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External Debt Accumulation and Poverty Rate in Nigeria: An Error Correction Approach

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Abstract: Owing to the increasing debt-to-GDP ratio and the attendant high multidimensional poverty in Nigeria, this study set out to examine the role of external debt on poverty alleviation in Nigeria. The model constructed for the study proxies final consumption expenditure as the endogenous variable, with the poverty rate determined by external debt and external debt service. Annual time series data were gathered from the World Bank's World Development Indicator (WDI) from 1981 to 2021. The econometric techniques of the Autoregressive Distributed Lag (ARDL) model, the Augmented Dickey-Fuller (ADF) Unit Root test, the Bounds Co-integration test, and the Error Correction Model (ECM) were employed in the empirical analysis. The co-integration test shows that a long-run equilibrium relationship exists among the variables. The long-run results show that external debt has a significant positive impact on the poverty rate in Nigeria. The study offers policy recommendations based on its findings.
Keywords: External debt; poverty rate; ARDL; ECM; Nigeria

1. Introduction:

The study of poverty has been a topic of interest for many years and has been a subject of research and policy discussions globally. Poverty is a complex phenomenon affecting individuals, families, and entire communities, with significant economic, social, and political implications. Extreme poverty poses a danger to a nation's human capital and security worldwide. The idea of poverty has evolved throughout the history of economic theory, with many periods of transformation beginning in the 18th century, according to (Ogwumike). With the end of the colonial era and heightened awareness of the causes of poverty in developing countries, the second phase in the formation of the term 'poverty' began. The anti-poverty strategies developed in Europe during the 19th and 20th centuries were deliberately transferred from the North to the South during the post-colonial period. One of the most challenging issues confronting many governments, particularly developing ones, is the difficulty of containing persistently high poverty rates. Every year on October 17, people celebrate the "International Year of Poverty Eradication," which raises awareness of poverty worldwide. As the first of its eight Millennium Development Goals, the UN set poverty reduction as a global challenge to be accomplished by 2015. It should come as no surprise that the number of people living in poverty has decreased significantly across the majority of the world's extreme poverty-level countries, from 43% in 1990 to 21% in 2010, in just 20 years. For instance, the rate decreased in China, where 77% of the population—about 800 million people—lived on less than $1 per day in 1980. By 2008, the rate had significantly decreased to 14%. India, a country with a sizable population and a high poverty rate, has likewise seen significant declines in poverty.

Despite the enormous progress, inequality and poverty remain significant global challenges. Only 5% of global revenue is still generated by the bottom 40% of the population (Unctad). The picture of poverty in Sub-Saharan Africa is considerably more striking, with a rate of 77% (UNCTAD, 2021)—possibly the only place in the world where this rate is rising. Nigeria, the country with the largest black population worldwide, played a role in this phenomenon. Ogwunike (2001) claims that poverty in Nigeria has been rising steadily. Based on the authors' statistics, it increased from 27% to 46% between 1980 and 1985, then to 67% in 1996, and finally to over 70% by 1999. The northeast and northwest of Nigeria are home to the majority of the country's poorest states, including Gombe, Sokoto, Yobe, Katsina, Jigawa, Zamfara, Borno, Niger, Taraba, and Adamawa, according to the 2021 Human Development Index (Central Bank of Nigeria). According to the executive summary, only 18.04% of

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Nigeria's urban residents are considered to be poor, compared to 52.1% of the country's rural residents. The Nigeria Bureau of Statistics executive summary (2020) states that on average, 4 out of 10 Nigerians spend less than N137,430 ($376.5) per day in actual per capita income expenditures. The World Poverty Clock Report (2021) states that Nigeria's growing population will pose problems now and in 2030 and 2050. According to their analysis, 90 individuals must escape poverty every minute to end it worldwide. According to the World Poverty Clock Report of 2021, 57 individuals in Africa and at least 12 in Nigeria must be pulled out of poverty every minute.

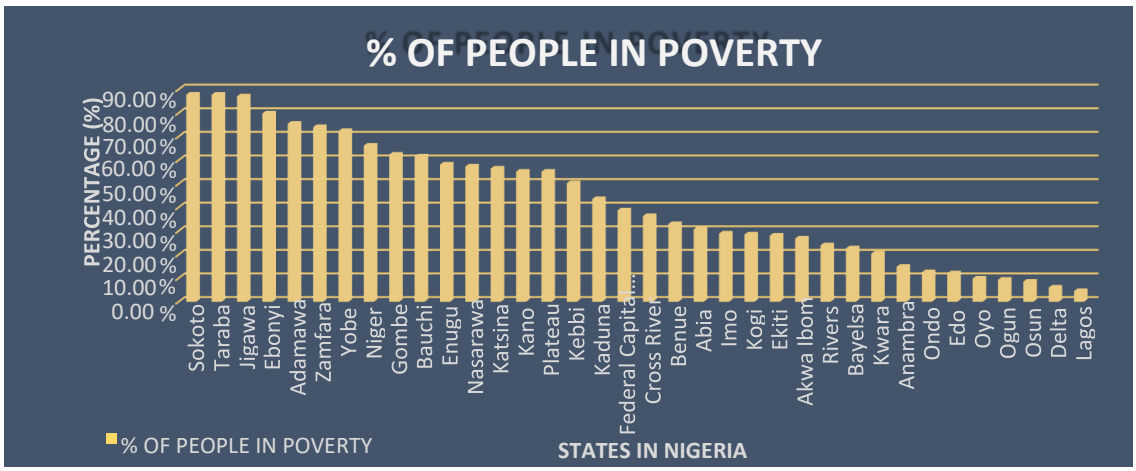

Figure 1: Bar Charts Showing Poverty Rates in Different Nigerian States
Source: Authors, using data from CBN, 2021

The contrary has been true since Nigeria's outplay. In Nigeria, seven individuals fall into extreme poverty on average every minute (National Bureau of Statistics). Nigeria's unfavorable condition stems from the fact that its population is growing faster than its GDP. Nigeria's population rose by 81% between 1990 and 2013, and if the aforementioned trend continues, it will rank third in the world by 2050 (World Poverty). Many factors increase the poverty rate, and external debt has been identified as one of those factors that can impact poverty rates globally. However, the link between external debt and poverty is complex and varies across contexts and circumstances. External debt is the total amount a country owes to foreign creditors. The concept of external debt has existed for centuries, as countries have borrowed from one another for various reasons. However, it was not until the 20th century that the study of external debt became more formalized, as more and more countries borrowed heavily from foreign lenders. In the 1970s, there was a significant increase in external debt among developing countries, as many borrowed to finance large-scale development projects. However, in the 1980s, a debt crisis emerged, as many developing countries were unable to meet their debt obligations, leading to widespread economic instability and hardship. Since then, the study of external debt has become even more important, as countries continue to borrow money from foreign lenders, and the global economy becomes increasingly interconnected (Macro).

