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IMPACT OF EXCHANGE RATE VOLATILITY ON ECONOMIC GROWTH: 1981-2019 (ARDL MODEL)

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Abstract:
This research investigates the relationship between exchange rates and economic growth in Nigeria during the period from 1981 to 2019. The research conducted an analysis of Nigerian data using the Ordinary Least Square (OLS) technique and identified that Exchange Rates have a favourable impact on Economic Growth. This paper affirmed the regression's validity with stationary residuals and found no long-term equilibrium using Bound Cointegration. The ARDL modelling revealed short-term connections between exchange rates and economic growth. Positive correlations were observed between exchange rates, GDP per capita growth, interest rates, and total exports, while negative relationships were noted with inflation and total imports, highlighting the importance of exchange rate stability in sustaining economic growth. This research provides a novel viewpoint on the connection between exchange rates and economic growth in Nigeria during the period from 1981 to 2019. It uncovers that more than 98% of the fluctuations in exchange rates can be accounted for by the included variables. The noteworthy discovery of the absence of a long-term equilibrium relationship within the specified time frame sets this study apart. Furthermore, it underscores the crucial role of exchange rate stability in promoting enduring economic growth, emphasising the necessity for well-designed policies that consider the intricate economic landscape.

Keywords: *Exchange Rate, Economic Growth, OLS, Bounds Test of Cointegration*

JEL: E4, E5, O2, O4

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INTRODUCTION

Exchange rates, which serve as a reflection of currency values, play a pivotal role in global economic interactions, exerting a significant influence over various aspects of economic performance (Barguellil et al., 2018). This influence is particularly pronounced in Nigeria, a nation of abundant natural resources and a burgeoning population, holding a pivotal position within the African continent (Akpan & Atan, 2011). The economic landscape of Nigeria encompasses diverse sectors, including agriculture, manufacturing, services, and notably, the oil industry, a major contributor to export earnings (Okonjo-Iweala & Osafo-Kwaako, 2007). Consequently, the stability and fluctuations of exchange rates, especially the Nigerian Naira, are intricately related to the economic health of the country, impacting crucial variables such as inflation, investment, and trade balances (Anyanwu, 2017).

Throughout its history, Nigeria has grappled with exchange rate volatility influenced by factors like monetary policies, fiscal decisions, external trade dynamics, and global geopolitical events. Responding to economic exigencies, the Central Bank of Nigeria has adopted various exchange rate regimes, fluctuating between fixed, managed floating, and recently, a flexible exchange rate

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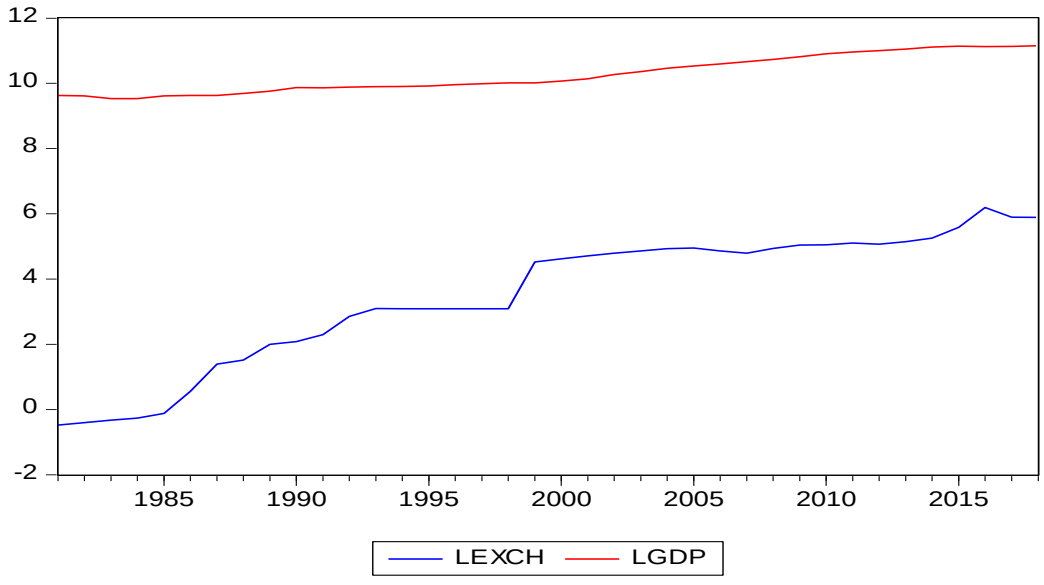
system (Adeniran, 2014). This policy dynamism reflects the intricate task of balancing external competitiveness, inflation control, and economic growth. The choice of exchange rate regime is pivotal, dictating the degree of flexibility and the extent of central bank interventions in the foreign exchange market, with Nigeria opting for a managed floating system, allowing the Naira to fluctuate within a defined range (Terhemba, 2017).

