Journal of Economic Studies (JES)
Department of Economics,
Nnamdi Azikiwe University, Awka,
Anambra State, Nigeria.
Web: www.nauecojournals.com
ISSN 1119-2259

MACROECONOMIC DETERMINANTS OF POVERTY IN NIGERIA: APPLICATION OF NONLINEAR ARDL

Anthony Ajana Uzodigwe [a], Kenneth Onyebuchi Obi [a], Uju Reginia Ezenekwe [a]; & Cajetan Chima Anuforo [b]

[a] Department of Economics, Faculty of Social Sciences Nnamdi Azikiwe University, Awka, Anambra State
[b] Department of Economics, Faculty of Social Sciences, University on the Niger, Umunya, Anambra State
Corresponding Author: Uzodigwe Ajana Anthony; Department of Economics, Faculty of Social Sciences, Nnamdi Azikiwe University, Awka.
aa.uzodigwe@unizik.edu.ng

Abstract
Poverty in Nigeria remains a persistent issue despite the nation's abundant natural resources and growing economy. This study explores the macroeconomic determinants of poverty in Nigeria for the period 1970 to 2023, focusing on variables such as inflation, foreign direct investment (FDI), trade openness, exchange rates, and economic growth. Using a Nonlinear Autoregressive Distributed Lag (NARDL) model, the study investigates the asymmetric short- and long-term effects of these factors on poverty, recognizing that poverty dynamics often do not follow linear patterns. The findings reveal that FDI, trade openness, and economic growth significantly reduce poverty in the short run, while sustained economic growth (measured by real GDP per capita) emerges as a key long-term factor in poverty alleviation. Conversely, exchange rate depreciation and inflation have mixed effects, sometimes exacerbating poverty, especially in the long run. The study highlights the need for stable exchange rates, controlled inflation, and policies that attract quality, long-term FDI. Recommendations emphasize sustaining economic growth, fostering an investment-friendly environment, and maintaining trade openness. These findings underscore the importance of nuanced, stability-focused policies to address the complex and multidimensional nature of poverty in Nigeria.

Keywords: Inflation, Exchange rate, Economic Growth, Poverty and Nigeria.

JEL Classification Codes: E31, F21, F31, I32

1. Introduction

Poverty is the deprivation of essential needs and opportunities. The World Bank's 2000 World Development Report defines poverty as an unacceptable deprivation of human well-being, encompassing both physiological and social aspects. Physiological deprivation includes unmet basic needs like nutrition, health, education, and shelter, extending beyond low income. Social deprivation

involves risk, vulnerability, lack of autonomy, powerlessness, and self-respect. The World Bank highlights poverty as a multidimensional issue, affecting economic, social, political, and cultural spheres, manifesting in hunger, limited access to services, social exclusion, and lack of participation in decision-making (World Bank, 2000).

Poverty has been a pressing and persistent issue in Nigeria. Despite being Africa's most populous nation and endowed with abundant natural resources, Nigeria struggles with a high poverty rate, with nearly 40% of its population living below the national poverty line. This coexistence of substantial economic wealth and widespread poverty suggests that various macroeconomic factors, including inflation, exchange rates, government expenditure, foreign direct investment (FDI), and economic growth, play critical roles in shaping poverty dynamics in the country.

In the global context, poverty is increasingly understood as a multidimensional issue that impacts individuals' quality of life through physiological and social deprivations, such as limited access to healthcare, education, and other essential services, as well as increased vulnerability and reduced autonomy. Given the significance of these multiple dimensions, exploring the economic underpinnings of poverty is essential for informing effective policy interventions. Traditional approaches to studying poverty often assume linear relationships between economic indicators and poverty outcomes, whereby changes in factors like inflation or FDI proportionately affect poverty levels. However, this perspective fails to capture the complexity of poverty dynamics, particularly in contexts where macroeconomic relationships exhibit nonlinear and asymmetric characteristics.

In this study, a nonlinear autoregressive distributed lag (NARDL) model is employed to investigate the short- and long-term nonlinear impacts of key macroeconomic variables on poverty in Nigeria. The NARDL approach allows for a nuanced understanding of how positive and negative changes in variables like inflation, exchange rates, and trade openness asymmetrically affect poverty, offering more accurate insights into poverty dynamics.

2. Literature Review

Empirical studies on the macroeconomic determinants of poverty have evolved over time, employing various econometric methodologies to analyse the complex relationship between economic growth, trade openness, foreign direct investment (FDI), inflation, exchange rate, and poverty. This literature review synthesizes key empirical findings on these determinants, focusing on their implications for poverty alleviation in Nigeria.

The role of economic growth in poverty reduction has been widely studied. Ahluwalia, Carter, and Chenery (1979) used a quantitative simulation framework to analyse the impact of GDP growth, population dynamics, and income distribution on poverty. They found that economic growth, though beneficial, does not automatically translate to poverty reduction unless accompanied by redistributive policies. Similarly, Fields (1989) and Roemer and Gugerty (1997) demonstrated that higher GDP per capita growth leads to a reduction in poverty levels, though the elasticity varies by income group. Stevans and Sessions (2008) extended this analysis to the U.S. and confirmed that economic growth significantly reduces poverty but is more effective in expansionary periods.

Focusing on developing regions, Perera and Lee (2013) found that economic growth in nine Asian countries led to poverty reduction, but governance quality influenced the extent of this impact. In contrast, Norton (2002) challenged the notion that economic growth alone benefits the poor, arguing that improving the incomes of the lower-income groups has a greater impact on overall well-being than merely increasing the wealth of the rich.