Nigeria's economy is recognised as heavily indebted to foreign countries, and this debt is only worsening (United). This has stymied several attempts at sustained economic growth using a variety of policies and programmes. The 1970s oil crisis marked the nation's mounting external debt, which first emerged. The economy developed a relatively unhealthy and long-lasting habit of debt as a result of spikes in oil prices and overreliance on imports during that period. Prior to this, Nigeria had a few minor debts from the Italian government, as a Paris Club debtor nation in 1964, with a loan of US$13.1 million for the construction of the Niger dam, and from the World Bank in 1958, with a credit of US$28 million for the construction of railroads. The first significant loan made by the International Capital Market (ICM) in 1978 was the $1 billion "Jumbo loan" (Karagöl). In the first three months of 2017, the nation's total public debt rose by 4.52%, according to the Debt Management Office (DMO). The national debt increased from 21.73 trillion ($71 billion) in December 2017 to 22.71 trillion ($74.28 billion) by the end of the first quarter of 2018. From January 2015 to December 2020, Nigeria's external debt profile increased from $9.7 billion to $27 billion. Furthermore, Nairametrics estimates that Nigeria's external debt profile is $33 billion as of 2021 (National Bureau of Statistics).

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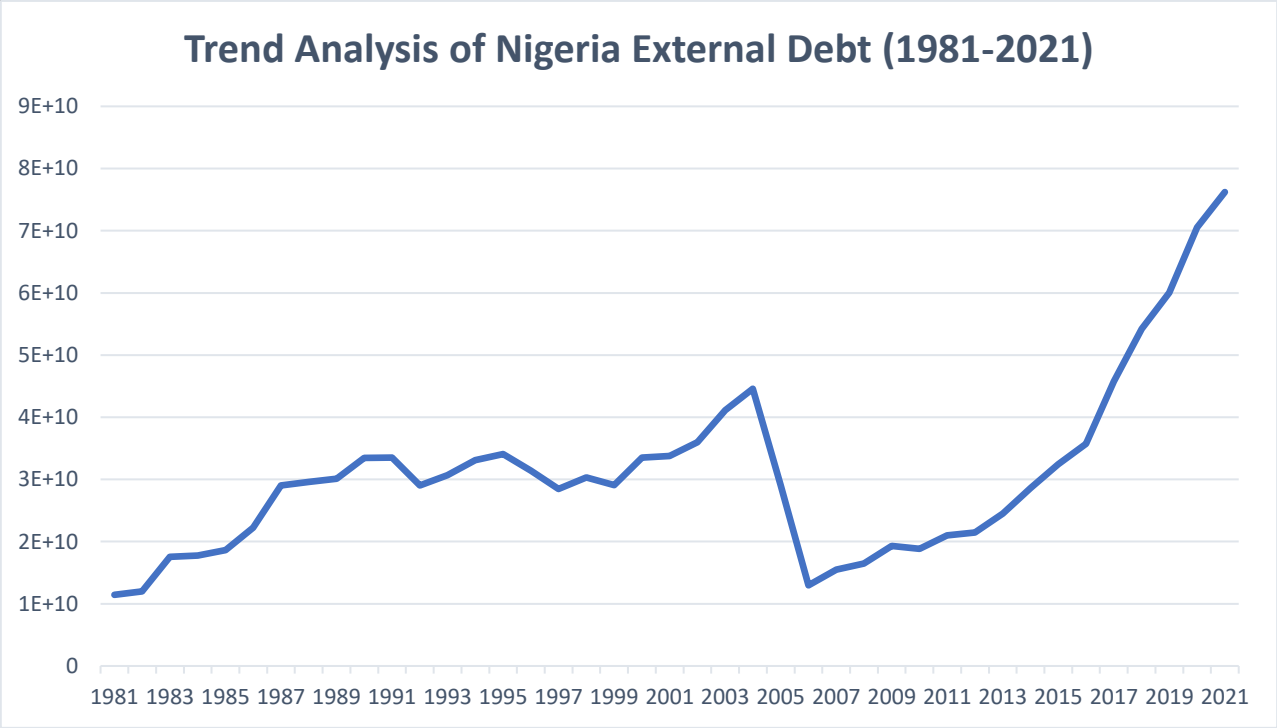

Figure 2: Line Trend Showing Nigeria's External Debt from 1981 to 2021
Source: Authors, using data from WDI (2022)

The graph above shows the trend in Nigeria's external debt. The x-axis represents the years (1981 to 2021) corresponding to its total observations (41), while the trend line shows the external debt. External debt increased at a declining rate from 1981 to 2003, then declined sharply in 2005; it continued to rise steadily up to 2021 (Adesola). In recent years, Nigeria's external debt has continued to rise, with the country borrowing heavily from international lenders to finance its infrastructure projects. As of 2021, Nigeria's external debt stood at over $33 billion, with a debt-to-GDP ratio of 22.5% (NBS, 2020). The effects of external debt on Nigeria have been significant and far-reaching, including debt servicing costs, dependency on foreign creditors, exchange rate instability, and a negative impact on credit rating (Akanbi & Ibrahim).

Nigeria is a country that has struggled with high poverty rates despite its vast natural resources and potential. One factor identified as contributing to this issue is the country's high external debt. Despite this debt burden, poverty rates in Nigeria have remained stubbornly high. Nigeria has one of the highest external debt levels in Africa. In 2020, the country's external debt stock was estimated at $31.98 billion, while in 2021 it was estimated at US$33.46 billion (NBS, 2020). This debt is owed to various creditors, including multilateral organizations such as the World Bank and the African Development Bank, as well as bilateral creditors such as China and the United States (World). The country has had to borrow heavily to finance its budget deficits and to fund various projects and initiatives aimed at promoting economic growth and development. However, despite these efforts, poverty rates in Nigeria have remained high, with the latest estimates indicating that over 40% of the population lives below the poverty line (NBS, 2020). Based on the foregoing, the broad objective of this study is to examine how the accumulation and management of external debt in Nigeria influence the country's poverty rate.

2. Literature Review

2.1 Conceptual Literature

The concept of poverty is complex and multidimensional, with no single, agreed-upon definition and multiple perspectives from scholars and researchers. Poverty is the inability to access opportunities and choices, which violates human dignity, according to the United Nations (Ilo). It indicates a fundamental incapacity to make a significant contribution to society. It means not having enough money to support a family's food and clothing, not having access to healthcare or education, not being able to get loans, and not owning enough property to grow their business. It implies ambiguity, powerlessness, and the isolation of individuals, residences, and

societies. It usually signifies living in a poor or unstable environment without access to sanitary facilities and is a sign of vulnerability to violence. The World Bank (2016) defines poverty as the deprivation of well-being, whether for an individual or a group. It is made up of people whose meager pay keeps them from affording the things they need to survive and prosper. Poverty is defined as having poor health, a low literacy rate, limited access to safe spaces and clean water, inadequate security, and few opportunities to improve one's life. Poverty is the deprivation experienced when one lacks the resources to satisfy even the most basic human needs.

