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Funding the future: Nigeria's battle against poverty through government expenditure

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ABSTRACT

This study investigates the effectiveness of government expenditure in combating the incidence of poverty in Nigeria from 1981 to 2022, employing a Vector Error Correction Model (VECM) framework. The research analyzes the relationship between poverty incidence and key variables including government expenditure, GDP per capita, Agricultural Credit Guarantee Scheme Fund (ACGSF), and gross enrollment ratio in secondary education. Using time series data and cointegration analysis, the study reveals a significant long-run relationship between government expenditure and poverty reduction, with a 1 % increase corresponding to a 0.05 percentage point reduction in poverty incidence. However, the error correction mechanism indicates a notably slow adjustment process (-0.000376), suggesting structural impediments to poverty reduction efforts. While government expenditure demonstrates significant poverty-reducing effects in the long run, the analysis reveals weak short-run dynamics and limited effectiveness of other policy instruments. The study finds evidence of a self-reinforcing poverty cycle, with past poverty levels significantly influencing current poverty rates. These findings underscore the need for more comprehensive and sustained policy interventions, particularly in addressing structural barriers to poverty reduction and improving the efficiency of government expenditure allocation in Nigeria's socioeconomic development initiatives.

1. Introduction

Nigeria is a nation with abundant natural resources, a substantial quantity of valuable resources, fertile land, and other valuable assets in addition to possessing a significant human resources capability. Notably, Nigeria stands as the sixth most populous country globally and the tenth largest exporter of crude oil in the world, boasting a populace exceeding 223 million as of July 2023 (Worldometer, 2023). Similarly, despite its abundance of resources, Nigeria's standing on the Human Development Index is rather unfavourable, as it holds the 161st position out of 189 countries with an HDI of 0.548 in 2022. Moreover, a staggering 63 % of its population resides below the poverty trend of US\$1.90 per day (NBS, 2023). This incidence of poverty has been identified as a significant concern in developing countries worldwide, due to its adverse effects on the well-being of affected individuals and the overall economy. Ayoo (2022) asserts that many developing nations are currently grappling with severe poverty, which necessitates immediate action in light of the detrimental implications for the inhabitants' welfare.

The incidence of poverty is a complex issue, encompassing deficiencies in education, healthcare, and living standards simultaneously. The Global Multidimensional Poverty Index (MPI) 2022 also defines individuals as poor if they lack at least one-third of education, health, and living standards concurrently. It denotes an individual's incapacity to attain a satisfactory quality of life, including the ability to procure food, clothing, shelter, sanitation services, piped water, education, and access to educational resources (Oxford Poverty and Human Development Initiative, 2020). Over the years, the Nigerian government has increasingly spent vast sums of money on running expenses, administrative costs, and infrastructure, with the assumption that the investment will hasten the process of economic growth and development.

Before 1980, the Nigerian government expenditure averaged 3.14 Billion Naira between 1960 and 1970, but increased to 5.97 Billion Naira between 1971 and 1980, reflecting an 89.97 % increase in government expenditure during the 1970s (Central Bank of Nigeria, 2022). The expansion can be linked to the early 1970s discovery of oil which resulted in an extraordinary increase in Nigeria's revenue. Similarly, between 1981 and 1985, the average government expenditure was

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11.19 Billion Naira, revealing an 87.3 % growth rate (Central Bank of Nigeria, 2022). In addition, there remained indications of an increase in public expenditure even with the sensational attempts by the government to reduce its expenditures, particularly through the Structural Adjustment Program (SAP) in 1986 which focused on the structural adjustment of the economy through short-term and medium-term factors. During this period, government expenditure continued on an upward trend where total government expenditure was 11.41 Billion Naira in 1986, but by 1990, it had risen to 60.27 Billion Naira.

However, from 1991 to 1995, in an attempt to reduce inflation, the government avoided large fiscal deficits, ensuring that government expenditures became less costly and sustainable with the resource capacity of the country (Chenge et al., 2022). Hence, government spending declined from 191.23 Billion Naira in 1993 to 160.89 Billion Naira in 1994, with a 1.81 % negative GDP growth rate and between the years 2000 and 2015, government expenditure increased from 701.06 Billion Naira to 4,988.86 Billion Naira. Between 2001 and 2010, the average growth rate of government expenditure was 19.2 per cent. Government spending has been on the rise in this period due to growing demand for socioeconomic services as a result of population growth, and improved revenue receipt from the sales of crude oil and other Petro products due to high crude oil prices in the international market (Apere, 2017). Consequently, total expenditure by the Nigerian government in 2017 increased from 6456.70 Billion Naira to 17,557.40 Billion, 19,965.04 Billion, and 24,431.21 Billion Naira in the years 2020, 2021, and 2022 respectively (Central Bank of Nigeria, 2022).

Moreover, government expenditure in Nigeria can be broadly categorized into capital expenditure and recurrent expenditure, each with distinct implications for poverty reduction. Capital expenditure, which includes investments in physical infrastructure such as roads, buildings, and machinery, typically operates through indirect channels to affect poverty levels. While essential for long-term economic development, these investments may not provide immediate poverty relief. For instance, between 2015 and 2022, Nigeria's capital expenditure averaged 24.3 % of total government spending (CBN, 2022), yet poverty rates remained persistently high. This suggests that while infrastructure development is crucial for long-term economic growth, its immediate impact on poverty reduction may be limited. In contrast, recurrent expenditure, particularly social spending components, tends to have more direct and immediate effects on poverty reduction. These include social protection programs (direct cash transfers, unemployment benefits, pension payments and food subsidy programs), human capital development (education spending, healthcare expenditure, skills development programs), and social services (primary healthcare delivery, basic education services, water and sanitation).

In addition to direct government expenditure, Nigeria has employed different fiscal policies to fight poverty, among which is the Agricultural Credit Guarantee Scheme Fund (ACGSF). The ACGSF has been in existence since 1977, though its operations started in 1978; it is an important policy tool that seeks to increase food security and decrease rural poverty through credit guarantees to commercial banks to borrowers in the agriculture value chain. Between 1978 and 2022, the ACGSF has committed over 130 billion Naira in loans to >1.1 million agricultural projects, especially for the most vulnerable smallholder farmer population which is 70 % of Nigeria's rural poor (Central Bank of Nigeria, 2022). The Agricultural Credit Guarantee Scheme Fund is a pioneering agricultural finance initiative in Nigeria that seeks to increase access to credit for small-scale farmers who lack conventional collateral. The scheme is a source of guarantees up to 75 per cent of the principal amount, should the borrower default, reducing the banks' risk in lending to this sector. This will encourage the banks to give credit to agricultural projects, especially to smallholder farmers who constitute the backbone of Nigeria's agricultural sector, which might otherwise be deemed too risky. The agricultural activities covered in the scheme are food crops, livestock, fisheries and acquisition of farm machinery, which makes the scheme a full package for the development of agriculture and reduction

of rural poverty.

Despite the huge increase in government expenditure over the years, the trend of poverty incidence in Nigeria indicates that there has been a rise in the number of individuals residing in destitution during the past four decades, encompassing 42 years. The prevalence of poverty incidence escalated from 28.1 % in 1980 to 46.3 % in 1985, subsequently experiencing a decrease to 42.7 % in 1992, followed by an ascent to its zenith at 65.6 % in 1996, before ultimately reducing to 54.4 % in 2004 and climbing back up to 60.9 % in 2010, (National Bureau of Statistics, 2020). The heightened prevalence of multidimensional poverty in Nigeria in 2022 signifies that the government pushed approximately 16.5 % of the 19.2 % of vulnerable individuals in 2020 to plunge into poverty by 2022 (Adeoye et al., 2022). This action escalated the poverty incidence from 46.4 % in 2020 to 62.9 % in 2022. Nonetheless, about 113 million impoverished persons (equivalent to 62.9 % of Nigeria's populace) are struggling not to fall further into the perils of intensifying indigence (Multidimensional Poverty Index, 2022).