A stable and competitive exchange rate is crucial for fostering investor confidence, both domestically and internationally, as foreign direct investment (FDI) plays a critical role in economic growth by infusing capital and expertise. Anticipating future exchange rates accurately is essential for investors considering long-term commitments in Nigeria, making an environment characterised by exchange rate stability a catalyst for sustained economic expansion (Alabi, 2019). Moreover, exchange rates significantly influence the country's trade balance, intimately linking Nigeria's import and export dynamics to the value of the Naira. The intricate relationship between exchange rates and economic growth is a multifaceted phenomenon influenced by a myriad of factors within specific national contexts, underscoring the critical area of study in shaping the trajectory of economic development, particularly in developing nations post-World War II (Cizmović, 2021).

Schumpeter's endogenous growth model, emphasising the intrinsic connection between economic progress and societal advancement within financial markets, is central to understanding the intricate relationship between exchange rate fluctuations and economic growth (Umaru, 2018; Zhang, 2012). The role of financial intermediaries within growth models is pivotal, enabling the implementation of innovative financial tools and strategies that synergistically contribute to fostering sustained, long-term economic growth. This complex interplay sets the stage for a comprehensive examination of the multifaceted relationship between exchange rates and economic growth in Nigeria, exploring the nuances within its unique national context.

Figure 1 provides a comprehensive overview of Nigeria's exchange rate patterns along with the corresponding GDP per capita growth rates spanning the years 1981 to 2019. This graphical representation notably illuminates a discernible causal relationship between the movements in exchange rates and the trajectories of economic growth, underscoring their interdependence within the Nigerian context.

Figure 1. Fluctuations in Nigeria's exchange rate and GDP per capita growth rate (1981-2019).



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The observed consistent upward trajectory of the exchange rate, indicating positive trends, despite fluctuations in GDP per capita with both positive and negative values over the specified period, aligns with findings in economies characterised by well-developed financial markets. This phenomenon suggests that in such economies, the influence of exchange rate fluctuations on economic growth tends to be somewhat subdued. This pattern is in line with the research conducted by (Ehikioya, 2019; Ufoeze, 2018; Oloyede, 2018; Tien, 2022), which collectively assert that well-established financial markets play a moderating role in the relationship between exchange rates and economic growth. In contrast, in regions with less mature financial markets, the impacts of exchange rate fluctuations are more noticeable, often leading to a significant suppressive influence on the overall paths of economic growth. This nuanced comprehension underscores the critical significance of financial market advancement in mitigating the potentially unfavourable consequences of exchange rate changes on economic growth. This, in turn, enhances economic resilience and stability.

The studies by (Ehikioya, 2019; Ufoeze, 2018; Oloyede, 2018; Tien, 2022), contribute valuable insights into how the maturity of financial markets can shape the dynamics between exchange rates and economic growth. In economies with well-developed financial markets, the impact of exchange rate fluctuations appears to be less pronounced, highlighting the mitigating role of financial market maturity. This nuanced understanding emphasises the importance of financial market development in influencing the relationship between exchange rates and economic growth, providing a context-specific perspective that is crucial to understanding the economic landscape, particularly in the case of Nigeria.