Food, healthcare, housing, education, employment, and participation are only a few of these necessities (Mustapha & Prizzon). According to the income/consumption perspective, someone is considered poor if and only if their income is less than a predetermined threshold, such as $1 or $2 per day (Panizza & Presbitero). However, for this study, poverty is defined as the denial of effective participation in society due to a lack of fundamental human needs, as well as the inability to access facilities or funds to sustain a living standard. On the other hand, a country's total debt to foreign creditors, commonly known as its foreign debt, is augmented by its internal debt, which is owed to domestic lenders. The debt includes money owed to international financial institutions, including the IMF and the World Bank, as well as private commercial banks, foreign governments, and other private parties (Ayadi & Ayadi). Debts result from borrowing and can be local or global in scope.

According to Ayadi and Ayadi (Adesola)External debt is the portion of a nation's debt that originates from international companies, governments, or financial institutions. The country's debt grows alongside the deficit, forcing it to borrow ever-larger sums to stay afloat. The International Monetary Fund defines gross external debt as the sum of disbursed and unpaid contractual obligations of citizens of a nation to citizens of other nations to repay principal, with or without interest, or to pay interest, with or without principal, at any given time. The African Union often refers to foreign debt as a collection of past-due financial obligations. This means that the central government or a public body has contracted the commitments, the central government has guaranteed the commitments, or the private sector has contracted the commitments. Researchers have defined external debt as amounts borrowed by the national economy for periods longer than a year, for which the borrower is required to repay the debt in foreign currency or by selling goods and services (Iyoha). In this study, "external debt" is defined as funds obtained by a nation from foreign lenders, such as commercial banks, governments, or international financial institutions, and often repaid with interest in the same currency as the loan.

2.2 Theoretical Literature

Several models, theorizations, and counter-theorizations have consciously emerged in a bid to address some explanations for the problems of poverty and external debt. The theory of spatial disparities is one such theory. This theory examines poverty from a geographic perspective, highlighting that specific individuals, places, and cultures lack access to opportunities for wealth creation. Examples of this type of poverty include ghetto poverty, southern poverty, urban poverty, and third-world poverty, among others. This theory is related to the economic agglomeration theory, which describes how the localization of businesses and industries attracts additional markets, development, and supportive services, which in turn attract more businesses and industries. In contrast, impoverished communities attract more residents, exacerbating poverty. Community development can be used to combat this kind of poverty in low-income communities, where it is common (Sachs).

Applying this theory to the Nigerian setting, where poverty is widespread across most geographic regions, including slums, rural areas, and areas vulnerable to natural disasters, low levels of economic activity and industry localization lead to high unemployment rates and other poverty-multiplier effects. There is now a significant developmental divide between rural and urban areas, resulting from the government's complete disregard for rural needs in terms of empowering opportunities and basic infrastructure, which has created issues with rural-urban migration. These regions have high poverty rates because successive levels of government have failed to recognize and leverage the potential and resources there to improve the well-being of residents. Therefore, despite Nigeria's abundant resources, those living in underprivileged areas continue to live in substandard conditions, suffer from poverty, and have little possibility to escape it.

Conversely, the neoclassical growth theory of external debt suggests that external borrowing can have both positive and negative effects on economic growth in developing countries. According to this theory, external debt can be a valuable tool for financing investment and boosting economic growth in the short run. However, it can also lead to negative long-term consequences if not appropriately managed.

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The theory holds that external debt enables developing countries to increase investment in physical and human capital, thereby boosting economic growth and development. This is because external debt can provide developing countries with access to funds that they may not otherwise have, which can be used to finance investment projects such as infrastructure development, education, and healthcare. Moreover, the debt sustainability theory is a key concept in international economics concerned with countries' ability to manage their external debt obligations without defaulting or experiencing significant economic and financial disruptions. The theory suggests that a country's ability to repay its external debt depends on various factors, including its economic performance, policies, and external economic environment.

The main idea behind debt sustainability theory is that a country's external debt should be manageable and not impose an undue burden on the economy or the population. If a country's external debt is too large or unsustainable, it can lead to several negative consequences, including default, financial crises, currency devaluation, inflation, and economic stagnation. Therefore, it is essential to ensure that a country's external debt is sustainable and manageable over the long term (Bracking). One of the key determinants of debt sustainability is a country's overall economic performance. A country with a strong, growing economy is likely to be able to service its external debt obligations more easily than one with a weak or stagnant economy. Economic growth generates income and tax revenue that can be used to service debt, and it also increases a country's ability to borrow in the future if necessary. Conversely, if a country's economy is in a recession or experiencing slow growth, it may struggle to meet its debt obligations. Omotoye et al. (Ijirshar & Godoo) assert that to assess a country's external debt sustainability, economists use a variety of measures and indicators. One standard measure is the debt-to-GDP ratio, which compares a country's external debt to its overall economic output. A high debt-to-GDP ratio may indicate that a country is taking on too much debt relative to its economic performance, raising concerns about debt sustainability. Other measures may include the debt service-to-revenue ratio, which compares a country's debt service payments to its tax revenue, or the external debt-to-exports ratio, which compares a country's external debt to its export earnings.

2.3 Empirical Literature

The nexus between poverty and external debt has generated diverse arguments over the years. A controversial issue concerns the effect of poverty on a nation's external debt: does it increase or decrease? One of the earliest studies examining the effect of external debt on poverty reported a negative relationship between foreign debt and poverty, indicating that higher external debt levels are associated with higher poverty rates (Omotoye & Eseonu, 2006). Similarly, panel data studies found that countries with lower human capital were more affected by external debt, leading to greater poverty (Omotoye & Eseonu). Other research indicates that external debt can negatively affect economic growth, thereby hindering poverty reduction efforts (Hameed & Chaudhary, 2008). In particular, reductions in the stock of expected external debt have been shown to directly boost per capita income and indirectly promote growth through increased public investment (Panizza & Presbitero). Debt relief programs have also been found to contribute to poverty reduction in African nations (Panizza & Presbitero).In Asia, studies using quantile regression and panel ARDL models demonstrated that external debt exhibits decreasing returns, meaning that beyond a certain point, it negatively affects the standard of living, while modest and efficiently managed debt can be beneficial (Karagöl, 2002).