Nationally, the rate of poverty has remained unbearable in a nation with immense wealth and a youthful urbanizing population that fuels commerce, a sound and fast-growing economy, and a veritably mineral-rich country with oil. Nevertheless, poverty might have been over-estimated due to the absence of information on the giant informal sector as it is estimated to be 60 % larger than the current gross domestic product figure. However, up to 2018, the growth of the population was faster than the economic growth and consequently, the poverty rate continued to increase steadily (Onwuka, 2022). Based on the World Bank estimate of 2018, the rate of poverty and those living below the international poverty trend of \$2 per day was estimated to be about 49 per cent and in 2022 it was approximately 63 per cent. As per the data for the year 2022, Nigeria contributed to about 12.9 per cent share of the global poor who are living in extreme poverty. However, the Nigeria 2018 Multidimensional Poverty Index data shows a high level of poverty, particularly in Northern Nigeria where >80 % of the inhabitants have been categorized as multidimensionally poor. The level of deprivation in the region was above 40 %, meaning that most states were deprived of more than half of the indicators, which was contrary to what was experienced in Southern Nigeria, especially the Southwest, where poverty was, to a certain extent, less severe than in the North (Oyebamiji and Khan, 2023).

There is no doubt that Nigeria has experienced a vast increase in government expenditure and troubling figures characterized by a persistently high rate of poverty incidence and given the increases in government spending in Nigeria and the GDP growth rate, transforming this into considerable development has proven to be challenging throughout the years. This is demonstrated by high rates of unemployment, and illiteracy, and about 71 million people have continued to live in abject poverty, living below the poverty line according to 2023 data from World Poverty Clock. The multidimensionality of poverty is attributed to a variety of factors, including global economic conditions; demographic changes; technological improvement; and social structure. However, the focus of this study on government expenditure as a key determinant of poverty reduction is grounded in several theoretical considerations.

Firstly, government expenditure is the principal policy tool through which a nation can directly control poverty outcomes. Secondly, government expenditure is a principal channel through which state policies affect development outcomes, particularly poverty levels. Government spending patterns are more flexible than such external factors as global market conditions or international trade dynamics. They can be changed comparatively quickly to deal with such immediate poverty challenges. Also, government expenditure is multi-channeled, and therefore spending on both direct welfare transfers and the provision of infrastructure, education and agricultural support simultaneously alleviate poverty. Lastly, in the Nigerian context, government expenditure has usually been employed as one of the principal instruments for the implementation of poverty reduction strategies, making it an important

issue for analysis and policy consideration.

To address potential concerns about omitted variables, this study incorporates key control variables identified by literature as significant determinants of poverty outcomes. These include GDP per capita (to control for overall economic development), the Agricultural Credit Guarantee Scheme Fund (to account for targeted poverty reduction initiatives), and the Gross Enrollment Ratio in secondary education (to control for human capital development). While other variables such as income inequality, unemployment rates, or technological adoption could potentially influence poverty levels, the selected variables represent the most direct and measurable factors within the Nigerian context, particularly given data availability constraints and the need for consistent time series data over the study period (1981–2022).

Importantly, growth is only pro-poor when the poor receive a considerably bigger proportion of output increases than the rich. It is unclear whether this has been the case in Nigeria, as the rate of poverty reduction appears to have lagged behind the rate of growth. As a result, probably, policy programs have not done enough to redistribute money in a way that improves welfare (Etuk and Ayuk, 2021). The primary objective of this study is to assess the impact of government expenditure in the fight against poverty incidence in Nigeria with the following specific objectives: To examine the trend and components of Nigerian government expenditure over time from 1981 to 2022, to analyze the trends of poverty incidence in Nigeria over time from 1981 to 2022, and to investigate empirically the relationship between government expenditure and poverty incidence. This study's rationale is grounded on multiple aspects. Primarily, despite the extensive body of research investigating the correlation between government expenditure and poverty incidence in Nigeria, the current literature is constrained by various shortcomings. Numerous studies have either concentrated on broad macroeconomic policies without specific attention to government spending or have predominantly relied on theoretical analyses rather than robust empirical inquiries.

Therefore, the main purpose of this study is to fill this gap by providing a sound empirical analysis of the effectiveness of government expenditure in the fight against poverty incidence in Nigeria. This research aims to provide concrete evidence and practical policy implications which will be facilitated through appropriate time series econometric techniques such as the Vector Error Correction Model (VECM) that this study intends to adopt. Adopting an evidence-based approach will improve the validity of these outcomes and expand the value they hold in shaping policy processes. Moreover, it is also important to obtain current and culturally appropriate data to enhance the findings in the current literature. The data set covering the years between 1981 and 2022 enables the use of the updated information, making it easier to provide a more accurate and relevant analysis of the correlation between government spending and poverty rates within the context of the Nigerian economy. This becomes even more significant since the economy and societies of the nation have changed in the last few decades.

2. Empirical literature review on poverty incidence and government expenditure

The persistent challenge of poverty reduction has been a central concern in development economics, particularly in resource-rich yet economically struggling nations like Nigeria. Existing literature reveals a complex landscape of research examining the complex relationship between government expenditure and poverty incidence, with scholars employing diverse methodological approaches to unravel this critical economic puzzle.

Ravallion and Chen (2011) challenged simplistic assumptions about the direct impact of government expenditure, demonstrating that the effectiveness of poverty reduction strategies varies dramatically across different economic contexts. Their research highlighted the nuanced nature of public spending, suggesting that mere increases in government

expenditure do not automatically translate into meaningful poverty reduction. Building upon these foundational insights, more researchers have delved deeper into the mechanisms through which government spending might influence poverty dynamics. Klasen et al. (2021) provided crucial evidence emphasizing the transformative potential of targeted human capital investments. Using eight developing economies as a case study, the study convincingly argued that strategic spending in education and healthcare yields more sustainable poverty reduction outcomes compared to direct income transfers. This perspective aligns closely with the current research's focus on examining secondary education enrolment as a critical variable in understanding poverty incidence.

Nwosa (2016) investigated the impact of government expenditure on unemployment and poverty rates in Nigeria, employing ordinary least squares estimation. The research suggested a statistically significant relationship between government spending and economic outcomes, albeit with limited poverty reduction effects. However, the study was constrained by methodological limitations and a relatively narrow analytical framework. Obayori (2020) explored government expenditure's relationship with economic discomfort, uncovering modest but statistically significant correlations between capital spending and poverty reduction. However, the study was constrained by methodological limitations that prevented a comprehensive understanding of long-term dynamics. The global landscape of poverty reduction strategies reveals a complex tapestry of approaches that extend far beyond traditional economic interventions. Keynes (1936) proposed that strategic public expenditure could generate multiplicative economic effects, potentially alleviating poverty through increased economic activity and employment generation. However, subsequent scholarly work revealed the limitations of such simplistic linear models.

Fukuda-Parr & Cid-Martinez (2019) built on the theoretical concepts of capabilities originated by Amartya Sen and Martha Nussbaum and presented a paradigmatic shift, challenging reductive economic measurements and arguing for a more holistic understanding of poverty. They emphasized human capabilities and opportunities, suggesting that government expenditure's effectiveness should be evaluated through monetary metrics and its capacity to expand individual human potential. Okulegu (2013) studied the effect and government expenditure on poverty reduction in Nigeria and the findings reveal a negative correlation between poverty reduction and government spending during the period of study, which indicates that a 1 percentage increase in government expenditure causes a 0.006 % reduction in poverty level. Anderson et al. (2018) used a novel instrumental variables approach to identify government social sector spending as the causal factor in reducing poverty. The results show that the composition of government expenditure matters a lot: spending on education and health care does much more than any other category of public spending to reduce income inequality and poverty.