Empirical research presents mixed evidence on the relationship between trade openness and poverty. Hassine and Kandil (2009) examined agricultural productivity and trade openness in 14 Mediterranean countries and found that trade openness contributes to poverty reduction in the long run. Similarly, Bharadwaj (2014) and Agusalim (2017) found that trade-induced income growth significantly reduces poverty in developing economies, though short-term effects are minimal. However, studies such as Figini and Santarelli (2006) and Hassan (2005) provided contrary evidence, indicating that trade openness might not significantly affect relative poverty. Hassan (2005), for instance, found that while trade openness and economic growth have a long-run equilibrium relationship in Bangladesh, the structure of international trade does not necessarily translate into poverty reduction through employment and income growth.

The impact of FDI on poverty remains a subject of debate. Okpe and Abu (2009) examined the effects of foreign private investment on poverty in Nigeria and found that while FDI inflows significantly alleviate poverty, government expenditure and petroleum profit tax tend to aggravate it. Gohou and Soumare (2012) extended this analysis to Africa, revealing that FDI significantly reduces poverty in Central and East Africa but has an ambiguous effect in West Africa.

Fowowe and Shuaibu (2014) utilized system GMM estimation for 30 African countries and found that FDI contributes to poverty reduction, particularly in countries with better

financial development and human capital. However, Kalirajan and Singh (2010) and Ogunniyi and Igberi (2014) argued that FDI's effectiveness in poverty alleviation depends on human capital development, institutional quality, and the ability to crowd in domestic investment. In Nigeria, Ogunniyi and Igberi (2014) found that FDI had an insignificant impact on poverty reduction due to institutional bottlenecks and underdeveloped human capital.

Inflation is often cited as a key macroeconomic factor influencing poverty. Yolanda (2017) analyzed Indonesia's inflation dynamics and found a significant positive relationship between inflation and poverty. In Nigeria, Danlami, Hidthiir, and Hassan (2020) applied the Toda-Yamamoto causality test and found a unidirectional causal relationship running from inflation to poverty, indicating that higher inflation rates exacerbate poverty levels.

The effect of exchange rate fluctuations on poverty is multifaceted. Maier (2015) investigated the impact of different exchange rate regimes on poverty reduction across 76 countries, finding that intermediate exchange rate regimes tend to have a more positive effect on the poorest 40% in developing economies. Similarly, Apergis and Cooray (2018) found that real exchange rate depreciation positively affects poverty reduction through increased remittances, particularly in emerging and developing economies.

3. Data and Methodology

The study uses secondary data from sources like the National Bureau of Statistics and World Bank databases. This study aims to investigate the dynamic impacts of FDI inflows, trade openness, exchange rate, and inflation on poverty in Nigeria, controlling for economic growth and population growth. The theoretical framework underpinning the model specification draws from several economic theories. The relationship between FDI and poverty is often examined through the lens of endogenous growth theory, which posits that FDI can enhance economic growth and reduce poverty through technology transfer, job creation, and improved productivity (Borensztein et al., 1998). Trade openness is theorized to influence poverty through comparative advantage and the export-led growth hypothesis (Krueger, 1997). Exchange rate dynamics impact poverty by affecting import prices and export competitiveness (Dornbusch, 1980). The inflation-poverty nexus is explained through the cost-push and demand-pull inflation theories (Friedman, 1968). Real GDP per capita serves as a proxy for economic growth and overall welfare (Barro, 1991). Population growth is analysed through the Malthusian theory and its modern adaptations, which consider the strain on resources and public services (Malthus, 1798).

3.1 The Model

To examine the long-run impact of FDI, trade openness, exchange rate, inflation, economic growth, and population growth on poverty, we specify the following model:

$$POV_t = f(FDI_t, TROPN_t, EXCHR_t, INFL_t, RGDPPC_t, POPGR_t) \quad (3.1)$$

We can write Equation (3.1) further to be expressed as:

$$POV_{n,t} = \beta_0 + \beta_1 FDI_t + \beta_2 TROPN_t + \beta_3 EXCHR_t + \beta_4 INFL_t + \beta_5 RGDPPC_t + \beta_6 POPGR_t + U_t \quad (3.2)$$

The subscript t denotes the time domain.

The variables POV, FDI, TROPN, EXCHR, INFL, RGDP, and POPGR denote poverty, foreign direct investment, trade openness, exchange rate, inflation rate, real GDP per capita, and population growth, respectively. Poverty is a vector of two variables, namely headcount ratio and household consumption expenditures. While β_j represents the long-run parameters, for *J = 0, 1, 2, ……..6.*

Taking into cognizance the possible asymmetric effects of FDI, TROPN, EXCHR, and INFL on POV, the study uses the NARDL approach propounded by Shin et al. (2014), which examines the asymmetric effects by decomposing the series into positive and negative partial sums. First, we develop an autoregressive distributed lag (ARDL) model and then the NARDL model.

3.1.1 Linear ARDL Model

Employing the autoregressive distributed lag (ARDL) model of Pesaran, Shin, and Smith (2001), we remodel Equation (3.2) by including an error correction model. Accordingly, the representation of the relationship between poverty and its fundamentals is expressed as:

$$\begin{aligned}\Delta POV_{n,t} = {} & \Omega_0 + \sum_{i=1}^{n} \Omega_1 \Delta\, POV_{t-i} + \sum_{i=1}^{n} \Omega_2 \Delta\, FDI_{t-i} + \sum_{i=1}^{n} \Omega_3 \Delta\, TROPN_{t-i} \\ & + \sum_{i=1}^{n} \Omega_4 \Delta\, EXCHR_{t-i} + \sum_{i=1}^{n} \Omega_5 \Delta\, INFL_{t-i} + \sum_{i=1}^{n} \Omega_6 \Delta\, RGDPPC_{t-i} \\ & + \sum_{i=1}^{n} \Omega_7 \Delta\, POPGR_{t-i} + \Phi_1 FDI_{t-i} + \Phi_2 TROPN_{t-i} + \Phi_3 EXCHR_{t-i} \\ & + \Phi_4 INFL_{t-i} \; \Phi_5 RGDPPC_{t-i} + \Phi_6 POPGR_{t-i} + U_t \end{aligned} \quad (3.3)$$

Where the summation is from the "0" (current) period to the "nth" period, and the lag length for the variables in each model is determined by Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC). $\Omega_1 - \Omega_7$ indicate short-run coefficients, and $\Phi_1 - \Phi_6$ indicate long-run coefficients.