Adding depth to this exploration, Ufoeze (2018) emphasised the moderating influence of financial market maturity on the nexus between exchange rates and economic growth. Their research likely investigates how mature financial markets mitigate or amplify the effects of exchange rate fluctuations, contributing a sophisticated dimension to understanding the challenges faced by Nigeria in maintaining economic stability. Furthermore, (Tien, 2022) extends this historical narrative by offering an in-depth analysis of factors influencing exchange rate fluctuations and corresponding policy responses. This comprehensive background sets the stage for the current study, which aims to further explore the multifaceted relationship between exchange rates and economic growth in Nigeria, armed with a rich contextual backdrop.

The anticipated novelty of this study lies in its concerted effort to emphasise the crucial role of exchange rate stability in nurturing enduring economic growth. Building on the findings of (Ehikioya, 2019; Ufoeze, 2018; Tien, 2022), the study seeks to provide fresh insights into the importance of exchange rate stability as a foundational element for crafting effective economic policies that foster long-term growth. The uniqueness of this study is underscored by its potential to offer a more comprehensive and nuanced understanding of how fluctuations in exchange rates can impact economic growth in the immediate context.

Furthermore, the utilisation of the Autoregressive Distributed Lag (ARDL) Model is anticipated to bring an additional layer of novelty. By employing this advanced analytical framework, the research aims to uncover the intricate short-term connections between exchange rates and economic growth, moving beyond traditional analyses that predominantly focus on long-term trends. The anticipation is that the ARDL Model will unveil previously unexplored dynamics, contributing to the evolving body of knowledge surrounding the interplay between exchange rates and economic growth. This approach represents an evolution in the exploration of their relationship, enriching the existing literature, and providing valuable insights for future research and policymaking.

The overarching purpose of this study is to conduct a thorough examination of the impact of exchange rate fluctuations on economic growth in Nigeria. With a specific focus on key variables such as inflation rate and real interest rate, the research aims to delve into the intricate dynamics

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that characterise the correlation between exchange rates and economic growth. The chosen analytical approach, the Autoregressive Distributed Lag (ARDL) Model, is designed to offer a nuanced understanding of the short-term connections between these variables, contributing to the refinement of existing knowledge on their complex interplay.

The study's purpose extends beyond mere observation, seeking to uncover specific patterns and relationships that can inform policymakers and economists about the dynamics of Nigeria's economic landscape. In addition to assessing the relationship between exchange rates and economic growth, the research aims to provide targeted policy recommendations and interventions. Recognising the importance of exchange rate stability for sustained economic development, the study endeavours to propose actionable strategies that can contribute to achieving this stability. Moreover, the research acknowledges the susceptibility of Nigeria's economy to external shocks, particularly volatile global oil prices. In response to this vulnerability, the study proposes measures aimed at diversifying the economy and reducing its dependence on oil exports, fostering a more resilient and stable economic environment. In essence, the study's purpose is multifaceted, aiming to bridge knowledge gaps, guide policy decisions, and play a role in shaping the stability and prosperity of Nigeria's economy on both local and global scales.

2. RESEARCH METHODOLOGY

2.1 Theoretical Perspectives on Exchange Rate and Economic Growth

The Mundell-Fleming Model, introduced by economist Robert Mundell in 1963, underscores the critical role of exchange rate stability in fostering economic growth. It emphasises that unpredictable exchange rates can create uncertainties for businesses and investors, potentially leading to hesitancy in making long-term commitments. This, in turn, can lead to a slowdown in economic activity. Therefore, maintaining a stable exchange rate environment is pivotal for creating an atmosphere conducive to sustained economic growth (Mundell, 1963).

The Balassa-Samuelson Hypothesis, formulated by economists Bela Balassa and Paul Samuelson in 1964, offers a key insight into how productivity disparities between different sectors can significantly influence exchange rates. In the context of Nigeria, a country heavily reliant on oil exports, understanding how changes in productivity levels, especially in the oil sector, impact exchange rates are of paramount importance. The dynamics of productivity in this sector can have far-reaching effects on the country's overall exchange rate dynamics and consequently its economic performance (Balassa, 1964; Samuelson, 1964).