Ibrahim and Umar (2021) analyzed the effect of government spending on poverty reduction using time series data from 1980 to 2019 in Nigeria. The objectives of the study are obtained by using the Vector Autoregressive (VAR) model technique. Results indicated that there is a positive effect on poverty reduction provoked by GDP and private investment while inflation is negative. Also from 2000 to 2017, Omodero (2019) examines the effect of government spending on various sectors with poverty reduction in Nigeria. Data analysis is done using Ordinary Least Squares and the results indicate that the current level of government expenditure on agriculture, building and construction, education, and health is inadequate to reduce poverty completely. Ekpo (2019) emphasizes the importance of high levels of expenditure on essential infrastructure such as education, health, and capital projects in alleviating poverty. Furthermore, the report advocates for a greater commitment from the government to regular capital expenditures for sustainable economic growth that will eradicate income poverty.

Joy et al. (2021) examined the effect of government capital expenditure on poverty reduction and economic performance in Nigeria. The

study found that the level of government capital expenditure was -0.2% : negative and insignificant impact on the poverty level in Nigeria during the analyzed period. Using government expenditure to explain poverty incidence in Nigeria, the paper discussed how expansionary public spending has helped to reduce the so-called poverty challenges that persisted between 1981 and 2014 (Gidigbi, 2023). Similarly, Liu et al. (2020) analyzed the role of rural public spending and poverty in China. From the study, the authors identified that an increase in spending on education, health, social security, and infrastructure expenditure by 1% will lead to a direct reduction of rural poverty by 0.635% , 0.902% , 0.280% , and 0.615% respectively, and an indirect reduction by 2.226% , 2.096% , 0.959% , and 2.356% . Analysis of the two classifications reveals that the indirect costs of negative externality for rural public expenditures are higher than the direct costs. This goes to indicate how such expenditures could not only bring an end to poverty within the area but also others similar economically and geographically. Obele and Adebisi (2022) embarked on a study that was aimed at achieving a quantitative assessment of the efficiency of government expenditure at the poverty level in Nigeria. These studies showed that government expenditure on infrastructure and health is not only desirable but brings positive results as far as the poverty level is concerned. Furthermore, the percentage of government expenditure on infrastructure and health has a positive relation to poverty as it raises poverty by 3.59% and 79.1% respectively. Using time series data analysis, Dagume (2021) analyzed the determinants of poverty in South Africa. The study thus gives empirical support to the fact that an increase in domestic credit extended to the private sector, FDI, growth rate, and gross investment rate by one unit decreases the poverty headcount rate. For instance, the increase of domestic credit to the private sector by 1% means an increase of the general indicator by 1.1% .

Öztornacı and Şengül (2023) examined the impact of social expenditure on multidimensional poverty in Turkey, to assess whether the social expenditure system reduces poverty. In the study, two different econometric techniques were used to conduct the analysis, namely, the ordinary least squares (OLS) and the three-stage least squares (3SLS). Findings from both econometric models indicated that individual social spending and household income excluding social expenditures were associated with a decrease in multidimensional poverty, whereas governmental social expenditures exhibited a positive influence. The researchers proposed that the current social expenditure system in Turkey may be inefficient, resulting in limited benefits for the population. Using a comprehensive analysis of poverty reduction programs across developing countries, Nallari and Griffith (2011) demonstrated that targeted government expenditure working collectively with progressive redistribution policies lowered the poverty headcount ratio by an average of 1.2 per cent annually. These results indicate a high sensitivity of the effectiveness of government spending on poverty reduction to the quality of institutions and targeting mechanisms. Hanna and Olken (2018) review evidence on the effectiveness of anti-poverty programs in different developing countries and conclude that administrative targeting of government expenditure delivers more poverty reduction than universal programs.

It has also been ascertained that agricultural credit programs are significant in poverty reduction in different ways. Adetiloye (2012) noted that Agricultural Credit Guarantee Scheme Fund (ACGSF-guaranteed) loans have positively impacted poverty levels in rural areas as they have boosted agricultural productivity and the income of small-scale farmers by reducing the poverty rate by 2.3 per cent. Similarly, Mbutor et al. (2013) revealed that the increased volume of ACGSF-guaranteed loans loosened poverty headcount amongst rural households due to upgrading technology in farming and expansion of farming activities. The argument for the effectiveness of the scheme arises from the reality that the identified beneficiaries of the scheme are smallholder farmers who are important players in Nigeria's agricultural value chain and at the same time, are among the most vulnerable in the society. While most poverty reduction programs work directly through

subsidies, the ACGSF works indirectly using the banking system as a means of efficiently allocating funds and loan subsidies which are provided through the banking system where market failures would otherwise prevent lending to poor rural farmers (Evbomwan et al., 2019).

Duflo and Banerjee (2011) in "Poor Economics" challenged conventional wisdom by demonstrating that poverty is not a monolithic experience but a nuanced set of challenges requiring targeted, context-specific interventions. Similarly, Pritchett and Woolcock (2004) introduced the concept of "solution space," arguing that effective poverty reduction strategies must emerge from local institutional contexts rather than universal prescriptive models. Their research highlighted the importance of understanding local economic ecosystems and institutional capacities. Acemoglu and Robinson's influential book "Why Nations Fail" (2012) further elaborated on this perspective, arguing that inclusive economic and political institutions are paramount in driving long-term economic development and poverty reduction. Their research suggests that government expenditure's effectiveness is deeply intertwined with broader institutional capabilities and structural economic arrangements (Robinson and Acemoglu, 2012).

This literature review demonstrates that while significant research has been conducted on government expenditure and poverty, there remains a critical need for comprehensive, context-specific studies that can inform more effective policy interventions. The current research responds to this need, offering a detailed, methodologically sophisticated analysis of Nigeria's ongoing battle against poverty. What distinguishes this study is its holistic approach to understanding poverty incidence. Unlike previous research that often relied on single-dimensional measures, this study embraces a multidimensional perspective aligned with the Global Multidimensional Poverty Index. By incorporating variables such as GDP per capita, government expenditure, agricultural credit schemes, and secondary education enrolment, the research offers a more comprehensive analysis of the factors influencing poverty dynamics in Nigeria.

3. Theoretical framework and model specification

The theoretical framework of this study is the Neo-Classical Growth Model. Here, the incidence of poverty (PI) is assumed to be a function of government expenditure (GE), human capital development (HC), and other control variables (CV) like economic growth, income distribution, credit facilities, etc.

$$PI = f(GE, HC, CV) \dots\dots\dots (i)$$

Where:

PI = Poverty Incidence

GE = Government Expenditure (Recurrent Expenditure)

HC = Human Capital (education and acquired skills)

CV = Control Variables (like economic growth, income disparity, credit resources, etc.)

The model specification builds upon the theoretical framework established above, incorporating the Neo-Classical Growth Model's premises while allowing for dynamic interactions among variables. The VECM framework extends this basic specification by incorporating temporal dynamics and error correction mechanisms. The model employs a semi-logarithmic specification where some variables are transformed into natural logarithms while others remain original. This approach is chosen because poverty incidence (PI) is already expressed as a percentage (ranging from 0 to 100), making logarithmic transformation unnecessary and potentially problematic when values approach zero. The gross enrolment ratio (GER) is also expressed as a percentage, making it more interpretable in its original form while variables like government expenditure (GEXP), GDP per capita (GDPpc), and Agricultural Credit Guarantee Scheme Fund (ACGSF) exhibit large scale differences and potential non-linear relationships with poverty incidence, making logarithmic transformation appropriate for these variables. The foundational relationship can be expressed as:

$$PI = f(\ln GDPpc, \ln GEXP, \ln ACGSF, GER) \dots\dots\dots (ii)$$

Where

PI = Poverty Incidence $\ln GDPpc$ = Log of Gross Domestic Product Per Capita $\ln GEXP$ = Log of Government Expenditure (Recurrent Expenditure) $\ln ACGSF$ = Log of Agricultural Credit Guarantee Scheme Fund

GER = Gross Enrollment Ratio (Secondary Education)