The bounds test can be used to examine the overall cointegration of the variables where the null hypothesis is $\Phi_1 = \Phi_2 = \Phi_3 = \Phi_4 = \Phi_5 = \Phi_6 = 0$.

3.1.2 Nonlinear ARDL (NARDL) Model

Taking into account the asymmetric effect, Shin et al. (2014) extended the traditional ARDL model by decomposing the exogenous variable into a partial sum of positive and a partial sum of negative changes. Following Shin et al. (2014), his study decomposes FDI, trade openness, exchange rate, and inflation into a partial sum of positive and negative series. If the non-linear regression model is $X_t = \gamma^+ Y^+ + \gamma^- Y^- + U_t$, where γ^+ and γ^- are the coefficients of long-run and Y_t is a vector of predictor variables which is decomposed as:

$Y_t = Y_0 + Y^+ + Y^-$

Where Y^+ and Y^- are the partial sums present the predictor variables. Accordingly, we decompose the series of FDI and TROPN, EXCHR, and INFL into positive and negative partial sums shown in the following equations:

$$FDI_t^+ = \sum_{K=1}^{t} \Delta FDI_k^+ = \sum_{K=1}^{t} Max(\Delta FDI_k, 0); \text{ and}$$
$$FDI_t^- = \sum_{K=1}^{t} \Delta FDI_k^- = \sum_{K=1}^{t} Min(\Delta FDI_k, 0) \quad (3.4)$$

$$TROPN_t^+ = \sum_{K=1}^{t} \Delta TROPN_k^+ = \sum_{K=1}^{t} Max(\Delta TROPN_k, 0); \text{ and}$$
$$TROPN_t^- = \sum_{K=1}^{t} \Delta TROPN_k^- = \sum_{K=1}^{t} Min(\Delta TROPN_k, 0) \quad (3.5)$$

$$EXCHR_t^+ = \sum_{K=1}^{t} \Delta EXCHR_k^+ = \sum_{K=1}^{t} Max(\Delta EXCHR_k, 0); \text{ and}$$
$$EXCHR_t^- = \sum_{K=1}^{t} \Delta EXCHR_k^- = \sum_{K=1}^{t} Min(\Delta EXCHR_k, 0) \quad (3.6)$$

$$INFL_t^+ = \sum_{K=1}^{t} \Delta INFL_k^+ = \sum_{K=1}^{t} Max(\Delta INFL_k, 0); \text{ and}$$
$$INFL_t^- = \sum_{K=1}^{t} \Delta INFL_k^- = \sum_{K=1}^{t} Min(\Delta INFL_k, 0) \quad (3.7)$$

Using equations 4 to 7, this study obtains the following asymmetric ARDL model.

$$\begin{aligned}\Delta POV_t = {} & \Omega_0 + \sum_{j=1}^{n1} \Omega_1 \Delta POV_{t-j} + \sum_{j=0}^{n2} \Omega_2 \Delta FDI_{t-j}^+ + \sum_{j=0}^{n3} \Omega_3 \Delta FDI_{t-j}^- + \\ & \sum_{j=0}^{n4} \Omega_4 \Delta TROPN_{t-j}^+ + \sum_{j=0}^{n5} \Omega_5 \Delta TROPN_{t-j}^- + \sum_{j=0}^{n6} \Omega_6 \Delta EXCHR_{t-j}^+ \\ & + \sum_{j=0}^{n7} \Omega_7 \Delta EXCHR_{t-j}^- + \sum_{j=0}^{n8} \Omega_8 \Delta INFL_{t-j}^+ + \sum_{j=0}^{n9} \Omega_9 \Delta INFL_{t-j}^- \\ & + \sum_{j=0}^{n10} \Omega_{10} \Delta RGDPPC_{t-j} + \sum_{j=0}^{n11} \Omega_{11} \Delta POPGR_{t-j} + \phi_1 POV_{t-j} \\ & + \phi_2 FDI^+_{t-1} + \phi_3 FDI_{t-j}^- + \phi_4 TROPN^+_{t-1} + \phi_5 TROPN_{t-j}^- + \phi_6 EXCHR^+_{t-1} \\ & + \phi_7 EXCHR_{t-j}^- + \phi_8 INFL^+_{t-1} + \phi_9 INFL_{t-j}^- + \phi_{10} RGDPPC_{t-1} \\ & + \phi_{11} POPGR_{t-1} + Vt \end{aligned} \quad (3.8)$$

The variables are as defined in Equation (3.2). This study considers specification (3.8) as a nonlinear ARDL model since it decomposes FDI, trade openness, exchange rates, and inflation into a partial sum of positive and negative changes. Where nj for j = 1,2, 3

…… 11 are lag orders for the underlying variables identified using appropriate lag selection criteria. Once the optimum lag is identified, we test the presence of a long-run relationship between poverty and the modelled fundamentals as specified in Equation (3.8). The null, H0: $\phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = \ldots\ldots\ldots\ldots = \phi_{11} = 0$ is tested using the bounds testing approach of Pesaran et al. (2001) and Shin et al. (2014). Next, the F-test is to be employed to examine the presence of a cointegration relationship among the underlying variables. When the F- statistic exceeds the upper bounds of the critical value, H0 of no cointegration is rejected, which confirms cointegration among the variables. If the F-statistic is less than the lower bounds of critical value, the null is not rejected, i.e., the variables are not cointegrated. The decision would be inconclusive when the calculated F-statistic lies between the upper and lower bounds of critical value. Long-run and short-run asymmetry can be tested using the Wald test.