The Optimal Currency Area (OCA) theory, initially developed by Robert Mundell in 1961 and further elaborated by Ronald McKinnon in 1963, plays a crucial role in shaping the discourse around exchange rate policies. This theory primarily focuses on trade and the stabilisation of business cycles within an economic region. It hinges on concepts such as shock symmetry, the level of openness in an economy, and the mobility of labour. Although it provides a foundation for understanding the choice of exchange rate regimes, it has faced criticism for its inability to offer a definitive recommendation for the most suitable regime. Nevertheless, it remains a foundational concept for understanding exchange rate policies, particularly in Nigeria's economic landscape (Mundell, 1961; McKinnon, 1963).

The choice of exchange rate regime is a crucial decision for any economy, including Nigeria. A fixed exchange rate system, for instance, can yield positive effects by enhancing trade and economic growth. It achieves this by reducing exchange rate uncertainty, subsequently lowering the costs associated with hedging, and by promoting investment through reduced currency premium due to lower interest rates. However, it can also have negative consequences by impeding trade and economic growth, potentially hindering the necessary adjustment of relative prices, which may lead to disruptions. Striking the right balance between flexibility and stability is essential to ensure that

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the chosen exchange rate regime aligns with Nigeria's economic objectives and external circumstances (Calvo, 2002).

Subsequent theoretical developments focused on the stabilisation of financial markets, particularly in relation to speculative financial behaviours in emerging economies. These theories argue that a fixed exchange rate system can support both trade and economic growth by providing a reliable nominal reference point and strengthening the credibility of monetary policies. This approach helps to avoid competitive devaluation and promotes the development of financial markets. However, these theories also caution that a fixed regime may hinder the necessary adjustments in relative prices and potentially expose the economy to speculative attacks. This dynamic is particularly relevant for many emerging economies, where concerns about exchange rate stability and the associated risks play a significant role in policy decisions. Understanding the delicate interplay between financial market stabilisation and exchange rate regimes is crucial for crafting effective economic policies in Nigeria and other emerging economies (Edwards, 2002; Frankel, 2003).

These theoretical frameworks provide a structured way to analyse the relationship between exchange rates and economic growth in Nigeria. By applying these models and theories to empirical data, researchers can gain deeper insight into the specific mechanisms at play in the Nigerian context. It is important to note that each framework comes with its assumptions and limitations, and their applicability may vary depending on the specific economic conditions and policy contexts in Nigeria.

2.2 Model Specification

Regarding the model specification in this study, it draws from the theoretical framework, especially referencing the work conducted by (Ehikioya, 2019). The study aims to establish a connection between the exchange rate and economic growth in Nigeria based on the conclusions derived from this theoretical foundation;

$$EXC = f(inf, int, imp, exp, rgdp) \dots\dots\dots\dots\dots\dots\dots\dots (1)$$

This was further conveyed in econometric terms below, involving the application of logarithmic transformations to some of the variables:

$$lEXC = \delta_0 + \delta_1 int_t + \delta_2 inf_t + \delta_3 imp_t + \delta_4 exp_t + \delta_5 rgdp_t + U_t) \dots\dots\dots\dots\dots\dots\dots (2)$$

Where:
Lexc = log of Exchange Rate
int = Real Interest Rate
inf = Inflation Rate
Limp = Log of Total Import
Lexp = Log of Total Export
rgdp = Real GDP per capita growth, which serves as an indicator for economic growth.
u = stochastic error term

The parameters that require estimation are as follows: δ0, δ1, δ2, δ3, δ4, δ5, and δ6

Most of the data used in this research was obtained from the Central Bank of Nigeria Bulletin (CBN, 2019; mundi, 2018). In this study, the Ordinary Least Square (OLS) estimation technique was employed. The choice of OLS was made to facilitate the analysis of the relationship between the independent variables and the endogenous variable, Lexc.