Similarly, studies in Nigeria reveal a complex relationship between external debt, debt service payments, and poverty reduction. While domestic debt and debt servicing are inversely related to poverty reduction, external debt has a positive, significant effect on poverty alleviation (Fasoranti & Adebayo, 2016). Empirical findings suggest that government debt and poverty reduction in Nigeria are positively correlated when external borrowing is effectively utilized.Broadly, although findings vary, most studies suggest that external debt significantly affects poverty in Nigeria, with some reporting negative effects and others reporting positive ones. Key factors influencing poverty reduction include economic growth, government expenditure, education, and health. However, few domestic studies have simultaneously examined poverty responses to external debt within Nigeria's socio-economic context, leaving a gap in the literature. Consequently, further investigation is necessary to clarify these relationships. Previous studies have largely used proxies for external debt, such as external debt stock and service (Akpan & Udoka, 2019 4). While gross domestic product per capita has often been used as a proxy for poverty, this study uses final consumption expenditure (% of GDP) to measure poverty rates, following the Nigeria Bureau of Statistics (2019), as consumption expenditures more accurately reflect

household welfare. Moreover, prior research has often omitted key control variables, such as GDP, per capita income, and the exchange rate, thereby creating measurement limitations. Therefore, this study aims to estimate the impact of external debt on poverty rates in Nigeria while addressing these gaps, including investigating the long-term dynamic relationship between these variables.

3. Methodology

3.1 Theoretical Framework

This empirical study is hinged on the principle of debt sustainability theory. The theory suggests that a country's ability to repay its external debt depends on various factors, including its economic performance, policies, and external economic environment. The main idea behind debt sustainability theory is that a country's external debt should be manageable and not impose an undue burden on the economy or the population. Suppose a country's external debt is too large or unsustainable. In that case, it can lead to several negative consequences, including default, financial crises, currency devaluation, inflation, economic stagnation, and most importantly, poverty. Therefore, it is essential to ensure that a country's external debt is sustainable and manageable over the long term. Insight into this theory, we can specify the model below:

$$P = f(EXTD, GDP, \psi) \quad (1)$$

Where;
P = poverty
EXTD = external debt
GDP = real gross domestic product to measure economic growth
Ψ= for other factors that affect poverty, such as interest rate and exchange rate, that will be included in the model. The selection of control variables is informed by the extant literature.

3.2 Model Specification

Occam's theory holds that a model should be specified parsimoniously to avoid specification bias or specification error. To this end, this study, in line with Gujarati's (Ghura & Grennes) model specification, will appropriately specify the models in accordance with the study's objectives. The models are specified based on three forms as follows:

Specification of Model 1

a) **Functional Form:**

LCEXP = F (LEXTD, LEXTS, LGDP, INT, and LEXCH) (2)

b) **Deterministic form:**

$$LCEXP_t = \alpha 0 + \beta 1 LEXTD_t + \beta 2\, LEXTS_t + \beta 3 LGDP_t + \beta 4 INT_t + \beta 5 LEXCH_t \quad (3)$$

c) **The Econometric Form: Equation (3) is transformed into:**

$$LCEXP_t = \alpha 0 + \beta 1 LEXTD_t + \beta 2 LEXTS_t + \beta 3 LGDP_t + \beta 4 INT_t + \beta 5 LEXCH_t + \mu t \quad (4)$$

Where:

L = Natural logarithm of a particular variable

LCEXP =	Final Consumption Expenditure
LEXTD =	External debt stock
LEXTS =	External debt service
LGDP =	Gross domestic product
INT =	Interest rate
LEXCH =	Exchange rate
$\alpha 0$ =	The intercept.
μt =	The error term
$\beta 1, \ldots \beta 5$ =	The Regression parameters

In Equ. (5), we present the generalized ARDL (p, q) model as:

$$Y_t = \alpha_{0j} + \sum_{i=1}^{p} \psi_{1i} Y_{t-i} + \sum_{i=0}^{q} \psi_{2i} X_{t-i} + \omega_t \quad (5)$$

p =optimum lag length for the predicted parameter.
q =optimum lag length for the predictors

Journal of Social Sciences and Economics
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ARDL Bounds Test Model for Objectives I and II

This model aims to establish whether there is a long-run relationship between the poverty rate and external debt in Nigeria. The model is expressed thus;

$$\Delta LCEXP_t = \alpha_0 + \sum_{i=1}^{p} \phi_i \Delta LCEXP_{t-I} + \sum_{i=0}^{p} \theta_i \Delta LEXTD_{t-I} + \sum_{i=0}^{p} \mu_i \Delta LEXTS_{t-I} + \sum_{i=0}^{p} \Psi_i \Delta LGDP_{t-I} + \sum_{i=0}^{p} \Omega_i \Delta INT_{t-I} + \sum_{i=0}^{p} \varphi_i \Delta LEXCH_{t-I} + \delta_1 LEXTD_{t-1} + \delta_2 LEXTS_{t-1} + \delta_3 LGDP_{t-1} + \delta_4 INT_{t-1} + \delta_5 LEXCH_{t-1} + \varpi_t \quad (6)$$

Where;
Δ = 1st diff. operator.
α1 – α5 = short-run relationship parameters
β1 – β5 = long-run relationship parameters
(t – i) = Lagged term of respective variables
∑ = Sum
ϖi = error term
All other variables are as defined above.
Justification for using the ARDL Model
Because it can analyze co-integrating relationships regardless of the series' integration order and because it uses a single reduced form equation to estimate the model's long- and short-term parameters simultaneously and to allow for variables with different optimal lags—a feature not possible with other methods—the Autoregressive Distributed Lagged (ARDL) estimation technique is widely used (Sachs & Warner). More so, the ARDL belongs to the dynamic model family, which has generally been found to be more robust than static models.