4. Empirical Results and Discussion

This section is structured as follows: First, we conduct preliminary tests to ensure the validity and reliability of the data and the chosen methodology. These tests include checking for stationarity, multicollinearity, and other diagnostic checks that are essential before proceeding to the main estimation. Second, the core analysis is performed. The chosen econometric models are applied to the data to estimate the relationships between the variables of interest. The results are then discussed, highlighting key findings, their implications, and how they align or contrast with existing literature. Last, we conduct additional tests to verify the robustness and reliability of the results. These tests include checking for heteroscedasticity and autocorrelation and conducting sensitivity analyses.

4.1. Pre-Estimation Tests

Table 4.1: Descriptive statistics

	POV	FDI	TROPN	EXCHR	INFL	RGDPPC	POPGR
Mean	45.73	1.24	29.47	97.41	18.30	1964.11	2.623
Median	47.90	1.08	32.45	21.95	13.13	2022.42	2.615
Maximum	58.40	4.28	53.28	425.98	72.84	2679.55	3.080
Minimum	30.90	-1.15	9.14	0.55	3.46	1408.21	2.140
Std. Dev.	8.69	0.98	13.67	121.94	15.06	427.18	0.198
Skewness	-0.54	0.54	-0.04	1.25	2.00	0.08	0.214
Kurtosis	2.24	3.51	1.67	3.58	6.35	1.53	3.233
Jarque-Bera	3.90	3.20	4.01	14.81	61.16	4.92	0.535
Probability	0.14	0.20	0.13	0.001	0.000	0.085	0.765
Observations	54	54	54	54	54	54	54

Source: The Authors (2024)

The descriptive statistics presented in Table 4.1 provide a comprehensive overview of the key economic indicators for the dataset from 1970 to 2023. The variables include Poverty (POV), Foreign Direct Investment (FDI), Trade Openness (TROPN), Exchange Rate (EXCHR), Inflation (INFL), Real GDP per Capita (RGDPPC), and Population Growth (POPGR). Each statistic offers insights into the central tendency, dispersion, and distribution shape of these variables. The mean values indicate the average levels of each variable over the observed period. For instance, the average poverty rate (POV) is 45.73%, while the average FDI is 1.24% of the GDP. Trade openness (TROPN) averages 29.47%, and the exchange rate (EXCHR) has a mean of 97.41. Inflation (INFL) averages at 18.30%, real GDP per capita (RGDPPC) at 1964.11 USD, and population growth (POPGR) at 2.623%. The mean poverty value of 45.73% over the period from 1970 to 2023 highlights a significant and persistent issue in Nigeria. This average suggests that nearly half of the population has been living in poverty for the past 50 years. Specifically, it means that approximately 4 out of every 10 Nigerians have been surviving on less than $2.15 per day, which is below the international poverty line. This statistic underscores the widespread and enduring nature of poverty in Nigeria, reflecting challenges in economic development, social inequality, and access to necessities.

The median values, which represent the middle point of the data, are close to the mean for most variables, suggesting a relatively symmetric distribution for these variables. However, the exchange rate and inflation show significant differences between their mean and median, indicating potential skewness. The maximum and minimum values highlight the range of the data. For example, the exchange rate ranges from 0.55 to 425.98, showing significant variability. Similarly, inflation ranges from 3.46% to 72.84%, indicating periods of both low and high inflation. The standard deviation (Std. Dev.) measures the dispersion of the data. High standard deviations for exchange rate (121.94) and inflation (15.06) suggest considerable volatility in these variables. In contrast, population growth has a low standard deviation (0.198), indicating stability over the period.

Skewness and kurtosis provide insights into the distribution shape. Negative skewness for poverty (-0.54) and trade openness (-0.04) suggests a leftward tail, while positive skewness for FDI (0.54) and exchange rate (1.25) indicates a rightward tail. High kurtosis values for inflation (6.35) and exchange rate (3.58) suggest a leptokurtic distribution, indicating more frequent extreme values. The Jarque-Bera test statistics and their associated probabilities assess the normality of the data. The low p-values for exchange rate (0.001) and inflation (0.000) indicate significant

deviations from normality, while other variables show higher p-values, suggesting they are closer to a normal distribution. Overall, these descriptive statistics provide a detailed snapshot of the economic variables, highlighting their central tendencies, variability, and distribution characteristics. This analysis is crucial for understanding the economic environment and making informed policy decisions.

Table 4.2: Outcome of the correlation matrix test

	POV	FDI	TROPN	EXCHR	INFL	RGDPPC	POPGR
POV	1.0000						
FDI	0.2077	1.0000					
TROPN	-0.1032	0.1179	1.0000				
EXCHR	-0.7602	-0.1586	0.5268	1.0000			
INFL	0.1837	0.1364	0.0272	-0.1816	1.0000		
RGDPPC	-0.8153	-0.0872	0.0808	0.6386	-0.337	1.0000	
POPGR	0.2029	-0.0707	-0.0968	-0.3258	-0.0699	0.0617	1.000

Source: The Authors (2024)

The correlation results indicate that poverty (POV) has a strong negative correlation with both exchange rate (EXCHR) and real GDP per capita (RGDPPC), suggesting that higher (stronger currency) exchange rates and GDP per capita are associated with lower poverty levels. The positive correlation between poverty and foreign direct investment (FDI) is weak, implying a slight increase in poverty with higher FDI, though this relationship is not substantial. Trade openness (TROPN) shows a weak negative correlation with poverty, indicating minimal impact. Inflation (INFL) has a weak positive correlation with poverty, suggesting that higher inflation slightly increases poverty. Lastly, population growth (POPGR) has a weak positive correlation with poverty, indicating that higher population growth is slightly associated with higher poverty levels. Overall, the results highlight the significant roles of exchange rate and GDP per capita in reducing poverty, while other factors show weaker associations.