To ensure the robustness of the analysis, a Unit Root Test using the Augmented Dickey Fuller (ADF) test was conducted on the dataset. This test was carried out to identify the presence of a unit root, the existence of which could potentially invalidate the results of the regression, as highlighted by Granger and Newbold in 1974. Additionally, the unit root test helped determine the order of

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integration of the variables, which is essential for confirming the long-term relationship among them through the Johansen cointegration test.

2.3 Hypotheses development

The influence of real interest rate on the exchange rate

The real interest rate significantly shapes the exchange rates in international finance. Higher real interest rates attract foreign investors, increasing demand for the associated currency and leading to appreciation. This relationship is key for understanding capital flows, carry trade dynamics, and overall market sentiment. Central bank policies and inflation expectations further contribute to the nuanced interplay between real interest rates and exchange rates. A country's economic health and risk perception are integral factors in this intricate relationship.

(H_1) Changes in the real interest rate significantly affect the exchange rate in Nigeria.

The influence of Inflation rate on the exchange rate

The relationship between the inflation rate and the exchange rate is a complex and multifaceted aspect of macroeconomic dynamics. Inflation rate, which represents the rate at which the general price level of goods and services in an economy rises, can have a profound impact on a country's exchange rate, the value of its currency relative to other currencies.

(H_2): Inflation rate changes significantly influence the exchange rate in Nigeria.

The influence of total import on the exchange rate

The impact of total imports on exchange rates is a critical aspect of a country's economic dynamics. The exchange rate, which represents the value of a country's currency in relation to other currencies, can be influenced by various factors related to the total import levels.

(H_3): The total import has a significant impact on the exchange rate in Nigeria.

The influence of total export on the exchange rate

The influence of total exports on the exchange rate is a dynamic interplay of economic, financial, and external factors. Successful export performance is generally associated with a stronger currency, but the impact is also contingent on various contextual factors and global economic conditions. Observing and understanding these dynamics is essential for policymakers, businesses, and investors in navigating the complexities of international trade and finance.

(H_4): The total export significantly affects the exchange rate in Nigeria.

The influence of Economic Growth on the exchange rate

Economic growth profoundly influences exchange rates in international finance, shaping the value of a country's currency. A robust economy often leads to higher interest rates, attracting foreign investors, and strengthening the exchange rate. Additionally, growing economies may experience trade surpluses, further enhancing their currency's value. Overall, the dynamic relationship between economic growth and exchange rates is pivotal in the global financial landscape.

(H_5) Changes in real GDP per capita growth significantly contribute to variations in the exchange rate in Nigeria.

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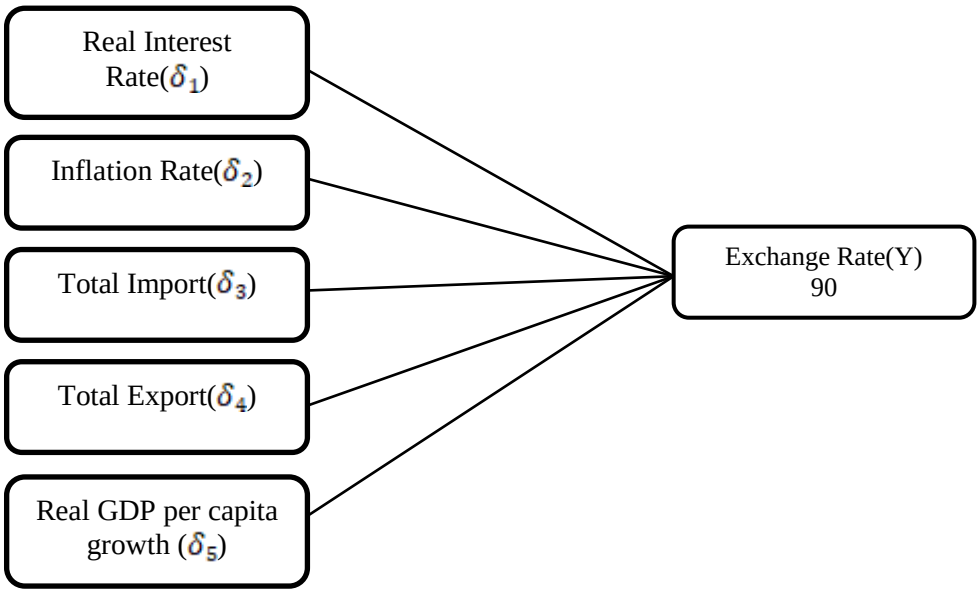

