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Exploring the Relationship Between Inequality and Economic Growth

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Abstract: Studies on the relationship between income inequality and economic growth have attracted much interest, particularly in low-income countries, such as Nigeria. While some scholars posit that income inequality stimulates economic growth, others argue that it has a negative effect, leading to an increase in a country's poverty level. This study examines the empirical relationship between income inequality and economic growth in Nigeria by assessing whether an inverted U-shaped connection exists between these two variables, as predicted by the Kuznets hypothesis. This study employs an Autoregressive Distributed Lag (ARDL) model, and the findings indicate an inverted U-shaped relationship in the short run. The research further reveals that inflation and the real exchange rates exhibit a statistically significant and negative correlation with income inequality in the long-run. Likewise, evidence suggests that political stability has a statistically significant positive long-term correlation with income inequality, while in the short term it seems to improve income inequality in Nigeria. Additionally, in the short run, real exchange rates reveal a statistically significant association that exacerbates income inequality.

Keywords: Inequality, economic growth, gini coefficient, Kuznets curve

1. Introduction

Bridging the gap between rich and poor has been a major concern in Nigeria and the world. For the past five decades, the gap between the rich and the poor has widened, and global GDP per capita has continued to grow (WID, 2017).

This paper was modified from the original term paper submitted by the author to the University of Hull in April 2020. Modifications were made to the empirical analysis and results, while the introduction and literature review were largely preserved.

Inequality often reflects poverty in rural and urban areas. The concept of inequality refers to inequitable circumstances which manifest in terms of unequal distribution of resources within a society. In economic terms, inequality is an outcome of a skewed distribution of income. If inequality exists in a country, a group often referred to as a capitalist gets a bigger share of the total income, while other groups of society get less share (Nurudeen & Ibrahim, 2014).

While factors such as unequal access to education, disparity between urban and rural areas, and corruption by public officials are alleged to fuel within-inequality in a country, some other factors such as capital mobility between countries also cause inequality, as investors and firms would move their investment to other countries where they can access cheap labour to reduce production costs (Nurudeen & Ibrahim, 2014). Some of the consequences of income inequality are reflected in how the poor are tempted to engage in crime and other disruptive activities (Alesina & Perotti, 1994). Higher inequality tends to reduce economic productivity. Countries practising democracy or even dictatorships will maintain income-equalising transfers if they decrease the chances of political instability or civil unrest (Barro, 2000).

Evaluating the relationship between higher income inequality and economic growth is a challenging and highly debated topic in the literature. While theoretically the effect can be either positive or negative, some argue that increased income inequality, resulting from substantial rewards for risky entrepreneurship and innovation, can stimulate economic growth. However, others suggest that higher inequality may hinder growth if low-income households experience reduced productivity, owing to slower human capital accumulation and greater financial exclusion (Berg *et al.*, 2012; Piketty & Goldhammer, 2014). Furthermore, there is currently a lack of agreement among empirical studies on the impact of inequality on economic growth and sustainability. While some studies have demonstrated a strong and detrimental association between these two variables, others have failed to find a statistically significant relationship. (Berg *et al.*, 2012; Cingano, 2014).

In the global arena, various studies have yielded contrasting results on the correlation between economic progress and income inequality. While some studies have demonstrated a positive association, others have indicated a different relationship (Barro, 2000; Forbes, 2000). As it relates to Nigeria, the extant literature attempts to triangulate the relationship between income inequality and economic growth by including another measure: the poverty rate (Aigbokhan, 2000; Nurudeen & Ibrahim, 2014; Kolawole *et al.*, 2015). A rise or reduction in income inequality and economic growth can lead to a rise or reduction in poverty.

However, this study examines the relationship between income inequality and economic growth in Nigeria between 1992 and 2022. Understanding the interaction between economic growth and income inequality will equip Nigerian policymakers with the knowledge and necessary policy tools to address Nigerian challenges. Nigeria faces issues such as high poverty, frequent labour union agitations, poor standards of living, and social and political disturbances. (Nurudeen & Ibrahim, 2014). Other significant challenges that merit attention include inflation, high exchange rates, and security issues, all of which are pressing and critical concerns. With inflation alarmingly high, surpassing two-decade records, and Nigerian currency losing considerable value, coupled with the prevalence of security issues (World Bank, 2023), the situation is dire and requires attention.

It is in light of the high-income inequality Nigerians face and coupled with the fact that the country has experienced some economic growth in recent years, which makes it appealing to examine the relationship between economic growth and income inequality. The Study examines theories pertinent to inequality and economic growth, tests Kuznet's (1955) inverted U-curve theory and adopts the Autoregressive Distributed Lag (ARDL) error-correction model to analyse and answer the research questions. This research is structured into six distinct sections. The first section, denoted as 1, serves as an introduction, followed by a literature review in section 2. The data sources and description are outlined in section 3, while the empirical analysis is presented in section 4. The empirical results and discussion are detailed in section 5, and the research concludes with recommendations and conclusions in section 6.

