productivity by increasing the cost of imported capital goods and creating macroeconomic uncertainty, which aligns with the findings of **Adjei (2019)**. Similarly, inflation (INF) exerts a negative influence on productivity, with a short-run coefficient of -0.001 ($p < 0.01$) and a long-run coefficient of -0.004 ($p < 0.05$), reinforcing the classical economic argument that rising inflation erodes purchasing power and increases production costs, leading to inefficiencies in resource allocation (**Kausar & Zulfiqar, 2017**).

On the other hand, foreign direct investment (FDI) has a positive and significant impact on TFP, both in the short run (0.021, $p < 0.05$) and the long run (0.249, $p < 0.05$), supporting the notion that capital inflows enhance productivity through technology spillovers, infrastructure improvements, and efficiency gains (**Alegwu et al., 2018**). Human capital (HCI) also emerges as a key determinant of productivity, with a large and statistically significant long-run coefficient (12.978, $p < 0.05$), indicating that investments in education and skills development contribute significantly to long-term productivity growth, as suggested by endogenous growth models (**Asongu & Odhiambo, 2023**).

Table 3:
Short and Long-run ARDL coefficients

	lexr	*inf*	*lfdi*	*hci*	*tp*	*llf*	*to*
δ^{lexr}	-0.030** (0.011)						
δ^{inf}		-0.001*** (0.002)					
δ^{lfdi}			0.021** (0.006)				
δ^{hci}				-0.059 (0.2254)			
δ^{tp}					0.001*** (0.000)		
δ^{llf}						0.942 (0.364)	
δ^{to}							-0.134*** (0.032)
λ^{lexr}	-0.233** (0.078)						
λ^{inf}		-0.004** (0.001)					
λ^{lfdi}			0.249** (0.085)				
λ^{hci}				12.978** (5.571)			
λ^{tp}					0.005*** (0.001)		
λ^{llf}						-2.403*** (0.705)	
λ^{to}							0.434** (0.160)
γ^{ect}	-0.613** (0.046)						

Note: The values in parentheses are the standard errors. The $\delta s'$ are for the short run while the $\lambda s'$ are for the long run. ***, ** & * imply significance at the 1%, 5% and 10% levels, respectively

Trade openness (TO) presents a mixed impact, showing a negative short-run effect (-0.134, $p < 0.01$) but a positive long-run effect (0.434, $p < 0.05$), which may reflect short-term structural adjustments and competitiveness pressures before yielding long-term productivity benefits through increased market access and technology diffusion (**Adjei, 2019**). Technological progress (TP) also plays a crucial role in driving productivity, with positive and significant effects in both the short run (0.001, $p < 0.01$) and the long run (0.005, $p < 0.01$), reinforcing the Schumpeterian perspective on innovation-driven economic growth (**Kausar & Zulfiqar, 2017**).

Interestingly, the labour force (LF) displays a paradoxical relationship with productivity, as it contributes positively to the short run (0.942, $p < 0.05$) but negatively in the long run (-2.403, $p < 0.01$). While an expanding workforce initially boosts economic output, long-term inefficiencies, skill mismatches, and underemployment may reduce its effectiveness, necessitating policy interventions to improve labour market efficiency (**Alegwu et al., 2018**). The error correction term (-0.613, $p < 0.05$) confirms a stable long-run equilibrium relationship among the variables, indicating that deviations from equilibrium are corrected at a rate of 61.3% per period.

Overall, these findings highlight the importance of maintaining macroeconomic stability, attracting foreign investment, fostering trade integration, and investing in human capital and technology to sustain long-term productivity growth. Addressing exchange rate and inflationary pressures while ensuring an efficient labour market can further enhance economic resilience and competitiveness. These results provide valuable policy insights for emerging economies, emphasizing the need for a balanced approach to macroeconomic management that prioritizes both short-term stabilization and long-term structural transformation.