Source: authors' compilation (2022)

3. RESULTS AND DISCUSSION

A prerequisite for the existence of cointegration is the confirmation that the variables involved are integrated at the same order, a determination made through the results of unit root tests. The study utilised the Bound Cointegration test to assess whether there is a sustained equilibrium relationship between the exchange rate and the independent variables in the long run. This test assists in deciding whether to employ an Autoregressive Distributed Lag (ARDL) or Error Correction Model (ECM) in the analysis.

Results Stationarity Test

Table 1. Augmented Dickey-Fuller (ADF) unit Root Test Results

Series	t- Value	Significant level	Remarks
LGDP	-3.395053	0.0177	I(1)
Inf	-3.351635	0.0195	I(0)
Lexc	-5.363257	0.0001	I(1)
LEXP	-6.284128	0.0000	I(1)
Limp	-6.880942	0.0000	I(1)
Lrint	-2.968579	0.0481	I(0)

Source: Authors' computation, 2022 * Stationary at level.

The results of the stationarity test, as displayed in Table 1, reveal that certain variables, such as the inflation rate and the real interest rate, demonstrate stationarity, whereas others exhibit stationarity only after differencing. This observation is supported by the fact that the Augmented Dickey-Fuller (ADF) test statistics for some variables in Table 1 are lower than the critical ADF value at the 99% confidence level. This suggests that when considered in their original form (at the level), the series include a mix of both non-stationary and stationary components. As a result, we proceeded to take the first difference of all the series to confirm stationarity. Table 1 also indicates that, after differencing, some variables are stationary and integrated of the same order I (1), while others are I (0).

Bound Test of Cointegration

The Bounds test is a more suitable method for assessing cointegration among time series variables when they are integrated at different levels. According to (Wong, 2018; Pesaran, 2001), this could

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involve a combination of I(0) and I(1) variables. The test was conducted using the level log-transformed series.

Table 2 presents the results, indicating that the calculated F-statistic (1.92) is lower than the F-critical values at the 1%, 5%, and 10% significance levels. Consequently, the findings support the acceptance of the null hypothesis, suggesting that there is no long-term relationship between the variables. This implies that there is no cointegration among the series in the model, leading to the estimation of an Autoregressive Distributed Lag Model (ARDL).

Table 2. Bound Test

Test Statistic	Value	K
F-statistic	1.921909	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: computed using E-views 9 (2022)

Table 3: Selected Model: ARDL (1, 1, 0, 1, 1, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LEXCH(-1)	0.654810	0.136475	4.798027	0.0001***
LINFL	-0.072357	0.084432	-0.856981	0.3990
LINFL(-1)	-0.243785	0.079975	-3.048256	0.0051***
LRINT	1.012373	0.296553	3.413795	0.0020***
LIMP	-0.167480	0.230453	-0.726744	0.4736
LIMP(-1)	0.450791	0.203361	2.216703	0.0353**
LEXP	0.359245	0.201028	1.787042	0.0852*
LEXP(-1)	-0.521753	0.189640	-2.751282	0.0105*
LGDP	0.287064	0.264713	1.084434	0.2878
C	-4.381001	2.945394	-1.487407	0.1485

R-squared	0.987120	Mean dependent var	3.576664
Adjusted R-squared	0.982827	S.D. dependent var	1.949447
S.E. of regression	0.255466	Akaike info criterion	0.334003
Sum squared resid	1.762095	Schwarz criterion	0.769386
Log likelihood	3.820945	Hannan-Quinn criter.	0.487496
F-statistic	229.9256	Durbin-Watson stat	2.328883
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