2. Literature Review

The relationship between income inequality and economic growth has been widely studied; however, there is no clear agreement on its impact. Some research suggests that it is difficult to determine whether income inequality has a significant effect on growth, whether it has a positive or negative impact, or if it has any impact (Klasen *et al.*, 2016), while other economists argue that inequality has detrimental consequences for economic growth (Aghion *et al.*, 1999; Stigliz, 2012).

The extant literature analyses the effects of income inequality on macroeconomic performance, as shown by economic growth rates. This relationship between economic growth and inequality has been a subject of interest since the seminal work of Kuznets (1955), which established a foundation for examining the connection between income inequality and economic growth. Kuznets argued that there is a trade-off between economic growth and inequality, particularly during the early stages of modernisation. He posits that during the transition from an agricultural, subsistence-based economy to a modernised, growth-oriented economy, income inequality increases but eventually stabilises before declining again. Kuznet's (1955) study on the relationship between income inequality and economic growth described it as an inverted U-shape, where income inequality increases during the early stage of economic growth and then decreases as the economy continues to expand.

As an extension of Kuznets' theory, List and Gallet (1999) demonstrated a significant correlation between income inequality and per capita income. In their seminal work, "The Kuznets curve: What happens after the inverted U?", they find that for lower- to middle-income countries, the Kuznets curve takes an inverted-U shape. Although the relationship between income inequality and per capita income again becomes positive for higher-income countries, this outcome suggests that income equity remains an important goal for policymakers (List & Gallet, 1999).

To date, many theories have been proposed to analyse this macroeconomic relationship. One of these is Keynes' General Theory. It is a popular belief among many scholars influenced by Keynes's General Theory that saving rates rise with the level of income. If this is true, it implies that the redistribution of resources from rich to poor tends to reduce the aggregate savings rate in an economy. Therefore, an increase in inequality tends to increase the investment level in an economy. The result is that greater inequality enhances economic growth. This is sometimes perceived as a complementary reason for the positive effect of inequality on economic growth (Barro, 2000).

According to political economy theory, if the average income in an economy exceeds the median income, the general voting preference tends to favour the redistribution of resources from rich to poor. Redistribution can take the form of regulatory policies and public expenditure programs, such as childcare and education, or explicit transfer payments (Alesina & Perotti, 1994). Political economy theorists justified their position by sighting the consequences of income inequality in a country which could include social unrest, increase in poverty, rent seeking, market imperfection, etc. (Delbianco *et al.*, 2014). However, in situations where political decisions determine economic policies, inequality is harmful to economic growth (Torsten & Tabellini, 1994).

Chong and Grandstein (2007) investigated the interactive relationship between institutional quality and income inequality using dynamic panel and linear feedback analysis. Their findings revealed that these two factors are interconnected and can reciprocally impact each other during the economic development process. The quality of institutions plays a crucial role in determining distribution and growth outcomes. Income inequality when high can foster poor institutions, which in turn exacerbates inequality and reduces efficiency, ultimately leading to low long-term growth rates. When income inequality is high, political decisions tend to favour wealthy minorities, resulting in unfairness towards the less fortunate (Mdingi & Ho, 2021).

In the context of credit markets that are less than perfect, there exists a restricted capacity to obtain loans, leading to a state of affairs in which the returns on investment opportunities are not necessarily equal at the margins (Piketty, 1997). Thus, the imperfection in this market is the result of asymmetric information and the limitations of legal institutions. An example is reflected in cases where creditors find it difficult to recoup defaulted loans because of imperfections in law enforcement. With limited access to credit, individuals' income and asset levels determine the exploitation of investment opportunities. In this case, the redistribution of income and assets from rich to poor is a viable mechanism that leads to a reduction in inequality and increases economic growth (Barro, 2000).

Forbes (2000) also shares the belief that income inequality has a positive relationship with economic growth. Forbes posits that the improved dataset and panel data estimation of income inequality led to a reduction in measurement errors and the elimination of omitted variable biases witnessed in earlier literature that income inequality has a negative relationship with economic growth. This finding suggests that, in the short and medium terms, income inequality has a statistically positive relationship with economic growth (Forbes, 2000).

Royuela *et al.* (2019) conducted a study to investigate the connection between income inequality and economic growth in more than 200 comparable regions across 15 OECD countries between 2003 and 2013, using a panel framework. The authors found a generally negative correlation between income inequality and economic growth in the OECD regions. Breunig and Majeed (2020) examined the connection between economic growth and inequality in 152 countries over a period of 55 years from 1956 to 2011. The results indicate that high levels of inequality hinder growth, and countries with higher poverty rates are more severely affected by the negative impact of inequality on economic growth.

Some inconsistent estimates of the variables have also been used to assess the relationship between income inequality and economic growth. Adinde and Stephannie (2017) investigate the effects of income inequality on economic growth in Nigeria between 1984 and 2005. Their research aimed to determine the form of the Kuznets curve in Nigeria by employing multiple linear regression and econometric modelling. The study finds that the Kuznets curve does not hold true for the country but that the relationship is linear. However, the data for the Gini coefficient were sourced from an article (Awe & Rufus, 2012) that calculated income distribution in Nigeria based on employment rates and average income levels. The estimates obtained in this study were found to be significantly higher than the validated open-source data available, such as those provided by the World Development Indicator.