Table 4:
Post-Estimation Diagnostic Tests
Source: Authors' Own work

Diagnostic Tests
$R^2 = 0.954 \quad \overline{R}^2 = 0.905 \quad DW = 2.061$
$X^2_{LM} = 0.176[0.675] \quad X^2_{BGP} = 23.128[0.453] \quad X^2_{JB} = 3.365[0.186] X^2_{RS} = 0.806[0.384]$
$F - statistic = 19.470[0.000]$ STABILITY=CUSUMSQ
ARDL bound test
$F - statistic = 10.904[I(0) = 2.22, I(1) = 3.39 @ 5\%]$

Notes: DW: Durbin Watson statistics. statistics ***, ** and * indicate significance at 1%,5% and 10%, respectively. $X^2_{LM}, X^2_{BGP}, X^2_{RS}, X^2_{JB}$ represent LM test for serial correlation, Breusch-Pagan Godfrey test for heteroscedasticity, Ramsey rest test for model specification and Jarque-Bera normality test, respectively. I(0) and I(1) represent lower and upper bound, respectively. [ ] indicate respective probability values.

The post-estimation diagnostic tests provide further validation for the robustness and reliability of the ARDL model estimates presented in Table 3. The results confirm that the model satisfies key econometric assumptions, ensuring that the estimated relationships between total factor productivity (TFP) and macroeconomic variables are statistically sound and not driven by spurious correlations. The Durbin-Watson (DW) statistic suggests the absence of severe autocorrelation in the model, reinforcing the credibility of the estimated coefficients (**Alegwu et al., 2018**). The Breusch-Godfrey LM test for serial correlation further supports this by failing to reject the null hypothesis of no autocorrelation, indicating that the model does not suffer from omitted dynamic effects that could bias the results. The Breusch-Pagan-Godfrey test for heteroscedasticity shows that the error terms are homoscedastic, ensuring that the variance of residuals remains constant over time, which is essential for obtaining efficient and unbiased estimates (**Kausar & Zulfiqar, 2017**). Additionally, the Ramsey RESET test confirms the correctness of the model specification, suggesting that the functional form is appropriate and that no significant variable is omitted. The Jarque-Bera test for normality of residuals indicates that the errors are normally distributed, a crucial assumption for valid hypothesis testing and inference (**Asongu & Odhiambo, 2023**). The CUSUM and CUSUMSQ stability tests demonstrate that the model remains stable over the sample period, further supporting the reliability of the estimated parameters in both the short and long run.