The econometric model can be specified as:

$$PI_t = \beta_0 + \beta_1 \ln GDPpc_t + \beta_2 \ln GEXP_t + \beta_3 \ln ACGSF_t + \beta_4 \beta GER_t + u_t \dots\dots\dots (iii)$$

3.1. Data methodology

This study employs a Vector Error Correction Model (VECM) to examine the dynamic relationship between government expenditure and poverty incidence in Nigeria. The VECM framework is particularly appropriate for this analysis as it allows for the investigation of both long-run equilibrium relationships and short-run dynamic adjustments among the variables of interest. This methodology is grounded in the understanding that poverty reduction through government expenditure involves complex interactions that manifest over different time horizons. In an attempt to explore the impact of government spending in the fight against the poverty rate in Nigeria, the study includes some variables such as Gross Domestic Product Per Capita, and Government Expenditure, representing recurrent government expenditures that are more likely to promote consumption and social welfare. Agricultural Credit Guarantee Scheme Fund, represents the annual value of loans guaranteed under the scheme, which serves as a proxy for government intervention in agricultural finance aimed at poverty reduction through rural development and agricultural productivity enhancement. Poverty Incidence, which measures the percentage of the population that is multidimensionally poor. While related to the Human Development Index (HDI), poverty incidence is a distinct measure that specifically captures the proportion of people experiencing multiple deprivations and Gross Enrollment Ratio: Secondary Education.

This study uses poverty incidence (PI) data from Nigeria's National Bureau of Statistics (NBS). The government recurrent expenditure and agricultural credit guarantee scheme fund data are annual data collected from the Central Bank of Nigeria Statistical Bulletin. At the same time, the gross domestic product per capita was obtained from the Interna-

$$\Delta \gamma_t = \alpha_0 + \Delta \gamma_{t-1} + \alpha_1 + \Delta \gamma_{t-1} + u_t \text{ for the intercept } \dots\dots\dots (iv)$$

$$\Delta \gamma_t = \alpha_0 + \Delta \gamma_{t-1} + \alpha_{it} + \alpha_i \Delta \gamma_{t-1} + u_t \text{ for the trend } \dots\dots\dots (v)$$

In the equations, the symbol γ_t denotes the variable. The symbol Δ represents the first difference while representing the error term at period t . Lastly, γ_{t-1} signifies the lag of the variables by one period.

3.3. Cointegration analysis

Following the confirmation of non-stationarity and identical order of integration, the Johansen cointegration procedure is implemented to investigate the presence of long-run equilibrium relationships.

The procedure utilizes two test statistics:

$$\text{Trace statistic : } \lambda \text{trace}(r) = -T \sum_{(i=r+1 \text{ to } n)} \ln(1 - \lambda_i) \dots\dots\dots (vi)$$

$$\text{Maximum eigenvalue statistic : } \lambda \max(r, r+1) = -T \ln(1 - \lambda_{r+1}) \dots\dots\dots (vii)$$

Where:

T represents the sample size

λ_i denotes the estimated eigenvalues arranged in descending order r indicates the rank of the cointegrating matrix.

3.3.1. Vector error correction model specification

Given the presence of cointegration, the VECM is specified as:

$$Y_t = \alpha [\beta' Y_{t-1} + \mu] + \sum_{(i=1 \text{ to } p-1)} \delta_i \Delta Y_{t-1} + e_t \dots\dots\dots (viii)$$

Where: Y_t is the 5×1 vector of endogenous variables [PI, $\ln GDPpc$, $\ln GEXP$, $\ln ACGSF$, GER]

α represents the matrix of adjustment coefficients

β represents the matrix of long-run cointegrating coefficients

μ represents the vector of constants

δ_i represents the matrices of short-run coefficients

e_t represents the vector of white noise error terms for each equation in the system

The explicit form for the poverty incidence equation within the VECM system is:

$$\Delta PI_t = \alpha_1 [\beta_1 PI_{t-1} + \beta_2 \ln GDPpc_{t-1} + \beta_3 \ln GEXP_{t-1} + \beta_4 \ln ACGSF_{t-1} + \beta_5 GER_{t-1} + \mu] + \sum_{(i=1 \text{ to } p-1)} [\gamma_1 i \Delta PI_{t-i} + \gamma_2 i \Delta \ln GDPpc_{t-i} + \gamma_3 i \Delta \ln GEXP_{t-i} + \gamma_4 i \Delta \ln ACGSF_{t-i} + \gamma_5 i \Delta GER_{t-i}] + \varepsilon_t$$

tional Monetary Fund (IMF), and the gross enrollment ratio: secondary education from the World Bank database. The time series data ranged from 1981 to 2022 to measure/estimate the coefficients of the short-/long-term linear equation models.

3.2. Unit root test

Datta and Mukhopadhyay (2011) contend that the utilization of regression analysis on a non-stationary series can yield erroneous outcomes. To circumvent the possibility of misleading findings, the Augmented Dickey-Fuller (ADF) method, pioneered by Dickey and Fuller (1979), was employed.

This test is indispensable as it assists in the determination of appropriate estimation techniques for the analysis. Eqs. (iv) and (v) delineate the trend and intercept of the unit root, respectively.

4. Results and analysis

This section considers the analysis of data and the interpretation of results. First, I examine the temporal patterns of the key variables through time series plots. The next step is the descriptive statistics and the level of stationarity in the time series variables, which are identified through the Unit Root. Subsequently, Johansen cointegration procedure is performed to investigate the presence of long-run equilibrium relationships

4.1. Time series analysis

This section presents the temporal evolution of government expenditure, poverty incidence, GDP per capita, agricultural credit guarantee scheme fund, and gross enrolment ration (secondary school education)

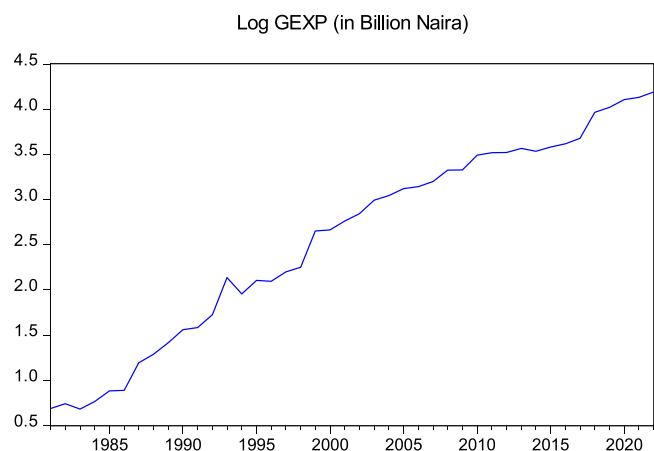


Fig. 1. Time Series Plot of Government Expenditure in Nigeria (1981–2022).

in Nigeria from 1981 to 2022

The evolution of government expenditure over time reveals the changing patterns of public spending in Nigeria. Fig. 1 depicts the temporal variation in Nigerian government expenditure from 1981 to 2022 (Data source: CBN, 2022). The time series exhibits an upward movement from 1995 and experienced a sharp decrease in 2000 when government expenditure was reduced to 701 Billion Naira from the previous 947 Billion Naira in 1999. There has been a steady increase in government expenditure since 2004 owing to the introduction of transfer payments into the Nigeria expenditure side of the total budget. However, the government expenditure also experienced a decrease in 2015 and spread to 2016 resulting from the 2016 economic recession when the economy contracted by 1.6 per cent as a result of the negative oil price and rose to 13, 786 Billion Naira in 2018 and 24, 431 Billion Naira in 2022. The rise in government expenditure can be attributed to a range of economic development projects that prioritize the improvement of infrastructure, the creation of employment opportunities, the reduction of poverty, the diversification of the economy, and the implementation of social welfare programs.