Similarly, Igwegbe and Amaka (2021) investigated the various factors that impact income inequality in Nigeria by employing the fully modified ordinary least squares (FMOLS) method to analyse annual time-series data from 1981 to 2018. Their study assessed both traditional and emerging determinants of income inequality, including education, inflation, poverty, economic growth, technology, globalisation, labour market policies, and rural-urban drift. The results show that the graph of income inequality in Nigeria is linear rather than an inverted U-shaped Kuznets curve. However, the study did not demonstrate how the Gini coefficient was calculated. Based on the WDI (2024), the available open-source data for the Gini coefficient are incomplete.

The relationship between income inequality and economic growth has been a subject of much debate and research, as evidenced by Mdingi and Ho (2021). Despite various studies, there is no clear consensus on the subject and methodological challenges abound. Therefore, further research is necessary to better understand the complex relationship between these two variables. This study intends to fill this knowledge gap by assessing the relationship between income inequality and the economic growth of Nigeria for the period 1992-2022. The primary objective of this research is to determine whether the Kuznets hypothesis is applicable in the context of Nigeria. Furthermore, to evaluate the hypothesis that suggests there is no meaningful connection between income inequality and economic growth. The hypotheses to be tested are:

H_0 : *There is no significant relationship between income inequality and economic growth.*

H_1 : *There is significant relationship between income inequality and economic growth.*

H_0 : *The Kuznets (1955) hypothesis is applicable to Nigeria.*

H_1 : *The Kuznets (1955) hypothesis is not applicable to Nigeria.*

3. Data Sources and Description

To conduct an extensive analysis of Nigeria's inequality and economic growth, we utilised data spanning the period from 1992 to 2022 sourced from the World Development Indicator (WDI). The World Development Indicators (WDI) serve as the primary repository of development indicators derived from the World Bank, which is sourced from reputable international organisations. It provides the most recent and accurate global development data, including national, regional, and international estimates (WDI, 2024). The selected variables, including Gross Domestic Product per capita (GDPC) growth rate, the Gini coefficient, inflation rates, real exchange rates, and political stability, were chosen to investigate the relationship between national income inequality and economic growth.

Due to missing data, the Gini coefficient and political stability variables were extrapolated using the last known values for the missing year's data point, as suggested in extant literature (Bennett, 2001; Rue *et al.*, 2008). In addition, we recognise that the objective of data analysis is to deliver unbiased estimates of population parameters, as well as to conduct accurate hypothesis testing, as suggested by Newman (2014). These issues are addressed in the post-estimation examination of the empirical results in Section 1.5.1.

Table 1 provides a concise overview of the abbreviated variables, along with their summary statistics, while Table 2 contains all variables and their respective definitions.

Table 1: Variable Summary Statistics and Description

Variable	*Variable Desc.*	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
gdpcgrt	Gdpc growth rate	31	1.499416	3.615641	-4.50715	12.27614
gini	Gini coefficient	31	41.45484	6.567437	35.1	51.9
infl	Inflation	31	18.59428	16.48649	5.388008	72.8355
realexch	Real exchange rates	31	112.1357	49.03658	49.77629	273.0093
polstab	Political stability	31	8.755808	6.575697	2.415459	26.59575

(data from: WDI, 2024)

Table 2: Variable Definition

Variables	*Definition*
GDPCGRT	The annual growth rate of GDP per capita, measured in local currency and adjusted for inflation, is calculated by dividing the country's gross domestic product by its mid-year population.
INFL	Inflation as measured by the consumer price index represents the yearly percentage change in the average cost of a set of goods and services, which may be adjusted periodically, such as annually.
REALEXCH	The real effective exchange rate is calculated by dividing the nominal effective exchange rate (which assesses the value of a currency against a group of foreign currencies) by a price deflator or cost index.
POLSTAB	The concept of Political Stability and Absence of Violence/Terrorism gauges the likelihood of political instability and/or politically motivated violence, including terrorism. The percentile rank signifies the country's standing among all countries that are part of the aggregate indicator, with (0) being the lowest and (100) the highest.
(WDI, 2024)	