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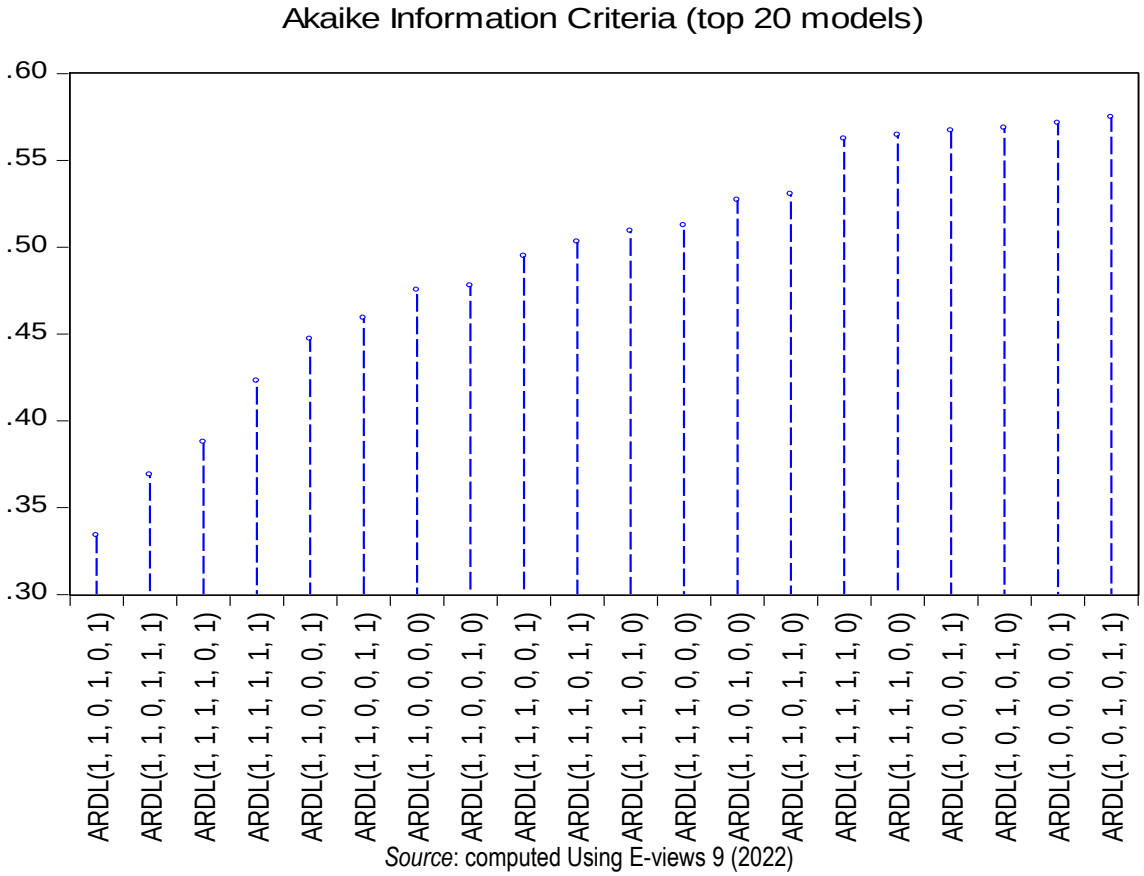

Source: computed Using E-views 9 (2022)

Table 3 presents an analysis of the relationships between various factors and the exchange rate in Nigeria.

Table 3 shows that GDP per capital growth (economic growth), interest rate, and total export are positively related to the exchange rate in Nigeria. This signifies that a 1% increase in exchange rates leads to 28% upsurge in Nigeria's exchange rate, so also a 1% surge in interest rate, and total export contributes 101% and 35.92% rise in LEXCH. However, inflation (INF) and total imports have a negative relationship with exchange rates. A 1% upward movement indicates a 7% reduction in Exchange rates in Nigeria, a 1% increment in total import motivates a 16% hike in LEXCH. Furthermore, the R-squared displayed 98% as variations in LEXC that were accounted for by the included explanatory variables with a goodness of fit shown by Adjusted R2 (98.2%). F-statistics (229.9) with corresponding Prob(F-statistics) of 0.00000 demonstrates the overall significance of all the regressors.