The temporal pattern of poverty incidence provides crucial insights into the effectiveness of poverty reduction efforts over time. Fig. 2 presents the evolution of poverty incidence in Nigeria (% of the multi-dimensional poor) and Fig. 3 represent the time series plot of other variables in the model. The Fig. 2 reveals persistent high levels of poverty, with the rate reaching its peak in 2003 at 88 % and its minimum in 1981 at 33 %. This pattern suggests that despite increased government expenditure, poverty reduction efforts have faced significant challenges. The poverty incidence stood at 69 % in 2010 and declined to

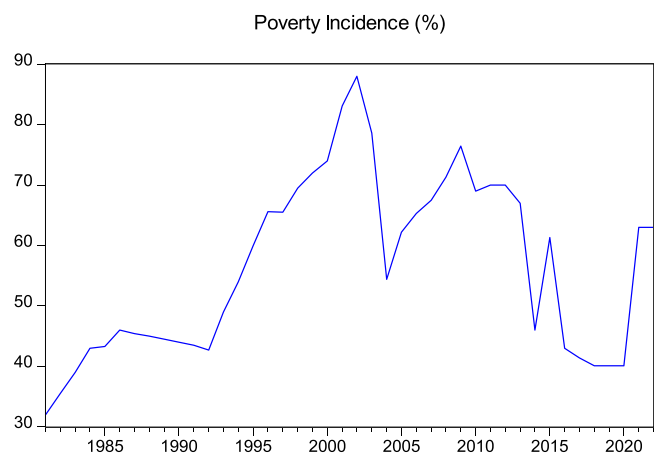


Fig. 2. Time Series Plot of Poverty Incidence in Nigeria (1981–2022).

40.1 % in 2019 with an estimation of about 82.9 million individuals residing below the poverty threshold. The incidence of poverty has continued to persist as 63 % still live below the poverty line in 2022, which accounted for about 133 million people of the total population.

4.2. Descriptive statistics

The descriptive statistics for the variables under investigation are presented in Table 4.1 below. The dataset comprises 42 observations for each variable. The Poverty Incidence (PI) exhibits a mean value of 56.53 and a median of 57.20, with values ranging from a minimum of 32.00 to a maximum of 88.00. The distribution of PI shows slight positive skewness (0.216) and is platykurtic with a kurtosis value of 1.866.

The logarithm of government expenditure (LOG_GEXP) demonstrates a mean of 2.573 and a median of 9.281, ranging from 0.681 to 4.198. Its standard deviation of 1.109 suggests considerable variation in government spending patterns. The distribution exhibits negative skewness (−0.329) and moderate platykurtosis (1.826), indicating a relatively flat distribution with a longer left tail. For the logarithm of GDP per capita (LOG_GDPpc), the mean value is 3.105 with a median of 3.221. The variable ranges from 2.676 to 3.505, with a relatively small standard deviation of 0.267, suggesting more clustered values around the mean. The LOG_ACGSF variable presents a mean of 5.875 and a median of 5.942, ranging from 4.392 to 7.113 with a standard deviation of 0.923, showing moderate dispersion. The Gross Enrolment Ratio (GER) averages 33.052 with a median of 29.470, ranging from 17.110 to 56.210. Its standard deviation of 9.900 indicates substantial variation in enrolment rates. The distribution displays moderate positive skewness (0.507). The Jarque-Bera test statistics and their associated probability values (ranging from 0.105 to 0.275) fail to reject the null hypothesis of normality at conventional significance levels, suggesting that all variables approximately follow normal distributions.

4.3. Augmented Dickey-Fuller and Zivot-Andrews test results

Before performing the unit root tests on time series data, I check whether the data exhibit structural breaks, since their existence may affect the stationarity properties of the variables. Using the Bai-Perron multiple breakpoint test, I seek potential structural breaks in the variables. The data series reveals several major structural breaks. The Agricultural Credit Guarantee Scheme Fund (ACGSF) showed a large structural break around 1990 which was the time financial sector reforms became active in Nigeria. Perhaps this was due to policy change when it came to agricultural financing during the structural adjustment period. Government expenditure in Nigeria from 1981 to 2022 displays some local structural breaks in the data. The shifts appear to be large around 1995, 2004, and 2014 implying that there have been structural changes to Nigeria's government expenditure pattern during these years. A break appears in the poverty incidence series in the mid-1990s possibly reflecting the socioeconomic impact of political instability during this time.

To work with the structural breaks in the analysis, I modify the unit root testing approach by employing the Zivot Andrews unit root test that admits an allowable endogenous structural break in the series. In the presence of structural breaks, this approach produces more robust results than traditional unit root tests. To obtain robust inference regarding the order of integration of variables, the results of both the conventional ADF test and the Zivot-Andrews test are presented in Tables 4.2 and 4.3 below which illustrate the results of the Augmented Dickey-Fuller (ADF) and Zivot-Andrews test. These results are utilized to evaluate if the series is stationary or non-stationary.

The summary of the Table 4.2 and 4.3 above presents the findings of the Augmented Dickey-Fuller (ADF) and Zivot-Andrews unit-root test results. The findings illustrate that Poverty Incidence (PI), Government Expenditure (GEXP), GDP per Capital (GDPpc), Agricultural Credit Guarantee Scheme Fund (ACGSF) and Gross Enrollment Ratio (GER)

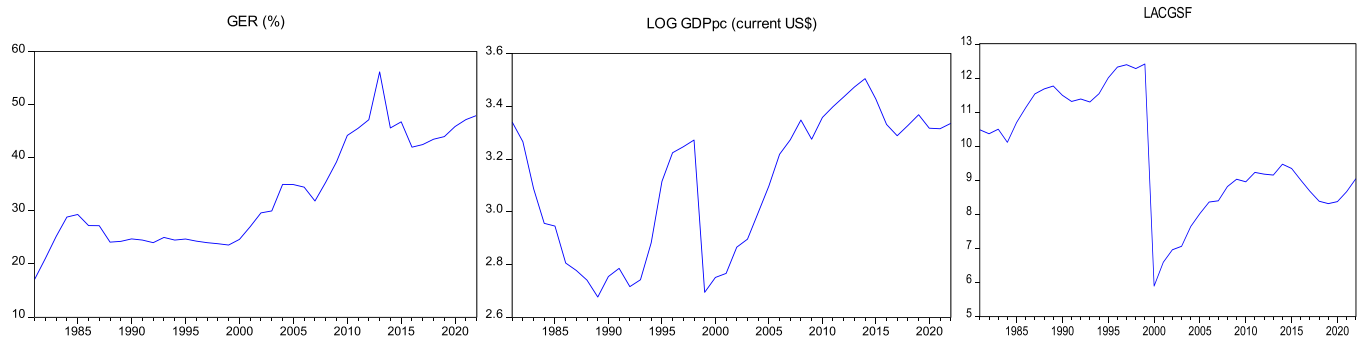


Fig. 3. Time series plot of other variables in the model.

Table 4.1
Descriptive Statistics of Variables.

Statistic	PI	LOG_GEXP	LOG GDPpc	LOG_ACGSF	GER
Mean	56.53286	2.575260	3.104522	5.875061	33.05190
Median	57.20000	9.287084	3.220891	5.942151	29.47000
Maximum	88.00000	4.191829	3.505279	7.113843	56.21000
Minimum	32.00000	0.681241	2.676197	4.391903	17.11000
Std. Dev.	14.64286	1.108745	0.266971	0.922640	9.900116
Skewness	0.216280	-0.328887	-0.271039	-0.089819	0.506476
Kurtosis	1.866255	1.826352	1.525549	1.406870	1.891415
Jarque-Bera	2.576852	3.167703	4.318748	4.498081	3.647099
Probability	0.275704	0.205183	0.115397	0.105500	0.161452
Observations	42	42	42	42	42

Source: Author's compilation from E-views 10.

Table 4.2
Unit Root Test Results.