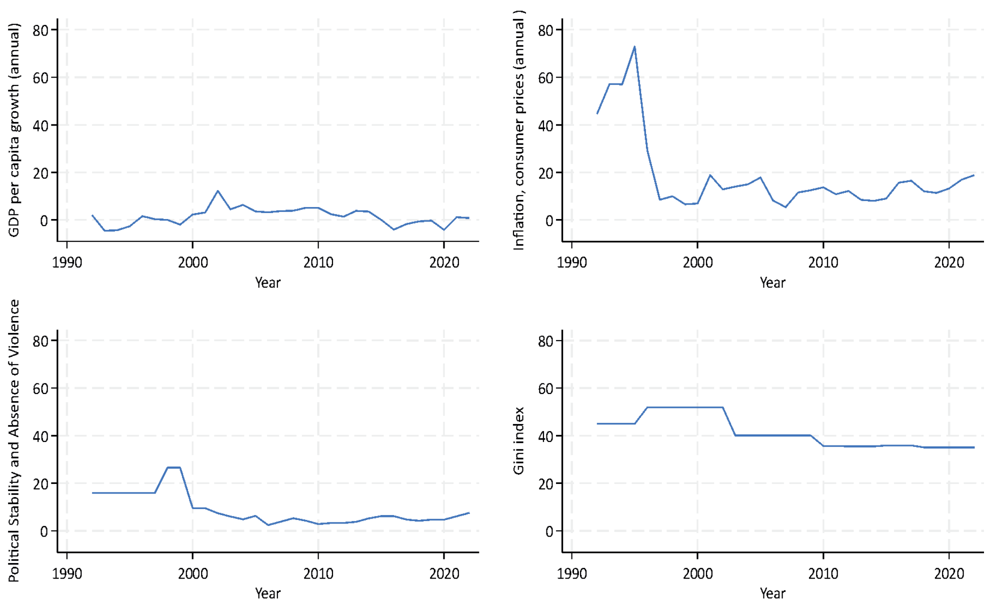

Figure 1: GDP per capita | Political stability | Inflation | Gini (Created with Stata, data from WDI (2024))

Referring to Figures 1 and 2, it is evident that the Gini coefficient has witnessed a decline in recent years, whereas the growth rates of GDP per capita, inflation rates, and political stability have fluctuated. However, inflation, exchange rates, and political stability show upward trends. Additionally, real exchange rates have been increasing since the early 2000s, posing a significant challenge to Nigeria.

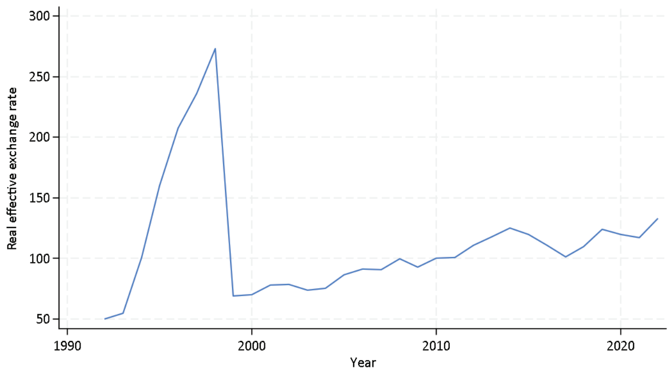

Figure 2: Real Effective Exchange Rates (Created with Stata, data from WDI (2024))

4. Empirical Analysis

4.1. Simon Kuznets' hypothesis

Simon Kuznets' hypothesis, which was presented in his 1955 work, suggests that economic growth may initially worsen income inequality before eventually improving it during the later stages of development (Kuznets, 1955). In order to test this hypothesis as it relates to Nigeria, two equations were derived from the works of Kim *et al.* (2011) and Gruber and Kosack (2014) to assess the linear and non-linear connections between economic growth and income inequality.

$$GINI_t = \beta_0 + \beta_1 GDPCGRT_t + \beta_2 Z' + \varepsilon_t \quad (1)$$

$$GINI_t = \beta_0 + \beta_1 GDPCGRT_t + \beta_2 GDPCGRT_t^2 + \beta_3 Z' + \varepsilon_t \quad (2)$$

The Gini coefficient (GINI) is used to proxy income inequality in year *t*, while the GDP per capita growth rate (GDPCGRT) is used to measure economic growth in year *t*. Vector Z' contains four economic and institutional variables that may affect Inequality. β_0 and ε_t are the intercept and normally distributed error term. β_1, β_2 and β_3 are the slope of the coefficient to be estimated.

To demonstrate the Kuznets inverted U-curve, the following parameters are expected in equation (2): $\beta_1 > 0$ and $\beta_2 < 0$ ($|\beta_1| > |\beta_2|$). The employment of quadratic equations aligns with Kuznets' original inverted U-shaped curve, delivering a comprehensive structure for comprehending the interconnections between income inequality, economic growth, and additional explanatory factors. The quadratic component provides insight into the inclination of the curve, revealing its steepness and orientation. Nonetheless, according to empirical literature, the S-curve is indeed an extension of Kuznets' inverted U-shaped curve (List & Gallet, 1999). Although the relationship between income inequality and per capita income becomes positive again for higher-income countries, it is expedient to examine this phenomenon, as it relates to Nigeria. Therefore, the cubic term of the GDPCGRT is included in equation three.

$$GINI_t = \beta_0 + \beta_1 GDPCGRT_t + \beta_2 GDPCGRT^2 + \beta_3 GDPCGRT_t^3 + \beta_4 Z' + \varepsilon_t \quad (3)$$

4.2. Autoregressive Distributed Lag (ARDL) Error-Correction model

The main estimation technique used for the analysis was the Autoregressive Distributed Lag (ARDL) error-correction model. This method has gained significant popularity and is well-suited for examining short- and long-term relationships, which has led to its extensive use in empirical research over the past few years. Furthermore, the ARDL model is a more statistically significant approach for determining cointegration relationships in small sample sizes (Pesaran *et al.*, 2001; Nayaran, 2004). In addition, the ARDL method is free of endogeneity issues. Moreover, this approach can be used regardless of whether the regressors are purely order one [I(1)], purely order zero [I(0)], or a combination of both. Finally, by using the ARDL method, the researcher can obtain unbiased and efficient estimators for the model (Nayaran, 2004).