The Model for Granger Causality for Objective III

This model aims to ascertain the causal relationship between the poverty rate and external debt. Since correlation does not imply causation, the model is framed in terms of Clive Granger's causality test of 1969. The Granger's Causality test determines whether a time series is useful in forecasting another. Granger causality exists in any of three major relationships: a) X affects Y = Unidirectional, b) Y affects X = Unidirectional, c) X and Y affect each other = bidirectional.
Hence, Granger causality for two models is specified thus:
a) Functional forms of the models:

$$LCEX \longleftrightarrow LEXT \quad (7)$$

$$LCEXP \longleftrightarrow TEXTS \quad (8)$$

b) The Mathematical or Deterministic forms

Equations (7) and (8) can respectively be rewritten as:

$$LCEXP_t = \alpha_0 + \alpha_i \sum_{i=1}^{m} LCEXP_{t-i} + \beta_j \sum^{n}{}_{j=1} LEXTD_{t-j} \quad (9)$$

$$LEXTDt = \lambda 0 + \lambda j \sum nj{=}1\ LEXTDt{-}j + \sigma i \sum ni{=}1\ LCEXPt{-}i \quad (10)$$

And

$$LCEXPt = \theta 0 + \theta i \sum vi{=}1\ LCEXPt{-}i + \phi j \sum wj{=}1\ LEXTSt{-}j \quad (11)$$

$$LEXTSt = \gamma 0 + \gamma j \sum wj{=}1\ LEXTSt{-}j + ¥i \sum vi{=}1\ LCEXPt{-}i \quad (12)$$

c) The Econometric forms of the models

$$LCEXP_t = \alpha_0 + \alpha_i \sum_{i=1}^{m} LCEXP_{t-i} + \beta_j \sum^{n}{}_{j=1} LEXTD_{t-j} + \mu_{1t} \quad (13)$$

$$LCEXPt = \theta 0 + \theta i \sum vi=1\ LCEXPt-i + \phi j \sum wj =1\ LEXTSt-j + \omega 1t \quad (15)$$

$$LEXTSt = \gamma 0 + \gamma j \sum wj=1\ LEXTSt-j + ¥i \sum vi =1\ LCEXPt-i + \omega 2t \quad (16)$$

Where:

LCEXP, LEXTD, LEXTS = Same as earlier defined.

(t – I and t – j) = Lagged terms on respective variables.

$\sum and\ (\mu_{1t}, \mu_{2t}, \omega_{1t}, \omega_{2t})$ = Summation operator and error terms of respective equations.

m, n, v, and w = Maximum lag lengths

α_0, λ_0, θ_0 and γ_0 = Constant parameters of respective equations

α_i, β_j, λ_j, σ_i, θ_i, ϕ_j, γ_j, and ¥$_i$ = Parameters/Slopes of respective variables.

4. Results

4.1 Descriptive Statistics

Table 1: Descriptive Statistics of the Variables

	CEXP	EXTD	EXTS	GDP	INT	EXCH
Mean	11.27438	10.4511	9.325404	11.12741	2.453578	1.556235
Median	11.26924	10.47165	9.311913	11.02011	4.310292	2.046227
Maximum	11.70243	10.88204	9.944834	11.75905	18.18000	2.554866
Minimum	10.87475	10.05863	8.694972	10.4433	-65.8571	-0.20922
Std. Dev.	0.276921	0.190724	0.301903	0.418936	14.25917	0.865637
Skewness	0.072302	0.02712	0.086953	0.125432	-2.71748	-0.82723
Kurtosis	1.35725	2.951684	2.715145	1.446942	12.91102	2.395806
Jarque-Bera	4.64588	0.009014	0.190283	4.22799	218.2688	5.299708
Probability	0.097985	0.995503	0.909244	0.120755	0.00700	0.070662
Sum	462.2494	428.4949	382.3415	456.2237	18.5967	63.80565
Sum Sq. Dev.	3.067401	1.455028	3.645818	7.020309	8132.955	29.9731
Observations	41	41	41	41	41	41

Source: Authors

A summary of the variables' descriptive statistics used in the models is presented in Table 1. They display the data's dispersion and central tendency measures. The variables are displayed in the table based on their face value. For every variable, there are 41 observations. Except for the interest rate, all variables have mean values larger than their standard deviations, suggesting that more time series data are clustered around the mean. In terms of skewness, LCEXP, LEXTD, LEXTS, and LGDP are all greater than zero (0), which means that they are positively skewed. Also, variables such as INT and LEXCH are negative (0), indicating they are negatively skewed. The Jarque-Bera probability values for LCEXP, LEXTD, LEXTS, LGDP, and LEXCH are greater than a 5% level of significance as well, and their kurtosis value are less than three (3), showing that the error terms of all the variables are normally distributed, while that of INT is not normally distributed because its Jarque-Bera probability values are less than 5%. In the panel above, we can see the movement and fluctuations of each variable used in our study. Goss's domestic product shows, on average, an upward movement, as shown in the table. We can also see that final consumption expenditure, used as a proxy for the poverty rate, is exhibiting jerky movements.

4.2 Pre-Estimation Test Results

4.2.1 Unit Root Test

The unit root test is used to examine the stationarity of the variables and their behavior over time. The test's hypothesis and judgment criteria are listed below.

Journal of Social Sciences and Economics
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https://finessepublishing.com/jsse

Table 2: Unit Root Result

VARIABLE	LEVEL FORM @ 5%			FIRST DIFFERENCE @ 5%			ORDER OF STATIONARITY
	ADF tstatistic	Critical Value	P-Value	ADF t-statistic	Critical Value	P-Value	
LCEXP	-3.3763	-3.5266	0.0690	-6.8251	-3.5298	0.0000	I(1)
LEXTD	-1.4500	-3.5266	0.8300	-4.5993	-3.5300	0.0037	I(1)
LEXTS	-3.2832	-3.5266	0.0837	-8.4262	-3.5398	0.0000	I(1)
LGDP	-1.8872	-3.5442	0.6397	-3.8883	-3.4260	0.0221	I(1)
INT	-7.5881	-3.5266	0.0000				I(0)
LEXCH	-0.9763	-3.5260	0.9361	-5.7058	-3.5300	0.0002	I(1)