LEVEL	Augmented Dickey-Fuller(ADF)			Zivot-Andrews test		
	Intercept	Trend & Intercept	None	Intercept	Trend	Both
PI	0.1991	0.5250	0.6892	0.5562	0.5787	0.7903
LOG_GEXP	0.6632	0.6752	0.9999	0.8971	0.7457	0.9975
LOG_GDPpc	0.5284	0.1424	0.6324	0.3686	0.3241	0.6854
LOG_ACGSF	0.2866	0.9962	0.4744	0.2698	0.3587	0.9850
GER	0.0718*	0.0570*	0.9379	0.0689	0.5463	0.7909
FIRST DIFFERENCE						
PI	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.033***
LOG_GEXP	0.0000***	0.0000***	0.0187**	0.0000***	0.0000***	0.0000***
LOG_GDPpc	0.0001***	0.0006***	0.0000***	0.0005***	0.0006***	0.0000***
LOG_ACGSF	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0060***
GER	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***

Source: Author's compilation from E-views 10.

Note: *, ** and *** represent 10 %, 5 % and 1 % levels of significance respectively.

were integrated of order one $I(1)$ at the 1 % significance level under the Zivot-Andrews unit-root test compared to the ADF test result. Consequently, I give priority to the Zivot-Andrews test results that take into consideration structural breaks and so offer more reliable inferences when structural changes are present. It is especially important, however, concerning Nigeria's evolving economic reforms and policy shifts during the time covered by the study.

4.4. Co-integration analysis

4.4.1. Johansen cointegration test

The Johansen cointegration test results in Table 4.4 below provide crucial insights into the long-run equilibrium relationships among the variables in the model. The test was conducted using both trace statistic and maximum eigenvalue approaches to ensure the robustness of the findings. The results reveal significant evidence of cointegration among the variables. From the trace test results, it can be observed that the null

hypothesis of no cointegration ($r = 0$) is rejected at the 5 % significance level, as the trace statistic value of 71.06637 exceeds the critical value of 69.81889, with a probability value of 0.0396. However, the null hypothesis of at most one cointegrating equation ($r \leq 1$) cannot be rejected, as the trace statistic of 44.12564 is less than the critical value of 47.85613, with a probability value of 0.1074.

The maximum eigenvalue test results corroborate these findings. The test rejects the null hypothesis of no cointegration at the 5 % significance level, with the max-eigen statistic of 26.94073 being lower than the critical value of 33.87687 and a probability value of 0.0266. Similarly, the hypothesis of at most one cointegrating equation cannot be rejected based on the max-eigen statistic of 19.46763, which is less than the critical value of 27.58434, with a probability value of 0.3792. These results collectively indicate the presence of one cointegrating equation among the variables in the model. This finding is particularly important as it confirms the existence of a long-run equilibrium relationship between poverty incidence, government expenditure, and other control

Table 4.3

Summary of the Unit Root Test Results.

	Augmented Dickey-Fuller (ADF) Test			Zivot-Andrews test		
	Level	First Difference	I (d)	Level	First Difference	I (d)
PI	0.1991	0.0000***	I (1)	0.5562	0.0000***	I (1)
LOG_GEXP	0.6632	0.0000***	I (1)	0.8971	0.0000***	I (1)
LOG_GDPpc	0.5284	0.0000***	I (1)	0.3686	0.0005***	I (1)
LOG_ACGSF	0.2866	0.0000***	I (1)	0.2698	0.0000***	I (1)
GER	0.0718*	–	I (0)	0.0689	0.0000***	I (1)

Source: Author's compilation from E-views 10.

Note: *, **, and *** represent 10 %, 5 %, and 1 % levels of significance respectively.

Table 4.4

Summary of the Johansen Cointegration Test Results.

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None * ($r = 0$)	0.490089	71.06637	69.81889	0.0396
At Most ($r \leq 1$)	0.385343	44.12564	47.85613	0.1074
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None * ($r = 0$)	0.490089	26.94073	33.87687	0.0266
At Most ($r \leq 1$)	0.385343	19.46763	27.58434	0.3792

Source: Author's compilation from E-views 10.

variables in the Nigerian context. The presence of cointegration justifies our use of the Vector Error Correction Model (VECM) framework and suggests that while the variables may deviate from equilibrium in the short run, they will eventually return to their long-run equilibrium relationship.

4.4.2. Vector error correction estimates

Given that the Zivot and Andrews test shows that all variables are integrated of order one (I(1)) even when taking into account the structural breaks, this study uses the Vector Error Correction Model (VECM). In particular, the VECM approach is suited since it enables the long-run equilibrium relations and short-run dynamics of poverty incidence and its determinants while taking into account the endogenous nature of the relationships. The long-run coefficients in Table 4.5 below reveal the equilibrium relationships between poverty incidence and its determinants. The poverty incidence (PI) is normalized with a coefficient of 1.000000. Government expenditure (LOG_GEXP) exhibits a significant negative coefficient of -5.019823 at the 1 % level, indicating that a

Table 4.5

Long-run Equilibrium Relationship (Cointegrating Equation).

Variable	Coefficient	Standard Error	t-statistic
PI	1.000000	–	–
LOG_GEXP	-5.019823^{***}	(1.38997)	[-3.61147]
LOG_GDPpc	-0.147118	(0.62882)	[-0.23396]
LOG_ACGSF	-0.004890	(0.06786)	[-0.06577]
GER	-0.004401	(0.06512)	[-0.06758]
C	13.89170		

Note:*** indicates significance at 1 % level, ** at 5 % level, * at 10 % level.

Source: Author's compilation from E-views 10.

1 % increase in government expenditure is associated with approximately a 0.05 percentage point reduction in poverty incidence in the long run, holding other factors constant. This interpretation accounts for the semi-logarithmic nature of the relationship, where the dependent variable (PI) is in levels and the independent variable (GEXP) is in logarithmic form.

The GDP per capita (LOG_GDPpc) shows a negative coefficient of -0.147118 , suggesting that a 1 % increase in GDP per capita is associated with about a 0.001 percentage point decrease in poverty incidence, although this relationship is not statistically significant. For the Agricultural Credit Guarantee Scheme Fund (LOG_ACGSF), the negative coefficient of -0.004890 indicates that a 1 % increase in agricultural credit is associated with a 0.00005 percentage point reduction in poverty incidence, though not statistically significant. The Gross Enrollment Ratio (GER), which is not log-transformed and is measured in percentage points, shows a coefficient of -0.004401 , suggesting that a one percentage point increase in enrollment ratio is directly associated with a 0.004 percentage point decrease in poverty incidence, but lacks statistical significance. The constant term (C) of 13.89170 represents the baseline level of poverty incidence when all other variables are held constant.

The error correction term (CointEq1) coefficients from the Vector Error Correction Model (VECM) estimates presented in Table 4.6 above reveal the speed of adjustment towards long-run equilibrium following a deviation. For poverty incidence, the coefficient (-0.000376) is negative but statistically insignificant, suggesting a very slow adjustment process. More notably, the error correction term for GDP per capita (0.079810) is positive and significant at the 1 % level, indicating that approximately 7.98 % of disequilibrium is corrected each period, though this adjustment moves away from rather than towards equilibrium, suggesting potential structural issues in the economic system. Examining the lagged effects of poverty incidence ($D(PI(-1))$), significant bidirectional relationships can be observed. The coefficient of 0.097197 for $D(PI)$ is significant at the 5 % level, indicating that a one percentage point increase in poverty incidence in the previous period leads to approximately 0.097 percentage point increase in current period poverty. This suggests a concerning self-reinforcing nature of poverty in Nigeria. However, there is also a significant negative relationship between lagged poverty and government expenditure (-0.572926 , significant at 1 % level).