The generalised ARDL *(p,q)* model based on the work of Pesaran and Shin (1995) and Adeleye (2018) is specified as

$$Y_t = \gamma_{0i} + \Sigma_{i=1}^{p} \delta_i \ Y_{t-1} + \Sigma_{i=0}^{q} \beta_i' X_{t-1} + \varepsilon_{it} \quad (4)$$

Where Y_t' is a vector and the variables in $(X_t')'$ could be I(0) or I(1) or cointegrated. β and δ are coefficients. γ is the constant while *i = 1,… k. p,q* are the optimal lag orders for the dependent variable and independent variables respectively. ε_{it} is a vector of the error terms. The unobserved *zero 0* is the white noise vector process. This can be serially correlated or independent.

4.2.1. Pesaran Shin Smith (2001) ARDL Cointegration Bounds Test

The initial stage in the ARDL model entails conducting a hypothesis test for the bounds test of cointegration. Pesaran *et al.* (2001) established two sets of critical values, referred to as upper and lower critical bounds, for the cointegration test. The lower critical bound assesses whether all variables are stationary at a level, indicating that there is no cointegration among them. Conversely, the upper bound considers all variables that are stationary only at the first difference, indicating the presence of cointegration. The hypotheses tested were as follows:

$$H_0 : b_{1i} = b_{2i} = b_{3i} = b_{4i} = b_{5i} = 0, \qquad \text{(where i = 1, 2, 3, 4, 5)}$$

$$H_0 : b_{1i} \neq b_{2i} \neq b_{3i} \neq b_{4i} \neq b_{5i} \neq 0,$$

The linear Cointegration Bounds Test equation are as follows:

$$\Delta gini_t = a_{01} + b_{11} gini_{t-1} + b_{21} gdpcgrt_{t-1} + b_{31} infl_{t-1} + b_{41} realexch_{t-1} + b_{51} polstab_{t-1} + \sum_{i=1}^{p} a_{l1} \Delta gini_{t-1} + \sum_{i=1}^{q} a_{2i} \Delta gdpcgrt_{t-1} + \sum_{i=1}^{q} a_{3i} \Delta infl_{t-1} + \sum_{i=1}^{q} a_{4i} \Delta realexch_{t-1} + \sum_{i=1}^{q} a_{5i} \Delta polstab_{t-1} + \varepsilon_{1t} \tag{5}$$

followed by quadratic Cointegration Bounds Test

$$\Delta gini_t = a_{02} + b_{12} gini_{t-1} + b_{22} gdpcgrt_{t-1} + b_{32} gdpcgrt^2{}_{t-1} + b_{42} infl_{t-1} + b_{52} realexch_{t-1} + b_{62} polstab_{t-1} + \sum_{i=1}^{p} a_{l1} \Delta gini_{t-1} + \sum_{i=1}^{q} a_{2i} \Delta gdpcgrt_{t-1} + \sum_{i=1}^{q} a_{3i} \Delta gdpcgrt^2_{t-1} + \sum_{i=1}^{q} a_{4i} \Delta infl_{t-1} + \sum_{i=1}^{q} a_{5i} \Delta realexch_{t-1} + \sum_{i=1}^{q} a_{6i} \Delta polstab_{t-1} + \varepsilon_{2t} \tag{6}$$

and the cubic Cointegration Bounds Test

$$\Delta gini_t = a_{03} + b_{13} gini_{t-1} + b_{23} gdpcgrt_{t-1} + b_{33} gdpcgrt^2{}_{t-1} + b_{43} gdpcgrt^3{}_{t-1} + b_{53} infl_{t-1} + b_{63} realexch_{t-1} + b_{73} polstab_{t-1} + \sum_{i=1}^{p} a_{l1} \Delta gini_{t-1} + \sum_{i=1}^{q} a_{2i} \Delta gdpcgrt_{t-1} + \sum_{i=1}^{q} a_{3i} \Delta gdpcgrt^2_{t-1} + \sum_{i=1}^{q} a_{4i} \Delta gdpcgrt^3_{t-1} + \sum_{i=1}^{q} a_{5i} \Delta infl_{t-1} + \sum_{i=1}^{q} a_{6i} \Delta realexch_{t-1} + \sum_{i=1}^{q} a_{7i} \Delta polstab_{t-1} + \varepsilon_{3t} \tag{7}$$

The ARDL cointegration method was used to estimate the parameters of the equations using a maximum of two lags to prevent a reduction in the degrees of freedom. The result indicates that the F-statistics from the Pesaran Shin Smith

(2001) ARDL cointegration bounds test for the linear equation is higher than the I-O series at the 5% significant levels. This implies that there is cointegration among the variables. See Appendix 1. However, cointegration does not exist for variables in the quadratic and cubic equations. Consequently, the ARDL model was employed to estimate short-run effects. The short- and long-run equations were adapted from Pesaran and Shin (1995) and Adeleye (2018).