Table 4.3: Outcomes of unit root test

	ADF Test Statistic		PP Test Statistics		
Variable	**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(d)**
Poverty	-0.3815 (0.9046)	-7.1974*** (0.0000)	-0.3776 (0.9052)	-7.1974*** (0.0000)	I(1)
FDI	-4.0613*** (0.0024)	-11.9212*** (0.0000)	-3.8970*** (0.0039)	-13.0294*** (0.0000)	I(0)

Trade Openness	-2.0653 0.2592)	-8.7089*** (0.0000)	-2.0653 (0.2592)	-8.8564*** (0.0000)	I(1)
Exchange rate	2.1756 (0.9999)	-4.6660*** (0.0004)	2.4356 (1.0000)	-4.6361*** (0.0004)	I(1)
Inflation	-3.5871*** (0.0093)	-7.4568*** (0.0000)	-3.4109*** (0.0149)	-15.2895*** (0.0000)	I(0)
Real GDP per capita	-0.7828 (0.8155)	-5.7477*** (0.0000)	-1.0445 (0.7307)	-5.9599*** (0.0000)	I(1)
Population Growth	-2.4712 (0.1283)	-10.2710*** (0.0000)	-3.1918** (0.0260)	-10.17491*** (0.0000)	I(1)

Note: ***, and ***, demonstrate that the series are stationary at 5%, and 1% respectively*

Source: The Authors (2024)

Table 4.3 shows the unit root tests of the variables. We apply Augmented Dickey-Fuller (ADF) by Dickey and Fuller (1979) and Phillips Perron (PP) by Phillips and Perron (1988). The results show that the foreign direct investment (FDI) and inflation rates are stationary at levels, that is they are I(0), while the other variables namely; poverty, trade openness, exchange rates, real GDP per capita, and population growth are non-stationary, but they become stationary at first difference. It implies that the variables meet the condition for ARDL, as they are all integrated of order I(0) and I(1). The NARDL model is applicable in the context of the selected macroeconomic series. Overall, the unit root tests revealed that there is not a single variable, which is I(2). Hence, we use the NARDL approach, which is entirely appropriate to explore the short and long-run results.

Table 4.4: Cointegration results for the models (ARDL and NARDL)

			Bound Critical values			
			1%		**5%**	
Model	**F- Statistic**	**K**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
Symmetric (ARDL)	4.13**	6	3.6	4.9	2.87	4.00
Asymmetric (NARDL)	4.37***	10	2.84	4.10	2.33	3.46

Note*: *** and **, denote statistically significant at 1% and 5% significant level respectively*

Source: The Authors (2024)

Table 4.4 presents the results of cointegration tests for two models: the Symmetric (ARDL) model and the Asymmetric (NARDL) model. The purpose of these tests is to determine whether a long-run relationship exists among the variables in the models.

4.2 Model Estimation

After the pre-estimation tests, we proceed to estimate the symmetric and asymmetric models. For the selection of suitable ARDL and NARDL specifications, the general-to-specific approach is applied. Moreover, we use the "Akaike Information Criterion" (AIC) approach to adopt appropriate lags.

4.2.1 ARDL Model

Table 4.5: Estimate from Linear ARDL model

Parameters	Coefficient	T-calculated	Probability
Panel A: Short-run coefficients			
Constant	2.868***	5.888	0.0000
@Trend	-0.012***	-6.181	0.0000
ΔFDI	-0.027**	2.576	0.0146
ΔEXCHR	0.053*	1.736	0.0918
ΔINFL	-0.026**	-2.493	0.0179
ΔINFL(-1)	-0.016	-1.656	0.1071
ΔINFL(-2)	0.062***	5.591	0.0000
ECM (-1)	-0.357***	-5.847	0.0000
Panel B: Long-run coefficients			
FDI	0.002	0.049	0.9611
TROPN	-0.093	-0.976	0.3361
EXCHR	0.177***	2.845	0.0076
INFL	0.090	1.195	0.2407
RGDPPC	-0.450***	-3.220	0.0029
POPGR	-0.350	-0.642	0.5256
Panel C: Diagnostics			
Durbin Watson = 2.13			
R^2 = 0.577			
CUSUM = Stable			
CUSUMQ = Slightly stable			

***Note**: ***, ** and *, denote statistically significant at 1%, 5%, and 10% significant levels respectively*

Source: The Authors (2024)

Table 4.5 shows the results of the Linear ARDL model. We estimated both the short-run (Panel A) and long-run (Panel B) versions of the model. The negative and significant trend in poverty reduction in Nigeria indicates progress over time. This decline could be attributed to various factors, such as economic growth, targeted social welfare programs, and policy interventions. Structural improvements, such as investments in education, healthcare, and infrastructure, may have contributed to lifting people out of poverty. In addition, successful poverty alleviation measures, including conditional

cash transfers, vocational training, and microfinance initiatives, could have played a crucial role. Though poverty may have been declining in Nigeria as shown in the log of poverty rate from 1970 to 2023 (see Figure 4.1), it is important to note that poverty is still a serious worry in Nigeria, where 3 to 4 in every 10 persons is considered poor.