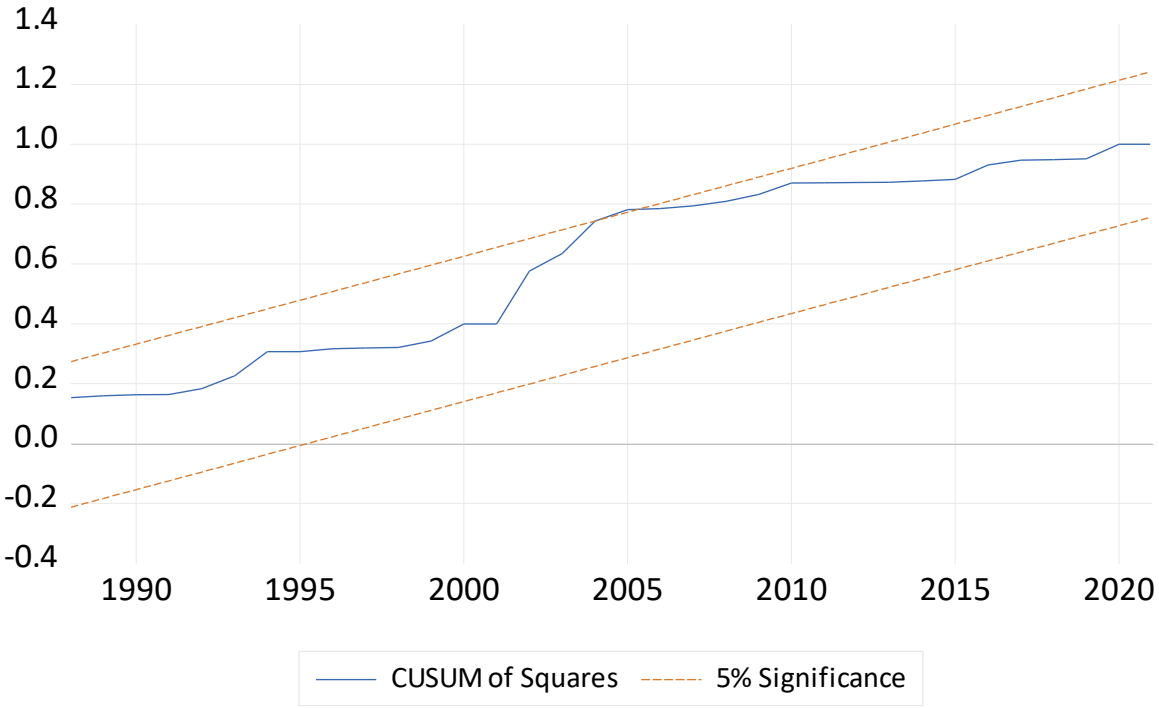

Figure 1; The plot of Cumulative sum square of recursive residuals.
Source: Author's compilation from E-views 12 output
Note: The blue line is the solid line, while the red lines that bounded the blue line are the critical bounds at 0.05

Furthermore, the ARDL bounds test confirms the presence of a long-run cointegration relationship between the variables, reinforcing the validity of the long-run coefficients in Table 3. This implies that despite short-term fluctuations, the macroeconomic determinants of TFP maintain a stable long-term equilibrium, aligning with the theoretical expectations of productivity-enhancing factors such as foreign direct investment, technological progress, and trade openness (**Adjei, 2019**).

In conclusion, the diagnostic tests validate the ARDL model's estimates, confirming that exchange rate, inflation, foreign direct investment, human capital, trade openness, and technological progress exert statistically significant and stable effects on TFP. The absence of econometric issues such as autocorrelation, heteroscedasticity, and misspecification strengthen the reliability of these findings, making them robust for policy recommendations in emerging economies.

5 Summary, Conclusion, and Recommendations

This study examines the impact of exchange rate on Total Factor Productivity (TFP) in Nigeria, revealing a significant negative effect of exchange rate movements on TFP in both the short and long run. These findings highlight the crucial role of exchange rate stability in fostering productivity and overall economic stability. While TFP contributes positively to real GDP growth in the short term, its long-term effects are more complex, requiring structural reforms and targeted policy interventions for sustained economic expansion. Additionally, the study identifies a counterintuitive short-term negative relationship between TFP and trade openness, underscoring the influence of macroeconomic variables such as inflation and foreign direct investment. The unidirectional causality from exchange rate to TFP reinforces the need for prudent exchange rate management to enhance productivity and economic resilience.

To address these challenges, policymakers should adopt a managed exchange rate system, strengthen foreign exchange reserves, and implement macroeconomic policies to stabilize inflation and promote economic stability. Additionally, fostering TFP growth requires investments in human capital, technological innovation, and structural reforms aimed at improving efficiency and economic diversification. Trade policies should focus on

reducing trade barriers, enhancing infrastructure, and supporting export competitiveness while ensuring inflation control and mitigating the adjustment costs associated with technological adoption.

In conclusion, a comprehensive policy framework that integrates exchange rate stability, productivity enhancement, economic growth strategies, and trade openness measures is essential for Nigeria's sustainable economic development. By implementing these recommendations, Nigeria can build a more resilient and productive economy, fostering long-term prosperity and global competitiveness.

References

Abdulkarim, Y. (2023). A systematic review of investment indicators and economic growth in Nigeria. *Humanities and Social Sciences Communications*, *10*(1), 1-13.

Abdullahi, S., & Wali, H. N. (2023). A Var Approach to Exchange Rate and Consumer Price Index Shocks on Economic Growth in Nigeria. *SAMVAD*, *26*(0), 34. https://doi.org/10.53739/samvad/2023/v26/172679

Adegbite, O., & Olayemi, T. (2021). The impact of exchange rate fluctuations on productivity growth in Nigeria. *Journal of African Economies, 30*(4), 432-451.

Ademosu, S. T., & Ayodele, T. D. (2023). Digital currencies and the Nigerian economy: Evidence from selected coins. *International Journal of Business Management and Finance Research*, *6*(2), 31–43. https://doi.org/10.53935/26415313.v6i2.264

Adeniyi, O. (2012). Exchange rate policy and industrial performance in Nigeria. *Economic Modelling, 29*(5), 1894-1902.

Adesola, W. A., & Alimi, S. R. (2017). Exchange rate management and non-oil export performance in Nigeria. *CBN Journal of Applied Statistics*, *8*(2), 1–29.