Source: Authors

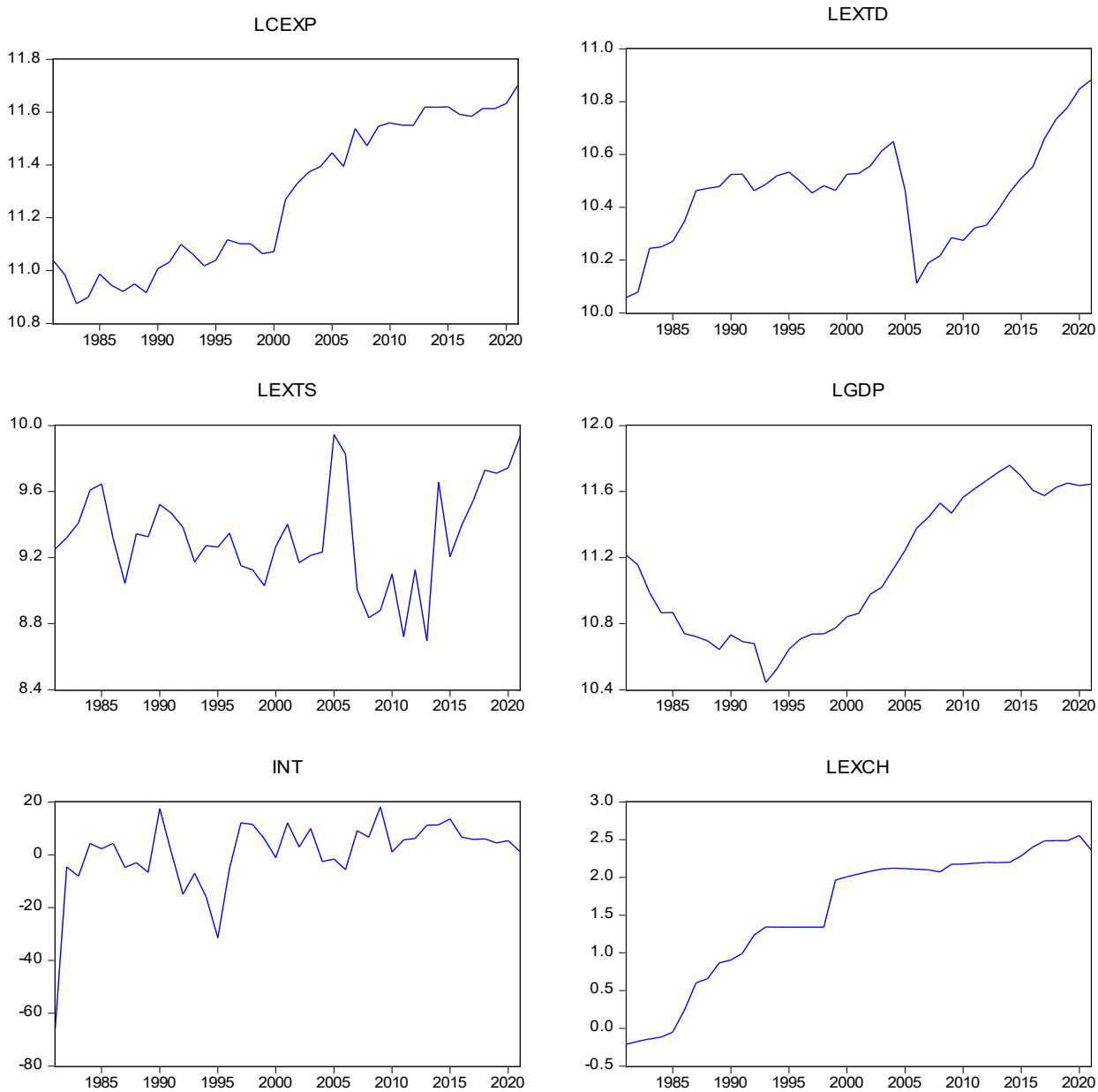

Figure 3: Descriptive Graphs of the Variables
Source: Authors

In Table 2, aside from the interest rate (INT), which is stationary at levels form, other variables became stationary after being differenced once. This possibly suggests co-integration and a dynamic relationship among the variables. According to Pesaran and Shin (Pesaran & Shin), a mix of order of integration is one of the fundamental conditions for employing an ARDL model. Also, in line with Pesaran, Shin, and Smith (Pesaran & Smith), who found that the ARDL is suitable when the order of integration or stationarity is greater than one. Hence, the observation of the order of stationarity in Table 2 meets the requirement upon which this study is conducted.

4.2.2 Optimum Lag-length Selection

As previously stated, the ARDL model requires selecting the maximum lag length for each variable using different selection criteria.

Decision Rule: Choose the lag length that has the least asterisked value among the various information requirements. The model's error is best minimized by the lowest value.

Table 3: Lag-Length Estimation Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	58.70226	NA	0.003401	-2.848771	-2.587541	-2.756675
1	63.56561	7.886512*	0.002765*	-3.05760*	-2.752832*	-2.950155*
2	63.56576	0.000238	0.002925	-3.003555	-2.655248	-2.88076
3	63.90923	0.519839	0.00304	-2.968066	-2.576221	-2.829923
4	63.91045	0.001785	0.003221	-2.914078	-2.478695	-2.760585

Source: Authors

From Table 3, the AIC (Akaike Information Criterion) yields the least asterisked value. It suggests an optimum lag length of 1. Hence, this study uses a maximum lag length of one. The AIC is advantageous over most other criteria in that it enables accurate model selection.

4.2.3 Bounds Test for Co-integration

Gujarati (Ghura & Grennes) states that if two or more variables have an equilibrium or long-term relationship, they are said to be co-integrated. A co-integration test is used to determine whether two or more variables that are not stationary at their level form have a long-term relationship.

Table 4: Bounds Test for Co-Integration Result

T-Statistic	Value	Sig.	I(0)	I(1)	Outcome
F-statistic	4.0693	10%	2.26	3.35	
		5%	2.62	3.79	**Co-Integrated**
		2.50%	2.96	4.18	
		1%	3.41	4.68	

Source: Authors

The Wald test's f-statistic is bigger (>) than the lower and upper critical bounds at the 5% level of significance, as indicated in Table 4. As a result, we reject the null hypothesis and conclude that the variables used in this investigation are co-integrated. In other words, there is a solid, lasting partnership. Both the long- and short-run models are estimated in this study. An ECM model is also expected to account for a specified adjustment period.

4.3 Presentation of Estimation Results and Discussion

Table 5: Long Run Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.

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Vol. 3(2), 2024, 185-201
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LEXTD	-0.27533	0.090897	0.632945	0.0431
LEXTS	0.10589	0.056435	0.813286	0.4223
LGDP	0.32341	0.053755	6.016414	0.0000
INT	-0.13262	0.001727	1.519719	0.1387
LEXCH	0.17066	0.026689	6.394471	0.0000
Constant	6.404115	1.09532	5.846796	0.0000
R-squared = 0.9800		F-statistic = 190		Durbin-Watson Stat = 2.0185
Adjusted R-squared = 0.9749		Prob(F-statistic)=0.000000		

Source: Authors

Table 6: Short Run and ECM Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXTD)	0.10418	0.054758	0.624365	0.0337
D(LEXTS)	0.12932	0.031078	-0.416121	0.6802
D(LGDP)	0.19218	0.067069	2.865503	0.0074
D(INT)	0.00155	0.000872	1.78797	0.0236
D(LEXCH)	-0.06422	0.063411	-1.012902	0.3189
CointEq(-1)	-0.59424	0.13793	-3.308307	0.0001

Source: Authors

From Table 5, the results show that external debt hurts final consumption expenditure in Nigeria. This implies that external debt increases the poverty rate in Nigeria and this conforms to a-priori expectation. This result supports our theoretical postulation which suggests that Nigeria's external debt is not sustainable, thus leading to a significant debt burden. By rational expectation, external debt burden can lead to increased debt service payment which can reduce the amount of money available for government spending on social services and other public goods. This can, in turn, lead to reduced household income and consumption, which contributes to an increase in the poverty rate.