The lagged effects of government expenditure ($D(LOG_GEXP(-1))$) show negative but insignificant relationships with current poverty levels (-0.178729). Given the logarithmic transformation, this suggests that a 1 % increase in government expenditure in the previous period is associated with an approximately 0.18 percentage point decrease in poverty incidence, though the lack of statistical significance limits the reliability of this interpretation. Regarding GDP per capita ($D(LOG_GDPpc(-1))$), the coefficients suggest minimal short-run impacts on poverty reduction (-0.017672 , insignificant). The logarithmic interpretation indicates that a 1 % increase in GDP per capita in the previous period is associated with only about a 0.018 percentage point decrease in poverty incidence, highlighting the weak translation of economic growth into poverty reduction in the short run. The Agricultural Credit Guarantee Scheme Fund ($D(LOG_ACGSF(-1))$) shows a negative but insignificant relationship with poverty (-0.104135), suggesting that a 1 % increase in agricultural credit in the previous period is associated with approximately 0.10 percentage point decrease in poverty incidence. The insignificance of this relationship may indicate implementation challenges in the agricultural credit scheme's effectiveness for poverty reduction.

For the Gross Enrollment Ratio ($D(GER(-1))$), the coefficient (-0.005526) suggests a minimal and insignificant impact on poverty reduction in the short run, with a one percentage point increase in enrollment being associated with only about 0.006 percentage point decrease in poverty incidence. These findings collectively suggest that while there are some significant short-run dynamics, particularly in the

Table 4.6
Short-run Dynamic Coefficients.

Error Correction	D(PI)	D(LOG_GEXP)	D(LOG_GDPPC)	D(LOG_ACGSF)	D(GER)
CointEq1	−0.000376 (0.00162) [−0.23158]	0.028711 (0.02555) [1.12382]	0.079810*** (0.02708) [2.94742]	0.026435 (0.02566) [1.03024]	0.430902 (0.70136) [0.61438]
D(PI(−1))	0.097197** (0.04457) [2.18072]	−0.572926*** (0.21918) [−2.61393]	−0.137281 (0.23231) [−0.59093]	0.111201 (0.22014) [0.50514]	−4.276531 (6.01728) [−0.71071]
D(LOG_GEXP(−1))	−0.178729 (0.15661) [−1.14126]	−0.117409 (0.17407) [−0.54127]	0.184933 (0.16599) [1.11413]	0.077974 (0.15729) [0.49573]	−3.124451 (4.29936) [−0.72672]
D(LOG_GDPPC(−1))	−0.017672 (0.15827) [−0.11166]	0.048691 (0.17407) [0.27972]	0.183498 (0.16775) [1.09388]	−0.171953 (0.15896) [−1.08175]	0.352285 (4.34499) [0.08108]
D(LOG_ACGSF(−1))	−0.104135 (0.18603) [−0.55977]	0.018479 (0.19718) [0.09372]	0.215472 (0.18685) [1.15321]	−6.751663 (5.10724) [−1.32198]	−6.751663 (5.10724) [−1.32198]
D(GER(−1))	−0.005526 (0.00605) [−0.91387]	0.006760 (0.00641) [1.05477]	0.007922 (0.00607) [1.30446]	−0.139990 (0.16600) [−0.84330]	0.139990 (0.16600) [−0.84330]

Note;*** indicates significance at 1 % level, ** at 5 % level, * at 10 % level.

Source: Author's compilation from E-views 10.

Table 4.7
Model Diagnostics.

Statistic	D(PI)	D(LOG_GEXP)	D(LOG_GDPPC)	D(LOG_ACGSF)	D(GER)
R-squared	0.275209	0.336182	0.394188	0.256489	0.256489
Adj. R-squared	0.016354	0.099104	0.177827	−0.009051	−0.009051
S.E. equation	0.110111	0.116708	0.110591	3.022912	3.022912
F-statistic	1.063180	1.418023	1.821900	0.965916	0.965916

Note;*** indicates significance at 1 % level, ** at 5 % level, * at 10 % level.

Source: Author's compilation from E-views 10. The diagnostic statistics in Table 4.7 above provide information about the model's explanatory power and fit. The poverty incidence equation shows the highest R-squared value of 0.435209, indicating that approximately 43.5 % of the variation changes in poverty incidence are explained by the model. The adjusted R-squared of 0.266354 suggests moderate explanatory power when accounting for the number of variables. However, the government expenditure equation demonstrates an R-squared of 0.336182 and an adjusted R-squared of 0.099104, indicating more limited explanatory power. The GDP per capita equation shows a slightly better fit with an R-squared of 0.394188 and an adjusted R-squared of 0.177827.

relationship between poverty and government expenditure, many of the policy instruments show limited effectiveness in poverty reduction in the short run. The weak error correction mechanism for poverty incidence also indicates structural challenges in poverty reduction efforts, suggesting the need for more comprehensive and sustained policy interventions to achieve meaningful poverty reduction in Nigeria.

4.4.3. Vector error correction model (VECM) cholesky structural residuals graphs

The Fig. 4 above present the Vector Error Correction Model (VECM) Cholesky structural residuals graphs which demonstrate varying patterns of stability and volatility across the five variables from 1981 to 2022. The poverty incidence (PI) residuals show significant fluctuations with notable spikes in the early 2000s and 2020, though generally remaining within the two-standard-deviation band. Government expenditure (LOG_GEXP) residuals exhibit substantial volatility in the 1990s before showing relative stability in later years. GDP per capita (LOG_GDPPC) residuals maintain a consistent pattern with one significant negative outlier around 2000. The Agricultural Credit Guarantee Scheme Fund (LOG_ACGSF) residuals display frequent oscillations, particularly in the early years, with diminishing volatility in recent periods. The Gross Enrollment Ratio (GER) residuals reveal increasing volatility after 2010, suggesting potential structural changes in educational patterns. Overall, while the residuals generally stay within acceptable bounds, their patterns indicate the presence of periodic shocks and policy implementation challenges in Nigeria's socioeconomic system.

4.5. Summary of the analysis results

The empirical analysis reveals complex dynamics between poverty incidence and its determinants in Nigeria from 1981 to 2022. The descriptive statistics demonstrate significant variations across all variables, with poverty incidence showing a mean of 56.53 % and ranging from 32 % to 88 %, indicating substantial fluctuations in poverty levels. Government expenditure exhibits considerable variation with a logarithmic mean of 2.575, while GDP per capita shows more clustered values with a relatively small standard deviation of 0.267. The Agricultural Credit Guarantee Scheme Fund and Gross Enrollment Ratio also display notable variations, with standard deviations of 0.923 and 9.900 respectively. The stationarity analysis through Augmented Dickey-Fuller and Phillips-Perron tests reveals that Poverty Incidence, Government Expenditure, GDP per Capita, and Agricultural Credit Guarantee Scheme Fund are integrated of order one I(1), while the Gross Enrollment Ratio is integrated of order zero I(0). The Johansen cointegration analysis confirms one cointegrating equation, establishing a long-run equilibrium relationship among the variables.

In the long-run equilibrium relationship, government expenditure demonstrates a significant negative coefficient of −0.019823, indicating that a 1 % increase in government expenditure corresponds to approximately a 0.05 percentage point reduction in poverty incidence. GDP per capita shows a negative coefficient of −0.147118, suggesting a modest poverty-reducing effect, though statistically insignificant. The Agricultural Credit Guarantee Scheme Fund exhibits a minimal negative coefficient of −0.004890, while the Gross Enrollment Ratio shows a similar coefficient of −0.004401, both lacking statistical significance. The



Fig. 4. VECM Cholesky Residual Graphs.

short-run dynamics reveal more intricate relationships. The error correction term for poverty incidence (-0.000376) indicates a very slow adjustment process, while GDP per capita shows a significant positive adjustment coefficient (0.079810), suggesting structural challenges in the economic system. The analysis reveals a self-reinforcing poverty cycle with a significant coefficient of 0.097197 for lagged poverty incidence. Government expenditure shows a negative but insignificant short-run relationship with poverty (-0.178729), while GDP per capita demonstrates minimal immediate impact (-0.017672). The Agricultural Credit Guarantee Scheme Fund shows a negative but insignificant short-run effect (-0.104135), and the Gross Enrollment Ratio indicates minimal immediate influence (-0.005526) on poverty reduction.