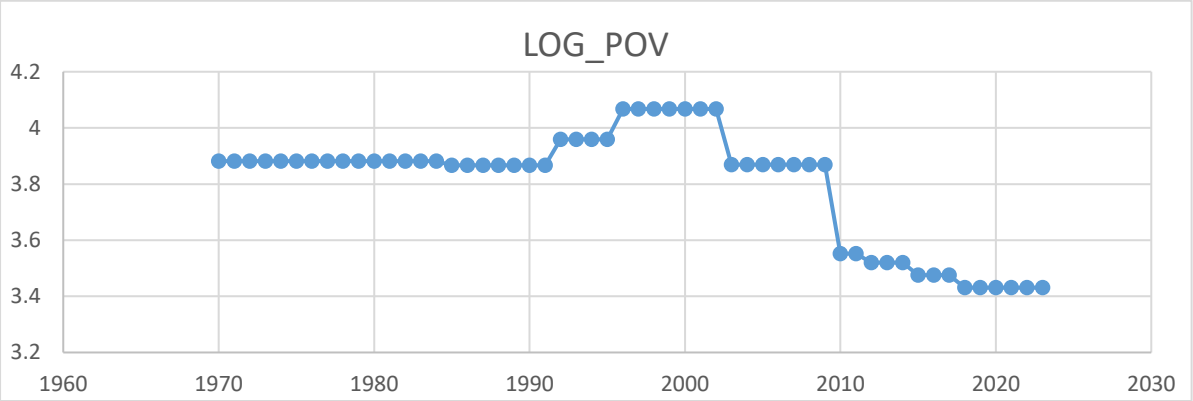


Figure 4.1: Trend of log of poverty in Nigeria from 1970 to 2023
Source: The Authors (2024)

In the short run, foreign direct investment (FDI) has a negative and statistically significant impact on poverty at a 5% significance level. This suggests that an increase in FDI contributes to poverty reduction. The mechanism behind this relationship lies in FDI's potential to create employment opportunities and stimulate economic activity. When foreign investors establish businesses or invest in existing enterprises, they often generate jobs, enhance productivity, and foster economic growth. These positive effects can directly lift people out of poverty or indirectly improve their well-being by boosting local economies.

The positive coefficient of the exchange rate, significant at the 10% level, implies that a depreciation of the Nigerian currency (i.e., weakening of the exchange rate) could potentially exacerbate poverty. This is because when the exchange rate depreciates, imported goods become more expensive. Nigeria is an import-dependent nation, meaning that expensive imports will hurt more. Furthermore, businesses that rely on imported inputs face higher production costs, which may result in reduced output and employment. Consequently, job losses and reduced economic activity can contribute to higher poverty rates.

The short-run impact of inflation is mixed. The immediate effect (ΔINFL) is negative and significant at the 5% level, indicating that rising inflation initially helps to reduce poverty, possibly through wage adjustments or increased nominal incomes. Also, the effect of inflation on poverty one period later (ΔINFL(-1)) is negative, though the effect is

not significant. Conversely, the effect two periods later (ΔINFL(-2)) is positive and highly significant. This underscores the nuanced relationship between inflation and economic outcomes. This complexity may arise from various factors, such as the interplay of monetary policy, exchange rates, and structural conditions within the broader economic landscape. Understanding these dynamics is crucial for formulating effective policy responses that mitigate inflation's adverse effects while promoting sustainable growth and social welfare. The Error Correction Mechanism (ECM) is negative and significant, indicating that any short-term deviations from the long-term poverty trend are corrected by 35.7% each period. This suggests a stable adjustment process towards the long-term equilibrium level of poverty.

In the long run, FDI has a positive but insignificant impact on poverty in Nigeria, suggesting that FDI does not have a meaningful impact on poverty reduction over the long term. This could imply that the benefits of FDI may not be sustained or adequately distributed to reduce poverty significantly. Trade openness (TROPN) has a negative but insignificant coefficient, indicating that, in the long run, increased trade openness does not significantly affect poverty. This might be due to unequal benefits from trade or inadequate integration into global markets. The positive and significant long-run coefficient for the exchange rate suggests that currency depreciation increases poverty over time. This could be due to higher import costs, inflationary pressures, or other adverse economic effects outweighing short-term competitiveness gains. Inflation has a positive but insignificant impact on poverty in the long run, indicating that persistent inflation may erode real incomes, but the effect is not strong enough to be statistically significant. Real GDP per capita has a significant negative coefficient, indicating that higher economic growth per capita strongly reduces poverty in the long run. This reinforces the importance of sustained economic growth for poverty alleviation. Population growth has a negative but insignificant coefficient, suggesting that population growth does not have a clear impact on poverty reduction in the long run. This could be due to varying effects of population growth depending on the context.

4.2.2 Non-Linear ARDL (NARDL) Model

The results presented in Table 4.6 are from a Nonlinear Autoregressive Distributed Lag (NARDL) model where the dependent variable is poverty in Nigeria from 1970 to 2023. The NARDL model allows for the examination of both positive and negative changes in explanatory variables and their asymmetric effects on the dependent variable.

Table 4.6A: Estimate from the NARDL model

Dependent Var: Poverty

Parameters	Coefficient	T-calculated	Probability
Panel A: Short-run coefficients			
C	11.070***	10.734	0.0000
@TREND	-0.098***	-10.740	0.0000
ΔFDI_POS	0.008	0.401	0.7001
ΔFDI_POS(-1)	-0.083***	-4.217	0.0040
ΔFDI_POS(-2)	-0.084***	-4.374	0.0033
Δ FDI_NEG	0.061***	4.718	0.0022
ΔFDI_NEG(-1)	0.001	0.077	0.9411
ΔFDI_NEG(-2)	-0.006	-0.516	0.6216
ΔTROPN_POS	0.103**	3.076	0.0179
ΔTROPN_POS(-1)	-0.436***	-6.134	0.0005
ΔTROPN_POS(-2)	-0.301***	-5.030	0.0015
ΔTROPN_NEG	-0.205***	-4.516	0.0027
ΔTROPN_NEG(-1)	0.433***	6.139	0.0005
ΔTROPN_NEG(-2)	0.323***	5.370	0.0010
ΔEXCHR_POS	0.007	0.231	0.8236
ΔEXCHR_POS(-1)	0.168***	4.827	0.0019
ΔEXCHR_POS(-2)	0.160***	4.607	0.0025
ΔEXCHR_NEG	-0.613**	-3.293	0.0133
ΔEXCHR_NEG(-1)	-1.021***	-4.273	0.0037
ΔEXCHR_NEG(-2)	0.465*	2.217	0.0621
ΔINFL_POS	-0.067**	-3.027	0.0192
ΔINFL_POS(-1)	-0.013	-0.660	0.5304
ΔINFL_POS(-2)	-0.121***	-8.585	0.0001
ΔINFL_NEG	0.022	1.222	0.2611
ΔINFL_NEG(-1)	-0.044**	-2.606	0.0351
ΔINFL_NEG(-2)	-0.028	-1.665	0.1397
ΔRGDPPC	-0.359***	-3.709	0.0076
ΔRGDPPC(-1)	0.116	0.995	0.3527
ΔRGDPPC(-2)	-0.287	-3.332	0.0126
ΔPOPGR	0.029	0.268	0.7965
ΔPOPGR(-1)	-0.352**	-2.431	0.0453
ΔPOPGR(-2)	-0.190	-1.478	0.1829
ECM(-1)	-0.768***	-10.820	0.0000