Adeyemo, S. (2023). Exchange rate dynamics and real GDP growth: An empirical assessment. *African Economic Review, 12*(2), 145-163.

Adjei, E. (2019). Exchange rate volatility and Economic growth in Ghana. *International Journal of Business and Social Science*, *10*(4), 105-118.

Adnan, Z., Chowdhury, M., & Mallik, G. (2019). Foreign direct investment and total factor productivity in South Asia. *Theoretical and Applied Economics*, *26*(2), 105–120.

Adu, G., Marbuah, G., & Mensah, J. T. (2013). Exchange rate volatility and inflation in Ghana: An empirical investigation. *Review of Development Finance*, *3*(3), 178–191.

Agbarha, E. K., & Peter, S. A. (2017). Globalization And Economic Growth in Nigeria: A Cointegration Approach. *Journal of International Business and Economics*. https://doi.org/10.15640/jibe.v5n1a9

Aghion, P., Bacchetta, P., Rancière, R., & Rogoff, K. (2009). Exchange rate volatility and productivity growth: The role of financial development. *Journal of Monetary Economics*, *56*(4), 494–513. doi:10.1016/j.jmoneco.2009.03.015

AIteh, A. A., Idaka, S. E., & Goodwill, G. F. (2022). Effect of economic indices on the performance of listed multinational manufacturing companies in Nigeria. *International Journal of Science and Research Archive*, *7*(2), 115–127. https://doi.org/10.30574/ijsra.2022.7.2.0256

Ajakaiye, O., & Fakiyesi, T. (2009). The exchange rate and macroeconomic performance in Nigeria. *West African Economic Review, 14*(2), 145-167.

Akenbor, A. S., & Esheya, S. A. (2022). Strengthening Nigeria's Weak Economy; Does Agricultural Exports Really Matter? Evidence from Cotton Seed Exports. *Journal of Agriculture and Food Sciences*, *20*(1), 111–124. https://doi.org/10.4314/jafs.v20i1.9

Akram, V., & Rath., B. N. (Eds.). (2018). Exchange rate misalignment and total factor productivity growth: Evidence from emerging market economies. Journal of Economic Studies, 45(6), 1285–1300.

Alegwu, F. O., Aye, G. C., & Asogwa, B. C. (2018). Effect of Real Exchange Rate Volatility on Agricultural Products Export in Nigeria. Agris On-Line Papers in Economics and Informatics, 10(3), 3–15. https://doi.org/10.7160/aol.2018.100301

Asongu, S. A., & Odhiambo, N. M. (2023). Foreign direct investment, information technology, and total factor productivity dynamics in sub-Saharan Africa. World Affairs, 004382002311542. https://doi.org/10.1177/00438200231154273

Ayinde, T. O., Adeyemi, F. A., & Ali-Balogun, B. A. (2022). Modelling oil price shocks and exchange rate behaviour in Nigeria – A - switching approach. OPEC Energy Review. doi:10.1111/opec.12263

Balassa, B. (1964). The purchasing power parity doctrine: A reappraisal. *Journal of Political Economy, 72*(6), 584-596.

Cassel, G. (1918). Abnormal deviations in international exchanges. *Economic Journal, 28*(112), 413-415.

Comin, D. (2006). Total Factor Productivity. In *The New Palgrave Dictionary of Economics* (2nd ed.). Palgrave Macmillan.

Das, S., & Upadhyay, M. (2019). Growth of real GDP and total factor productivity in Asia with an emphasis on Malaysian growth. *Atlantic Economic Journal: AEJ*, *47*(4), 391–413. doi:10.1007/s11293-019-09642-5

Dornbusch, R. (1980). Exchange rate economics: Where do we stand? *Brookings Papers on Economic Activity, 1*, 143-185.

Edwards, S., & Yeyati, E. L. (2005). Flexible exchange rates as shock absorbers. *European Economic Review, 49*(8), 2079-2105.

Egbuna, M. N., & Udeh, S. O. (2020). Exchange rate s and total factor productivity in Nigeria: The role of policy flexibility and macroeconomic stability. *Journal of Economic and Sustainable Development*, *11*(3), 9–18.