4.2.2. The ARDL Model

The ARDL model for the quadratic equation is this specified as:

$$\Delta gini_t = a_{02} + \sum_{i=1}^{p} a_{l1}\,\Delta gini_{t-1} + \sum_{i=1}^{q} a_{2i}\,\Delta gdpcgrt_{t-1} + \sum_{i=1}^{q} a_{3i}\,\Delta gdpcgrt_{t-1}^{2} + \sum_{i=1}^{q} a_{4i}\,\Delta infl_{t-1} + \sum_{i=1}^{q} a_{5i}\,\Delta realexch_{t-1} + \sum_{i=1}^{q} a_{6i}\,\Delta polstab_{t-1} + \varepsilon_t \quad (8)$$

While the ARDL model for the cubic equation is:

$$\Delta gini_t = a_{03} + \sum_{i=1}^{p} a_{l1}\,\Delta gini_{t-1} + \sum_{i=1}^{q} a_{2i}\,\Delta gdpcgrt_{t-1} + \sum_{i=1}^{q} a_{3i}\,\Delta gdpcgrt_{t-1}^{2} + \sum_{i=1}^{q} a_{4i}\,\Delta gdpcgrt_{t-1}^{3} + \sum_{i=1}^{q} a_{5i}\,\Delta infl_{t-1} + \sum_{i=1}^{q} a_{6i}\,\Delta realexch_{t-1} + \sum_{i=1}^{q} a_{7i}\,\Delta polstab_{t-1} + \varepsilon_t \quad (9)$$

Since there is cointegration for the linear equation, the model is thus specified as:

$$\Delta gini_t = a_{01} + \sum_{i=1}^{p} a_{l1}\,\Delta gini_{t-1} + \sum_{i=1}^{q} a_{2i}\,\Delta gdpcgrt_{t-1} + \sum_{i=1}^{q} a_{3i}\,\Delta infl_{t-1} + \sum_{i=1}^{q} a_{4i}\,\Delta realexch_{t-1} + \sum_{i=1}^{q} a_{5i}\,\Delta polstab_{t-1} + \lambda ECT_{t-1} + \varepsilon_t \quad (10)$$

$\lambda = 1 - \sum_{i=1}^{p}\delta_i$, This represents the speed of adjustment parameter with a negative sign.

$ECT = (gini_{t-1} - \theta X_t)$ This represents the error correction term.

$\theta = \frac{\sum_{i=0}^{q}\beta_i}{\alpha}$, this is the long-run parameter.

a_{1i}, a_{2i}, a_{3i}, a_{4i}, a_{5i}, a_{6i}, a_{7i} are the short-run dynamic coefficients of the model's adjustment long-run equilibrium.

4.3. Stationarity results of the variables

To evaluate the stationarity of the variables in the study, Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were carried out to investigate the stationary properties of the time series, with particular attention paid to identifying unit roots. The objective of the unit root test is to ensure that the order of integration does not exceed [I(1)], as this is a prerequisite for applying the ARDL cointegration bound test. Furthermore, ADF and PP tests were administered to guarantee that no variable was integrated at level I (2) and to prevent spurious outcomes. The results of the unit root tests are presented in Table 1.3. Based on Table 1.3, the study confirms that all variables are stationary at the 1% or 5% level of significance. Using ADF, GDPCGRT, INFL, REALEXCH, and POLSTAB are significant in levels form [*I(0)]* whereas GINI is stationary after first differencing [*I(1)]*. Furthermore, when using PP, only GDPCGRT was stationary in level forms. The other variables are stationary after first differencing.

The selection of the appropriate lag length was established using the Bayesian Information Criterion (BIC), which was determined through automatic selection using the Stata software. In accordance with Nayaran's (2004) suggestion, we chose two lags in the model to limit the selection to a maximum of two lags for the annual data series.

Table 3: Stationarity Results of the Variables (Data from: WDI, 2024)

	Augmented-Dicky Fuller (ADF) Test		*Phillips-Perron (PP) test*	
Variable	*ADF Statistics*	*Order of Integration*	*PP Statistics*	*Order of Integration*
GDPCGRT	-2.260**	*I(0)*	-2.555**	*I(0)*
INFL	-3.419 ***	*I(0)*	-5.258***	*I(1)*
REALEXCH	-3.082***	*I(0)*	-5.220***	*I(1)*
POLSTAB	-1.882 **	*I(0)*	-5.383***	*I(1)*
GINI	-3.613*	*I(1)*	-5.292***	I(1)

Notes: Significance at: ***1% and **5%. *I(0)* refers to stationarity in levels while *I(1)* refers to stationarity after first differencing. ADF and PP test statistic results 1992-2022.