Parameters	Coefficient	T-statistics	Probability
Panel B: Long-run coefficients			
FDI_POS	0.110	0.746	0.4801
FDI_NEG	0.072	0.787	0.4571
TROPN_POS	0.909	2.144	0.0692
TROPN_NEG	-0.985**	-2.402	0.0473
EXCHR_POS	-0.181	-0.941	0.3781
EXCHR_NEG	-1.162	-0.621	0.5543
INFL_POS	-0.006	-0.104	0.9202
INFL_NEG	0.194	1.444	0.1920
RGDPPC	-1.436***	-3.788	0.0068
POPGR	1.225*	2.034	0.0814
Panel C: Diagnostics			
Durbin Watson = 2.22			
R^2 = 0.95			
CUSUM = Stable			
CUSUMQ = Stable			

*Note: ***, ** and *, denote statistically significant at 1%, 5%, and 10% significant levels respectively*

Source: The Authors (2024)

In the short run, the constant term is highly significant with a positive coefficient of 11.070, indicating a baseline level of poverty. The trend variable (@TREND) has a significant negative coefficient (-0.098), suggesting that poverty decreases over time.

Foreign Direct Investment (FDI) shows mixed effects. Positive changes in FDI (ΔFDI_POS) are not significant in the current period but have significant negative coefficients in the first and second lags, indicating that past increases in FDI reduce poverty. Conversely, negative changes in FDI (ΔFDI_NEG) have a significant positive coefficient in the current period, suggesting that reductions in FDI increase poverty. Trade openness (TROPN) also exhibits significant effects. Positive changes in trade openness (ΔTROPN_POS) initially increase poverty but have significant negative coefficients in the first and second lags, indicating a reduction in poverty over time. Negative changes in trade openness (ΔTROPN_NEG) decrease poverty in the current period but increase it in subsequent periods. Exchange rate (EXCHR) fluctuations show that positive changes (ΔEXCHR_POS) are not significant in the current period but have significant positive coefficients in the first and second lags, indicating that past increases in the exchange rate reduce poverty. Negative changes (ΔEXCHR_NEG) have a significant negative coefficient in the current period,

suggesting that decreases in the exchange rate increase poverty.

Inflation (INFL) has mixed effects. Positive changes in inflation (ΔINFL_POS) significantly reduce poverty in the current period and second lag, while negative changes (ΔINFL_NEG) have a significant negative coefficient in the first lag, indicating that past decreases in inflation reduce poverty. Real GDP per capita (RGDPPC) has a significant negative coefficient in the current period, indicating that increases in real GDP per capita reduce poverty. Population growth (POPGR) shows mixed effects, with a significant negative coefficient in the first lag, suggesting that past increases in population growth reduce poverty.

The error correction term (ECM(-1)) is highly significant and negative, indicating a strong adjustment mechanism towards long-run equilibrium.

In the long run, the coefficients for FDI (FDI_POS and FDI_NEG) are not significant, suggesting that FDI does not have a long-term impact on poverty. Trade openness (TROPN_POS) is marginally significant with a positive coefficient, indicating that increased trade openness may reduce poverty. However, negative changes in trade openness (TROPN_NEG) have a significant negative coefficient, suggesting that reductions in trade openness increase poverty. Exchange rate changes (EXCHR_POS and EXCHR_NEG) are not significant in the long run, indicating no long-term impact on poverty. Inflation (INFL_POS and INFL_NEG) also shows no significant long-term effects. Real GDP per capita (RGDPPC) has a significant negative coefficient, indicating that increases in real GDP per capita reduce poverty in the long run. Population growth (POPGR) is marginally significant with a positive coefficient, suggesting that higher population growth may increase poverty in the long run.

The diagnostic tests indicate that the model is well-specified. The Durbin-Watson statistic is 2.22, suggesting no autocorrelation. The R-squared value is 0.95, indicating that 95% of the variation in poverty is explained by the model. The CUSUM and CUSUMQ tests show that the model is stable over time. Overall, the results highlight the importance of economic variables such as trade openness, exchange rates, inflation, real GDP per capita, and population growth in influencing poverty levels both in the short run and long run. The significant error correction term underscores the model's ability to adjust towards long-term equilibrium.

5. Conclusion and Recommendations

5.1 Conclusion

The findings indicate that Foreign Direct Investment (FDI) has a significant short-term impact on poverty reduction, primarily through job creation and economic

stimulation. However, its long-term effects are negligible, suggesting that the benefits may be short-lived or unevenly distributed. Trade openness shows mixed results; while initial increases do not immediately alleviate poverty, sustained openness positively impacts poverty reduction over time. Conversely, reductions in trade openness have an immediate adverse effect on poverty levels.