Also, a country with a high external debt stock may struggle to repay its creditors, leading to a debt crisis. This can have severe economic consequences, including inflation, currency devaluation, and a decline in foreign investment. These consequences can affect a country's ability to provide essential services, such as education and healthcare, which can have a significant impact on poverty reduction, and this is evident in Nigeria and most other African countries with high debt burden, like the Congo Republic, Sierra Leone, Ghana, Malawi, and Angola.

This finding is consistent with that of Akanbi et al. (Macro), who discovered that external debt negatively affects Nigerian households' ultimate consumption expenditures. Yusuf et al. (National Bureau of) found in another study that household consumption expenditures are negatively affected by external debt, thereby raising the poverty rate. Therefore, this study rejects the first null hypothesis based on empiricism and concludes that there is a statistically significant relationship between external debt and Nigeria's poverty rate.

Asongu (2020) also found a similar result, examining the relationship between external debt and poverty reduction in 42 African countries and finding that external debt was negatively associated with poverty reduction, indicating that higher levels of external debt were associated with higher poverty rates. Going further, our findings are also in line with the work of Arshed, Nasir, and Saeed (Karagöl), who looked at the effects of both long-term and short-term external debt on the standard of living in 23 high-debt Asian nations from 1980 to 2020.

Using the Two-Step Panel Quantile ARDL model, the quadratic effects of external debt are evaluated. According to their study, external debt exhibits decreasing returns, meaning that beyond a certain point it will negatively affect people's quality of life.

This conclusion was further supported by the observation that servicing high levels of debt may directly shift budgetary funds away from investments required to spur economic growth. Due to the uncertainty surrounding the government's ability to service the substantial external debt, high levels of debt deter private-sector-led investment, employment, and, therefore, growth.

The bounds cointegration test accounts for the long-run relationship between the two variables. The result presented earlier in Table 4 shows that the model is co-integrated and that it will adjust by about 59.42% towards its equilibrium against any exogenous shock in the next year. Hence, the study rejects the second null hypothesis and concludes that there is a long-run relationship between external debt and poverty rate. Previous studies, such as Karoglu's (Arshed & Saeed), have shown that there is a long-run relationship between external debt and the poverty rate. The log of external debt service has a long-run coefficient of 0.1059 based on the control variables. Therefore, an increase in the external debt stock as a percentage will increase final consumption expenditure by 10.59%, holding other factors constant. This is contrary to a priori assumptions. Furthermore, the log of the gross domestic product has a long-run coefficient of 0.3234. Therefore, a percentage rise in GDP will result in a 32.34% increase in final consumer spending, leaving other factors constant. This is consistent with prior expectations.

This can be interpreted as a positive development for poverty reduction efforts, as it suggests that economic growth may be improving households' living standards. This is consistent with Nwabueze (Ndubuisi), who found that GDP growth was positively associated with household consumption expenditure in Nigeria between 1985 and 2015. Furthermore, the long-run coefficient of interest rate is 0.1326. This indicates that, holding other variables constant, a percentage increase in the interest rate will decrease final consumption expenditure by 13.26%, and this conforms to a-priori expectations.

This indicates that when interest rates are high, borrowing becomes more expensive, investors may be less inclined to borrow, and this may hamper domestic production, thereby reducing employment, income, and final consumption expenditure, which in turn leads to poverty. Also, the long-run coefficient of the exchange rate is 0.17066. This implies that, holding other variables constant, a percentage increase in the exchange rate will raise final consumption expenditure by 17.07%, which is consistent with a-priori expectations. This implies that when the exchange rate increases, households have more purchasing power to buy goods and services, including imported goods.

Studies in Nigeria have shown that an increase in the exchange rate leads to cheaper imports and higher consumption of domestically produced goods, both of which boost household consumption expenditure. Examples of such studies can be seen in the research work of (Easterly). Going further, the error correction component, which co-integrates the long- and short-run effects with a negative sign, is consistent with economic expectations, suggesting the possibility of adjusting the lags or disequilibrium in the long run. The Error correction model has a coefficient of -0.5942. This means 59.42% of the model's disequilibrium will be corrected or rectified within the next period (Clements & Nguyen). The Appendix contains the findings of the ARDL model's diagnostic tests. All of the requirements, including normality, autocorrelation, and heteroscedasticity, are satisfied by the model residuals.

As a result, the model can be used to draw inferences (Hameed & Chaudhary). Additionally, the R-squared and modified R-squared values are quite high, and the models' overall importance is demonstrated by the substantial F-statistic. To verify the stability of the model parameters, Persan and Pesaran (Gujarati) introduced the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares (CUSUMsq) of the residuals based on the Schwarz Bayesian Criterion. The plots of the CUSUM and CUSUMsq remained within the 5% significance level, as shown in the figures. In light of the stability indicated by the CUSUM and CUSUMsq, the study concludes that the variables are stable.

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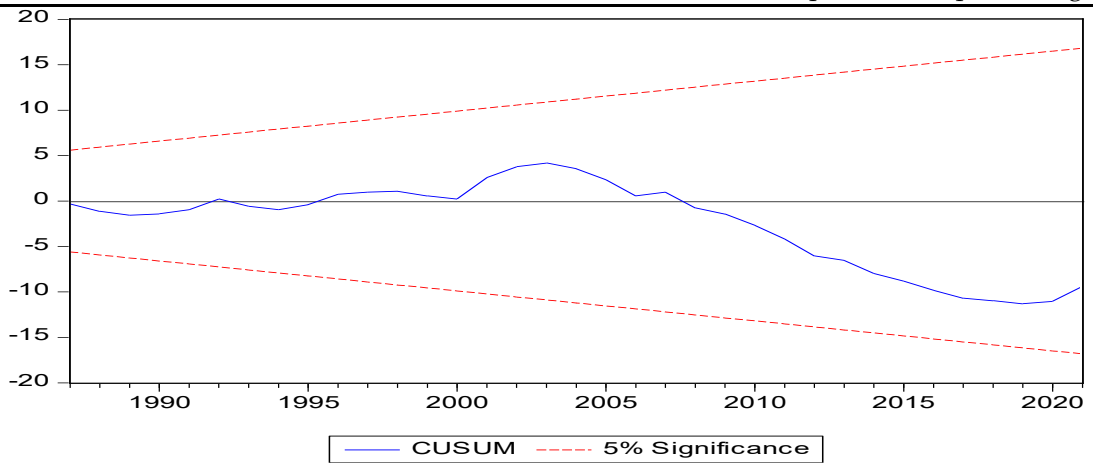