(data from: WDI, 2024)

5. Empirical Result and Discussion

The coefficient for the ARDL-EC model's ADJ is shown to be (-0.74) in Table 1.4, and it is utilised to determine the rate at which adjustments are made towards the long-term equilibrium. This suggests that any errors from the previous period will be rectified in the current period. Therefore, the results suggest that approximately 74% of the difference between the long and short runs is rectified within a year. The ECT-ADJ coefficient is statistically significant at the 1% level, with t-statistics (-5.08) and coefficients displaying negative signs.

The outcomes of the long-run analyses of equation (1), as per BIC, are presented in Table 1.4. The findings indicate that the growth rates of GDP per capita exhibit a positive trend, although this is not statistically significant. Similarly, political stability has a statistically significant positive association with income inequality. The findings further indicate that political stability and the absence of violence/terrorism have detrimental impacts on income inequality. Nigeria returned to a democratic form of governance in 1999 and implemented various policies to improve the country; it is unfortunate that the issue of insecurity in the form of terrorism and kidnapping has had a devastating effect on certain sectors of the economy (Onuoha and Oyewole, 2018; Ajide & Alimi, 2021). Although the political stability score has improved slightly in Nigeria, this study suggests that this improvement is unlikely to lead to a reduction in income inequality in the long run. As of 2022, the political stability and absence of violence/terrorism score for Nigeria was approximately (8%) (WDI, 2024). This value is similar to that of countries such as Burkina Faso (8%), Cameroon (11%), and Chad (9%). In comparison, developed countries, such as the Netherlands (71%) and Germany (67%), had significantly higher scores (WDI, 2024). Nigeria must take further steps to enhance its security apparatus and institutions.

On the contrary, inflation and exchange rates exhibit a negative association with inequality and are both statistically significant in the long run. Previous research has yielded mixed results regarding the relationship between income inequality and inflation (Cassette *et al.* 2012; Siami-Namini and Hudson, 2019; Berisha *et al.* 2023). Berisha *et al.* (2023) discovered that the effect of inflation on inequality is negative, significant, and greater for higher quantiles of income inequality. Over the course of a year, it has been observed that the inflation rate increases income inequality more at the initial level (Berisha *et al.*, 2023). Nevertheless, a more precise understanding of the relationship among inflation, exchange rates, and income inequality in Nigeria requires controlling for monetary and fiscal policy indicators, which is beyond the scope of this study. Future studies should investigate this relationship and the underlying mechanisms that enable these circumstances.

Furthermore, in the short run, the growth rate of GDP per capita demonstrated a positive and statistically significant relationship with income inequality, as presented in Table 1.4. This suggests that, in the short term, the growth rate of GDP per capita is positively and significantly associated with income inequality. Additionally, real exchange rates seem to exacerbate income inequality in Nigeria as it exhibits statistical significance. Finally, political stability appears to enhance income equality in Nigeria. This suggests that an improvement in political stability in Nigeria, whether due to a decrease in violence or terrorism or a more favourable perspective of government policies, could result in declining income inequality at the national level in Nigeria. However, political stability has both positive and negative effects on income inequality. On the one hand, in the short term, it can lead to a reduction in income inequality. On the other hand, in the long term, it can result in an increase in income inequality.

Table 4: ARDL-EC – Linear Equation

*Dependent variable: GINI ADJ -0.7394*** | t-stat (-5.08)*					
	Long-run		*Short-run*		
Variables	*Coefficients*	*P-value*		*Coefficients*	*P-value*
GDPCGRT	0.0847	0.730		0.3275	0.021
INFL	-0.2811	0.004		- - -	- - -
REALEXCH	-0.0779	0.024	D1	0.0788	0.009
			LD	0.0689	0.001
POLSTAB	1.5636	0.000	D1	-0.8666	0.000
			LD	-0.2427	0.051
Constant	30.0566	0.000			
Number of obs = 29 F(12, 7) = 58.23 Prob > F = 0.000 R-squared = 0.9700 Adj R-squared = 0.9534 Durbin–W atson = 1.8989 Breusch–Godfrey LM = 0.8966 White's test (Homoskedasticity) | Prob > chi2 = 0.4125 Jarque-Bera test for Ho: normality| 1 Chi(2) = .6813					
Note: ARDL (1,1,0,2,2) selected based on Schwarz Bayesian Information criterion					

To evaluate the nonlinear connection between income inequality and economic growth, specifically in relation to the Kuznets hypothesis, this study incorporates the squared term of the growth rate of GDP per capita into the linear model, thus making it a quadratic model, as shown in equation (2). Table 1.5 presents the findings of the quadratic estimation. The coefficients for the growth rates of GDP per capita with a positive sign (+) and the squared term of the growth rates of GDP per capita with a negative sign (-) reveal an inverted U-shaped relationship. Additionally, both coefficients are statistically significant at the 10% and 1% levels.