Exchange rate depreciation is linked to higher poverty levels in both the short and long term, reflecting Nigeria's reliance on imports and the inflationary pressures from a weak currency. Inflation has a dual impact: it may reduce poverty in the short term due to wage adjustments or increased nominal incomes, but sustained inflation erodes real income, worsening poverty. Economic growth, measured by real GDP per capita, consistently reduces poverty, indicating a direct correlation between growth and poverty alleviation. Population growth presents a complex dynamic, offering short-term benefits but posing long-term challenges due to the strain on resources and services.

5.2 Policy Recommendations

To reduce poverty, first, policies should prioritize sustained economic growth with investments in infrastructure, education, healthcare, and technology. Second, quality FDI should be encouraged, focusing on long-term investments that create jobs and develop skills. Third, trade openness should be maintained, supported by complementary policies to aid affected sectors and avoid protectionist measures. Fourth, exchange rate stability is crucial to reducing import-related inflationary pressures that disproportionately affect low-income households. Fifth, effective inflation management is essential, with monetary policies aimed at keeping inflation within manageable levels. Sixth, population management policies should promote balanced growth through family planning, healthcare, and education initiatives. Finally, a stable and predictable economic environment is vital, integrating trade liberalization, inflation control, exchange rate management, and FDI promotion.

References

Abernethy, V. D. (2002). Population dynamics: Poverty, inequality, and self-regulating fertility rates. *Population and Environment, 24*(1), 69-96.

Agusalim, L. (2017). The dynamic impact of trade openness on poverty: An empirical study of Indonesia's economy. *International Journal of Economics and Financial Issues, 7*(4), 566-574.

Ahluwalia, M. N. G., Carter, N. G., & Chenery, H. B. (1979). Growth and poverty in developing countries. *Journal of Development Economics, 3*(3), 307-342.

Aigbokhan, B. E. (2008). Growth, Employment, Institutional Development, and Poverty

Alleviation in Nigeria. *New Growth and Poverty Alleviation Strategies for Africa: International and Regional Perspectives*, *13*, 45.

Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy Modeling*, *26*(5), 627-639.

Anyanwu, J. C. (2012). Why does foreign direct investment go where it goes?: New evidence from African countries. *Annals of economics and finance*, *13*(2), 425-462.

Apergis, N., & Cooray, A. (2018). Asymmetric real exchange rates and poverty: The role of remittances. *Emerging Markets Review, 35*, 111-119.

Awokuse, T. O. (2008). Trade openness and economic growth: is growth export-led or import-led?. *Applied Economics*, *40*(2), 161-173.

Baloch, M. A., Khan, S. U. D., Ulucak, Z. Ş., & Ahmad, A. (2020). Analysing the relationship between poverty, income inequality, and CO2 emission in Sub-Saharan African countries. *Science of the Total Environment, 740*, 139867.

Bharadwaj, A. (2014). Reviving the globalization and poverty debate: Effects of real and financial integration on the developing world. *Advances in Economics and Business, 2*(1), 42-57.

Danlami, I. A., Hidthiir, M. H., & Hassan, S. (2020). Evidence of inflation-poverty causality in Nigeria based on the Toda-Yamamoto dynamic causality test. *Journal of Business and Social Review in Emerging Economies, 6*(1), 277-286.

Dollar, D., & Kraay, A. (2002). Growth is good for the poor. *Journal of Economic Growth, 7*(3), 195–225.

Fields, G. S. (1989). Changes in poverty and inequality in developing countries. *The World Bank Research Observer, 4*(2), 167-185.

Figini, P., & Santarelli, E. (2006). Openness, economic reforms, and poverty: Globalization in developing countries. *The Journal of Developing Areas, 39*(1), 129-151.

Fowowe, B., & Shuaibu, M. I. (2014). Is foreign direct investment good for the poor? New evidence from African countries. *Economic Change and Restructuring, 47*(4), 321-339.

Gohou, G., & Soumaré, I. (2012). Does foreign direct investment reduce poverty in Africa and are there regional differences? *World Development, 40*(1), 75-95.

Gunter, B. G., Cohen, M. J., & Lofgren, H. (2005). Analysing macro-poverty linkages: An overview. *Development Policy Review, 23*(3), 243-265.

Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Narloch, U., Rozenberg, J., & Vogt-Schilb, A. (2014). Climate change and poverty--an analytical framework. *World Bank Policy Research Working Paper (7126)*.

Hassan, A. K. (2005). Trade openness and economic growth: Search for a causal relationship. *South Asian Journal of Management, 12*(4), 38-55.

Hassine, N. B., & Kandil, M. (2009). Trade liberalisation, agricultural productivity, and poverty in the Mediterranean region. *European*

Review of Agricultural Economics, 36(1), 1-29.

Maier, R. (2005). Exchange rate regimes and pro-poor growth. *International Finance, 8*(1), 87-117.

Moser, G., & Ichida, T. (2001). Economic growth and poverty reduction in Sub-Saharan Africa.

Omoyibo, K. U. (2013). Leadership, governance, and poverty in Nigeria. *Mediterranean Journal of Social Sciences*, *4*(6), 29-36.

Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In S. Strom (Ed.), *Econometrics and economic theory in the 20th century: The Ragnar Frisch centennial symposium* (pp. 371-413). Cambridge University Press.

Rizk, R., & Slimane, M. B. (2018). Modelling the relationship between poverty, environment, and institutions: a panel data study. *Environmental science and pollution research*, *25*(31), 31459-31473.

Sarel, M. (1996). Nonlinear effects of inflation on economic growth. *Staff Papers*, *43*(1), 199-215.

Todaro, M. P., & Smith, S. C. (2012). Economic development 11th ed. Pearson, Addison Wesley: New York-USA.

Ulaşan, B. (2015). Trade openness and economic growth: panel evidence. *Applied Economics Letters*, *22*(2), 163-167.

World Bank. (2000). *World Development Report 2000/2001: Attacking Poverty*. Oxford University Press.