Eichengreen, B. (2008). The real exchange rate and economic growth. *World Development, 36*(7), 1045-1072.

Eniekezimene, F. A., Wodu, E., & Peres, J. (2023). Interrogating the Asymmetric Impact of Exchange Rate on Agricultural Output in Nigeria. *American Journal of Applied Statistics and Economics*, *3*(1), 24–32. https://doi.org/10.54536/ajase.v3i1.2247

Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). The next generation of the Penn World Table. *American Economic Review, 105*(10), 3150-3182.

Garzarelli, G., & Limam, I. (2019). Growth drivers in sub-Saharan Africa: The role of total factor productivity. *Economic Development Quarterly, 33*(3), 145-162.

Goldberg, P. K., & Knetter, M. M. (1997). Goods prices and exchange rates: What have we learned? *Journal of Economic Literature, 35*(3), 1243-1272.

Hall, R. E., & Jones, C. I. (1998). Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics, 114*(1), 83-116.

Hulten, C. R. (2000). Total factor productivity. A short biography. National Bureau of Economic Research.

Hulten, C. R. (2001). Total Factor Productivity: A short biography. *NBER Working Paper No. 7471.*

Iliyasu, M. D., Ibrahim, S. S., & Musa, I. (2024). Monetary Policy on Exchange Rate Volatility in Nigeria: Evidence from BARDL/ARCH and Garch Modellings. *South Asian Journal of Social Studies and Economics*, *21*(4), 119–129. https://doi.org/10.9734/sajsse/2024/v21i4805

IMF (2021). Nigeria: Selected Issues. *International Monetary Fund Publication.*

Iyoha, M. A. (2018). Foreign exchange reserve management and economic performance in Nigeria. *International Journal of Economics, Commerce, and Management*, *6*(6), 245–256.

Iyoha, M. A. (2019). Exchange rate management and economic performance in Nigeria. *International Journal of Economics, Commerce, and Management*, *7*(5), 165–179.

James, J., Marsh, I. M., & Sarno, L. (2005). Exchange Rate s: Fixed, Flexible or Something inbetween. *John Wiley&Sons New Jersey. Moosa, I.M.*

Jeong, H., Kim, K. H., & Lee, S. J. (2004). Sources of economic growth: An extensive growth accounting exercise. *Journal of Economic Growth*, *9*(3), 281–304.

Jibir, A., Abdu, M., & Buba, A. (2023). Does human capital influence labor productivity? Evidence from Nigerian Manufacturing

and Service Firms. *Journal of the Knowledge Economy*, *14*(2), 805-830.

Kallon, A., & Barrie, A. S. I. (2023). An empirical assessment of exchange rate depreciation and currency substitution in Sierra Leone. *Modern Economy*, *14*(12), 1828-1848.

Kausar, R., & Zulfiqar, K. (2017). Exchange rate volatility and productivity growth nexus in selected Asian countries. Pakistan Economic and Social Review, 55(2), 595-612.

Krugman, P. R., & Obstfeld, M. (2017). *International Economics: Theory and Policy* (11th ed.). Pearson.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3-42.

Malikane, C., & Chitambara, P. (2018). Foreign direct investment and total factor productivity in Africa. *Journal of African Economies, 27*(4), 418-437.

Mishkin, F. S. (2016). *The Economics of Money, Banking and Financial Markets* (11th ed.). Pearson.

Misra, S. (2020). Infrastructure development and productivity growth in India. *Economic Analysis and Policy, 69*, 14-29.

Mordi, C. N. (2006). Challenges of exchange rate volatility in economic management in Nigeria. *CBN Economic and Financial Review, 44*(4), 10-29.

Nwokoye , M. O., Okoye, M. I., Nwokocha, A. F., Eze, C. C., Onwuka, I. N., Okechukwu , S. C., & Ekwugha, J. C. (2023). Effect of Exchange Rate on Domestic Price Level in Nigeria. *Asian Research Journal of Arts & Social Sciences*, *21*(3), 26–38. https://doi.org/10.9734/arjass/2023/v21i3469

Nyeche, E. (2024). Impact of exchange rate on economic growth in Nigeria. *International Journal of Advanced Economics*, *6*(6), 242–250. https://doi.org/10.51594/ijae.v6i6.1237

Obansa, S. A. J., Okoroafor, O. K. D., Aluko, O. O., & Millicent, E. (2013). Perceived relationship between exchange rate, interest rate and economic growth in Nigeria: 1970-2010. American Journal of Humanities and Social Sciences, 1(3), 116–124.