3.2 Discussion

Positive Relationships with GDP per Capita Growth, Interest Rate, and Total Exports:

The study underscores a positive link between exchange rates and crucial economic indicators in Nigeria. A noteworthy finding reveals that a 1% surge in exchange rates corresponds to a substantial increase in Nigeria's overall exchange rate. This corroborates the research conducted by (Ehikioya, 2019; Tien, 2022), providing consistent evidence that GDP per capita growth, higher interest rates, and increased total exports collectively contribute significantly to an upward shift in exchange rates. These positive associations highlight the pivotal role of economic growth, interest rate policies, and export dynamics in shaping Nigeria's exchange rate. Policymakers, businesses, and investors can draw valuable insights from these relationships to navigate the complexities of the Nigerian economic landscape effectively.

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Negative Relationships with Inflation and Total Imports:

Contrastingly, the study illuminates substantial negative correlations between exchange rates and inflation (INF), as well as total imports. A 1% uptick in inflation is linked to a considerable decrease in exchange rates, signalling potential challenges associated with reduced purchasing power. Furthermore, a 1% increase in total imports triggers a significant increase in the exchange rate. These findings align with the conclusions of (Offiong, 2020; Oseni, 2019), underlining the pivotal roles of inflation and total imports in exerting a restraining influence on exchange rates. Policymakers and stakeholders should consider these relationships, as they carry implications for managing inflationary pressures and balancing trade dynamics to maintain exchange rate stability.

Model Significance:

The robustness of the model is evident through a high R-squared value of 98%, indicating that a substantial proportion of the variability in exchange rates (LEXC) can be explained by the integrated explanatory variables. The Adjusted R-squared, standing at 98.2%, further attests to the model's superior goodness of fit. Importantly, the F-statistics, registering at 229.9, coupled with an exceptionally low Prob(F-statistics) of 0.00000, affirm the collective significance of all regressors in the model. These findings echo the insights of (Edwards, 1998; Razafimahefa, 2012), emphasising the critical role of incorporating pertinent economic indicators when scrutinising exchange rate dynamics and economic growth. The model's robustness positions it as a valuable tool for policymakers and researchers alike, facilitating a nuanced understanding of Nigeria's economic complexities and aiding in the formulation of informed strategies for sustainable economic development.

4. CONCLUSIONS

This comprehensive study, conducted from 1981 to 2019, aimed to delve deeply into the intricate relationship between exchange rates and economic growth in Nigeria. Employing OLS regression, the objective was to unravel the various factors shaping the fluctuations in exchange rates over the specified period.

The study's rigorous analysis yielded a compelling finding that more than 98% of the variations in exchange rates could be accounted for by the included variables. This not only highlighted the robustness of the model, but also emphasised the absence of a long-term equilibrium relationship within the studied timeframe.

The empirical findings brought to light a positive association between GDP per capita growth, interest rates, and total exports with exchange rates. Conversely, inflation and total imports exhibited a negative relationship, signalling that these factors play pivotal roles in influencing currency values. The study underscored the vital importance of exchange rate stability to promote sustainable economic growth. It emphasised the need for well-crafted policies to navigate the complexities of the global economic landscape, particularly in mitigating uncertainties associated with exchange rate dynamics.

The recommendations emanating from this study have significant implications for future research and policymaking. They include a call to prioritise exchange rate stability as a key strategy for attracting investments and creating a more predictable business environment. Implementing strategies for balanced economic growth, effective management of inflation rates, optimising import policies, and emphasising research and collaboration were also highlighted as crucial components of a comprehensive approach to achieving long-term economic stability.

In essence, these suggestions provide a nuanced roadmap for future studies in Nigeria, offering a guide for policymakers, economists, and financial experts to navigate the challenges and opportunities in the realm of exchange rates and economic growth. By heeding these insights,

Nigeria has the potential to not only spur enduring economic development, but also to establish a foundation for sustained prosperity.

AUTHORS CONTRIBUTIONS

The author/authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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