The Cholesky residual analysis reveals varying stability patterns, with notable fluctuations in poverty incidence during the early 2000s and 2020, while government expenditure shows significant volatility in the 1990s before stabilizing. GDP per capita residuals maintain consistency except for a significant negative outlier around 2000, and the Agricultural Credit Guarantee Scheme Fund displays diminishing volatility over time. The Gross Enrollment Ratio residuals indicate increased volatility post-2010, suggesting structural changes in educational patterns. These comprehensive findings underscore the relationship

between poverty and its determinants in Nigeria. While government expenditure shows significant long-run poverty-reducing effects, the weak short-run dynamics and slow adjustment processes across variables suggest structural impediments to poverty reduction. The results emphasize the need for a more integrated policy approach that addresses both immediate poverty challenges and underlying structural issues, particularly in education, agricultural credit access, and economic growth. The findings also highlight the importance of policy consistency and the need for sustained, well-coordinated interventions across all sectors to achieve meaningful poverty reduction outcomes in Nigeria.

This empirical analysis's findings corroborate and diverge from previous research in interesting ways. The significant negative relationship between government expenditure and poverty incidence (-5.019823) is consistent with [Mehmood and Sadiq \(2010\)](#) study for Pakistan, using the Error Correction Model where a 1 % increase in government expenditure resulted in a 0.48 % reduction in poverty levels. Nevertheless, the magnitude of the effect in the present study is notably larger which suggests greater sensitivity of poverty to government spending in the Nigerian context. This study identifies weak short-run dynamics and slow adjustment processes which are also observed in findings by [Quarterm \(2008\)](#) in Ghana where government

spending for poverty reduction was unable to overcome the structural impediments. Remarkably, Quartey found an error correction term of -0.003 for poverty adjustment, suggesting that slow poverty adjustment mechanisms could be a regional characteristic of West Africa.

While the finding that the coefficient on GDP per capita is statistically insignificant (-0.147118) differs from that of Dollar and Kraay (2002) in their influential cross-country study, they found a one-for-one relationship between GDP growth and income growth of the poor across 92 countries. Since diverging, this suggests that Nigeria's growth might be less pro-poor than the international average as Ogunleye et al. (2017) conclude that economic growth in Nigeria is largely non-inclusive. Agricultural credit has a significantly different minimal impact compared to findings in other developing countries. For example, agricultural credit programs in Bangladesh have been found by Khandker and Koolwal (2016) to reduce poverty by about 4 percentage points over three years. Such disparity may be an outcome of implementation challenges peculiar to Nigeria's Agricultural Credit Guarantee Scheme Fund as also noted by Olomola (2014), in that efforts designed to ameliorate the distribution of inputs in the input distribution system in Nigeria may not yield the applaudable outcome unless the output marketing system is modified concurrently to facilitate the availability of remunerative output markets and to stabilize farmers' income.

The educational enrollment findings are particularly startling compared to international evidence. In their comprehensive review, Psacharopoulos and Patrinos (2018) discovered that each additional year of schooling would lower the chance of being poor by 4–8 % around the globe. The much smaller coefficient of this study points to possible problems in education quality or the labour market absorption of trained graduates in Nigeria, as also shown by Longe (2017) that Nigeria cannot reasonably expect to achieve her developmental aspirations if she cannot effectively use a large number of her trained graduates in his study. The short-run analysis of self-reinforcement of poverty echoes Carter's (2019) finding of similar poverty traps in six developing countries. Yet, compared to their average finding, this study coefficient is stronger in having a persistence effect. This study's poverty error correction mechanism is similar to what Fosu (2017) reported of similarly sluggish processes of poverty adjustment across sub-Saharan African countries. The finding of a positive and significant error correction term for GDP per capita argues a less comforting structural divergence between growth and poverty alleviation than what Fosu perceived.

Like Ravallion (2020), this study's findings on long-run effectiveness and short-run limitations of government expenditure match those of developing countries. The long-run impact in this study is substantially greater than Ravallion's average result implying greater potential for poverty reduction through government spending in Nigeria if structural impediments can be overcome. The Cholesky residual analysis shows similar volatility patterns to Shimeles and Verdier-Chouchane (2016) observation of increased education sector instability across Africa, hit by the global financial crisis including the post-2010 period of increased educational enrollment volatility. A comparison of Nigeria's plight with other developing nations indicates that there are shared problems in poverty reduction in Nigeria; however, it also exhibits unique characteristics that require tailored policy approaches. Given their weaker transmission mechanisms for growth and human capital development to poverty reduction and the stronger potential impact of government spending, institutional reforms are also required concurrently to public investment.

5. Conclusion and policy recommendation

The empirical analysis of Nigeria's battle against poverty through government expenditure from 1981 to 2022 reveals several critical insights into the effectiveness of fiscal policy interventions. The study's findings demonstrate a complicated relationship between government spending and poverty reduction, characterized by significant long-term effects but constrained by structural inefficiencies and implementation

challenges. The long-run analysis confirms a statistically significant negative relationship between government expenditure and poverty incidence, suggesting that increased government spending does contribute meaningfully to poverty reduction over time. However, the magnitude of this effect indicates that substantial increases in expenditure are required to achieve meaningful reductions in poverty levels. This finding aligns with theoretical expectations but raises questions about the efficiency of resource allocation and the effectiveness of poverty reduction strategies.

The study's revelation of a very slow error correction mechanism for poverty incidence is particularly concerning, as it indicates significant structural rigidities in Nigeria's socioeconomic system that impede rapid poverty reduction. This is further compounded by the evidence of a self-reinforcing poverty cycle, where past poverty levels significantly influence current poverty rates, suggesting the entrenchment of poverty traps that are difficult to break through conventional fiscal interventions alone. The limited effectiveness of other policy instruments, including the Agricultural Credit Guarantee Scheme Fund and educational enrollment, points to potential implementation gaps and the need for better-targeted interventions. The weak short-run dynamics across variables suggest that immediate poverty relief through government spending faces substantial obstacles, possibly due to institutional inefficiencies, corruption, or misallocation of resources. These findings contribute significantly to the existing literature on poverty reduction in developing economies by providing empirical evidence of the complex relationships between fiscal policy and poverty outcomes. They highlight the importance of considering long-term structural changes and short-term poverty alleviation measures in policy design and implementation. Based on these findings, the study recommends the following policy actions:

- i. The Nigerian government should implement a comprehensive reform of its expenditure framework by establishing a performance-based budgeting system that directly links spending to poverty reduction outcomes, supported by transparent tracking systems and regular impact assessments. This should include implementing digital payment systems and independent oversight mechanisms to reduce leakages, improve fund distribution efficiency, and ensure accountability in poverty reduction programs.
- ii. It is critical to restructure and enhance agricultural support systems, particularly the Agricultural Credit Guarantee Scheme Fund, to improve its accessibility and effectiveness. This should encompass the development of comprehensive farm insurance schemes, the establishment of agricultural processing zones, and the implementation of modern farming techniques, alongside the development of rural infrastructure to support agricultural activities and reduce post-harvest losses.
- iii. The government should significantly strengthen its educational and skills development programs by increasing allocation to educational infrastructure in disadvantaged areas, implementing targeted scholarship programs, and developing vocational training centers. Partnerships with industries should complement this to ensure curriculum relevance and job placement, particularly focusing on practical skills development that matches market demands.

These recommendations should be implemented within a coordinated framework that prioritizes both immediate impact and long-term structural changes. By implementing these policy recommendations, the Nigerian government can leverage the synergies between government expenditure, human capital development, and targeted poverty reduction initiatives to make substantial progress in the fight against poverty and enhance the well-being of its citizens.

Disclosure of interest

There are no relevant financial or non-financial competing interests to report.

Declaration of funding

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CRediT authorship contribution statement

Temitope Adebayo: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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