Obansa, S. A., Okoroafor, O. K., Aluko, O. O., & Eze, M. (2013). Perceived relationship between exchange rate, interest rate and economic growth in Nigeria. *American Journalof Economics, 3*(2), 82-86.

Obstfeld, M., & Rogoff, K. (1995). Exchange Rate Dynamics Redux. The Journal of Political Economy, 103(3), 624–660. doi:10.1086/261997

Obstfeld, M., & Rogoff, K. (1995). The mirage of fixed exchange rates. *Journal of Economic Perspectives, 9*(4), 73-96.

Ogunyiola, T., Ajibola, J., & Eze, P. (2018). Exchange rate volatility and total factor productivity in Nigeria. *Journal of Economic Modelling, 23*(1), 78-95.

Ogwuche, D. D., & Obiaje, E. (2023). Impact of Monetary Policy on Economic Growth in Nigeria: 1985-2022. *Asian Journal of Economics, Business and Accounting*, *23*(24), 27–38. https://doi.org/10.9734/ajeba/2023/v23i241184

Ogwuche, O., & Obiaje, C. (2023). The role of exchange rate management in economic productivity: A Nigerian perspective. *African Review of Economics and Finance, 15*(2), 98-117.

Okoroigwe, D. (2023). Exchange rate fluctuations and GDP performance: A time series analysis. *Journal of Economic Perspectives, 18*(2), 112-129.

Okoroigwe, D., Ikenna, A., & Opara, J. (2023). The adverse effects of exchange rate volatility on economic growth: Nigerian evidence, 1986-2021. *International Journal of Monetary Economics, 10*(4), 203-222.

Okoroigwe, E. S., Obilikwu, J., Sayedi, S. N., & Yusuf, A. B. (2023). Fluctuating Exchange Rate and Nigeria's Economic Growth: A Time Series Assessment of Over Three Decades' Experience Using Interest Rate and Inflation Rates as Control Variables. *European Journal of Accounting, Auditing and Finance Research*, *11*(11), 34–58. https://doi.org/10.37745/ejaafr.2013/vol11n113458

Orisdare, M. A., & Olofin, S. (2024). Exchange Rate Volatility and Productivity in Nigeria: An

Empirical Analysis. *Asian Journal of Economics Business and Accounting*, *24*(6), 240–250. https://doi.org/10.9734/ajeba/2024/v24i61357

Rodriguez, F., Duran, C., & Donayre, L. (2020). Total factor productivity and exchange rate s: New evidence from developing countries. Journal of Development Economics, 142.

Romer, P. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71-S102.

Samuelson, P. A. (1964). Theoretical notes on trade problems. *Review of Economics and Statistics, 46*(2), 145-154.

Shen, Z., & Valdmanis, S. (2022). Total factor productivity growth in selected African economies: A nonparametric approach. *African Development Review, 34*(2), 187-209.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, *70*(1), 65. doi:10.2307/1884513

Subair, K. (2023). Shifting the paradigm for securing efficient management of exchange rate in Nigeria: A GARCH and BEKK-MGARCH analysis. *Jurnal Perspektif Pembiayaan Dan Pembangunan Daerah*, *11*(5), 323–346. https://doi.org/10.22437/ppd.v11i5.25271

Udoh, E., & Egwaikhide, F. O. (2008). Exchange rate volatility, inflation uncertainty, and foreign direct investment in Nigeria. *Botswana Journal of Economics, 5*(7), 14-31.

Ugwu, C. C., Okwa, E. I., & Sonia, I. (2023). Exchange Rate Fluctuations and Firm's Survival: Evidence Manufacturing Contribution to the Nigerian Economic Growth. *Journal of Economics and Business*, *6*(3). https://doi.org/10.31014/aior.1992.06.03.520

World Bank (2019). *Nigeria Economic Update: Jumpstarting Inclusive Growth.*

World Bank. (2019). Functional reviews of the Public Employment Services in the Western Balkans: Overview.