Figure 4: Cusum Plots for Stability Test

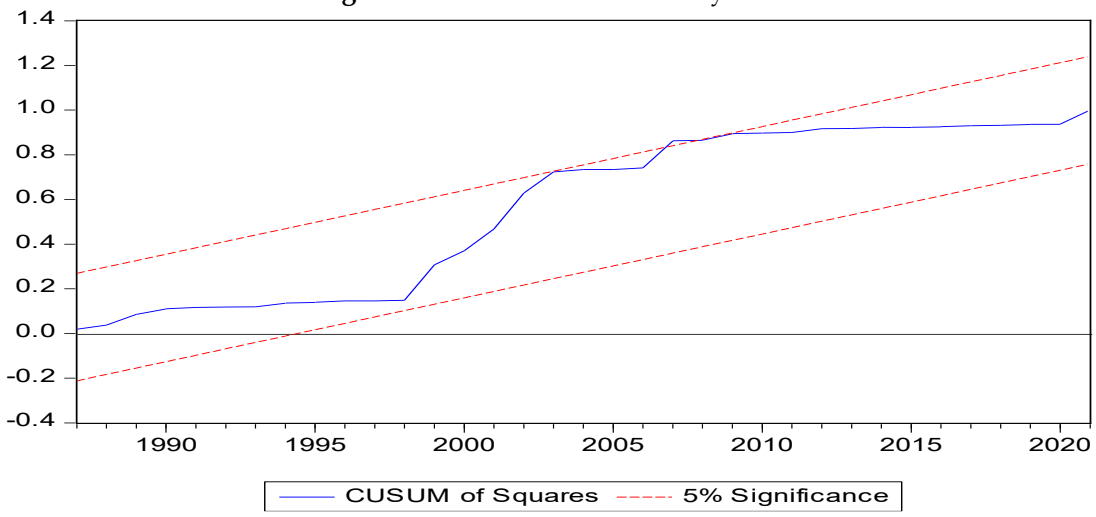

Figure 5: Cusum of Squared Residuals

4.4 Granger Causality Test

The third hypothesis of this study is captured in the second model of this study as presented in Table 7. The model estimation results indicate that no causal connection exists among the variables used in the study. Hence, upon establishing that there is no causal relationship between external debt and the poverty rate, this study fails to reject its third null hypothesis and concludes that there is none.

This means that changes in external debt do not have a significant or direct impact on Nigeria's poverty rate. This result, however, negates our a priori expectation. The uniqueness of Nigerian data could be one of the reasons for this result. Hence, if the goal is to reduce the poverty rate in Nigeria, policymakers may need to focus more on factors that directly affect household consumption expenditure and the poverty rate, such as improving access to employment, education, and social welfare.

Table 7: Granger Causality Test Result

Null Hypothesis	F-Statistic	P-Value	Outcome
External Debt Does Not Granger-Cause Poverty Rate			
EXTD does not Granger-cause CEXP	1.8326	0.1840	No Causation
EXTS does not Granger-cause CEXP	0.4407	0.5109	No Causation
Poverty Rate Does Not Granger-Cause External Debt			
CEXP does not Granger-cause EXTD	0.1695	0.6829	No causation
CEXP does not Granger-cause EXTS	0.0837	0.7739	No Causation

Source: Authors

5. Conclusion

The overall goal of this study is to use econometric, statistical, and economic approaches to investigate how Nigeria's foreign debt affects the country's poverty rate. This work's overarching goal is to determine how Nigeria's external debt affected the country's poverty rate from 1981 to 2021. This was broken down into three (3) distinct goals, which are as follows: (1) assess how Nigeria's external debt affects the country's poverty rate; (2) find out if there is a long-term correlation between external debt and poverty rate in Nigeria; and (3) ascertain whether there is a causal relationship between poverty and external debt in Nigeria. To accomplish these objectives, a model was formulated and estimated using the Autoregressive Distributed Lag (ARDL) model under some respective research hypotheses.

An econometric methodology was then employed to test the stated hypotheses. The results indicate that external debt is a major cause of poverty in Nigeria, which means that Nigeria's external debt burden can lead to an increased poverty rate due to high interest paid to service such debt, and this may divert resources from the productive sectors of the economy, which may also lead to a decline in economic growth. The results further indicate that other macroeconomic variables that positively and significantly impact the poverty rate (proxied by final consumption expenditure) in Nigeria are gross domestic product (GDP) and the Exchange rate, while the interest rate has a negative but insignificant impact.

Based on this study's findings, while external debt negatively affects final consumption expenditure, a proxy for poverty in Nigeria, the government needs to adopt prudent debt management practices. This involves borrowing only when necessary, ensuring that borrowed funds are used for productive purposes, and developing strategies to manage debt effectively. Effective debt management can prevent debt overhang and ensure that future generations are not burdened by debt obligations. The government should develop a comprehensive debt management strategy that outlines borrowing policies, debt management procedures, and risk management strategies.

The government should also establish a debt management office that is responsible for managing external debt, negotiating loan agreements, and monitoring debt service payments. Additionally, the government should prioritize transparency and accountability in debt management, including disclosing debt information to the public and establishing an independent debt audit mechanism. While external debt can help finance development projects and stimulate economic growth, it is important to ensure that borrowing is sustainable. Over-borrowing can lead to debt distress, undermining economic growth and exacerbating poverty. The government should develop a debt sustainability framework to guide borrowing decisions and promote responsible borrowing.

This framework should take into account the country's debt capacity, the impact of borrowing on economic growth, and the ability to service debt. The government should also prioritize concessional borrowing, which offers lower interest rates and longer repayment periods, and avoid excessive commercial debt. These debt management strategies have been carefully adopted by most developed countries worldwide, and Nigeria can learn from them. Given the direct impact of external debt on Nigeria's GDP, there is a need to enhance domestic resource mobilization. The government should focus on improving the efficiency and effectiveness of tax collection to increase domestic revenue. This can be achieved by increasing the tax base, improving tax administration, and reducing tax evasion.

The government should implement policies that support domestic resource mobilization, such as expanding the tax base to include more sectors of the economy, introducing new taxes, and increasing tax compliance through technology. Additionally, the government can invest in building capacity within tax administration agencies and explore alternative sources of revenue, such as natural resource royalties and excise taxes on labor-intensive industries, such as agriculture, construction, and manufacturing.

Finally, this research will act as a benchmark for further studies. This is because in addition to the gap this paper fills, there are still other topics left out of this study due to its scope and context. It will be interesting to examine the role of governance institutions in the relationship between foreign debt and the poverty rate in Nigeria. The results of such a study will provide a solid basis for policy recommendations regarding the quality of institutions in Nigeria.

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Data availability
The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent
Not applicable. This study uses publicly available, de-identified secondary data and does not involve human participants or personal information.

Competing interests
The authors declare no competing interests.

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