This result provides validation for the existence of the Kuznets inverted U-shaped curve in the context of Nigeria. Additionally, the outcome is in line with the prevailing literature (Kuznets, 1955; List & Gallet, 1999) which posits that economic expansion initially exacerbates inequality; however, as the economy expands further, inequality begins to decrease. However, this study acknowledges that certain scholars perceive the relationship between income inequality and economic growth differently. Cingano (2014) suggests that increased inequality might impede growth by diminishing the productivity of low-income households and exacerbating financial exclusion. Similarly, some scholars argue that inequality can have negative consequences for economic growth (Aghion *et al.*, 1999; Stiglitz, 2012; Royuela *et al.*, 2019). However, these perspectives were not substantiated by the findings of this study.

Furthermore, the results in Table 1.5 indicate that S-curve theory is not applicable to Nigeria. Neither the GDP per capita growth rates nor the squared terms of GDP per capita growth rates were statistically significant. Although the cubic term of the GDP per capita growth rate is significant, it displays a negative association with income inequality. List and Gallet (1999) posited that the Kuznets inverted U-curve constitutes an S-Curve. This contention is validated through the incorporation of the cubic term of the growth rates of GDP per capita in the nonlinear model, as shown in equation (3). List and Gallet (1999) found that as per capita income increases, it initially contributes to greater income inequality. However, after reaching a specific level, further increases in per capita income result in lower income inequality. Furthermore, they reveal that for high per capita income levels, beyond the second quartile in all three estimated versions, the association between income inequality and per capita income reverts to positive.

5.1. Postestimation Diagnostic

For diagnostics of the linear equation, as shown in Table 1.4, the Dubin–Watson (DW) test yields a value of (1.9), which indicates no evidence of serial correlation. This finding is corroborated by the Breusch-Godfrey LM test, with a p-value stands

Table 5: ARDL Model – Inverted U-curve and S-curve

Dependent variable: GINI				
	Quadratic equation (∩-curve)		*Cubic equation (S-curve)*	
Variables	*Coefficients*	*P-value*	*Coefficients*	*P-value*
GDPCGRT	0.2144	0.070	0.0861	0.484
$GDPCGRT^2$ (L1)	-0.0754	0.000	-0.0126	0.726
$GDPCGRT^3$ (L1)	- - -	- - -	-0.0060	0.000
INFL (L1)	0.1068	0.000	0.1465	0.001
REALEXCH	-0.0061	0.340	0.0072	0.468
POLSTAB	0.0918	0.244	0.0236	0.787
Constant	3.8263	0.126	-1.100	0.741
	Number of obs = 30 F(12, 7) = 109.82 Prob > F = 0.000 R-squared = 0.9767 Adj R-squared = 0.9678 Durbin–W atson = 2.2270 Breusch–Godfrey LM = 0.4128 White's test (Homoskedasticity) = 0.4140 Jarque-Bera test for Ho: normality = .0517 ARDL(*1,0,1,1,0,0*) regression		Number of obs = 29 F(12, 7) = 86.58 Prob > F = 0.000 R-squared = 0.9796 Adj R-squared = 0.9683 Durbin–W atson = 2.0111 Breusch–Godfrey LM = 0.8527 White's test (Homoskedasticity) = 0.4125 Jarque-Bera test for Ho: normality = 1.7 ARDL(1,0,0,1,2,0,0) regression	
Note: ARDL were selected based on Schwarz Bayesian Information criterion				

at (0.8966). Furthermore, the White test indicated the absence of heteroskedasticity, as the p-value (0.4125) is not statistically significant. The Jarque-Bera test for normality also revealed that the errors were normally distributed, as the chi-square value (0.6813) is not statistically significant. Finally, the model stability falls within the 5% bound, as depicted in Figure 1.3, which confirms its stability.

In relation to the quadratic equation shown in Table 1.5, the result of the Dubin Watson test is (2.23), signifying the absence of serial correlation. This conclusion is reinforced by the Breusch-Godfrey LM test, as its p-value of (0.4128) is not statistically relevant. Furthermore, the White test demonstrates that there is no presence of heteroskedasticity, as its p-value (0.4140) is not statistically significant. The Jarque-Bera test for normality also indicates that the errors are normally distributed, as its chi-square value of (0.0517) is not statistically significant at the 5% level. Finally, the model stability lies within the 5% bound, as shown in Figure 1.4, which confirms the stability of the model.

Finally, for the cubic equation presented in Table 1.5, the outcome of the Durbin Watson test is (2.01), signifying the absence of serial correlation. This conclusion is reinforced by the Breusch-Godfrey LM test, as its p-value of (0.8527) is not statistically relevant. Furthermore, the White test demonstrates that there is no presence of heteroskedasticity, as its p-value (0.4125) is not statistically significant. The Jarque-Bera test for normality also indicated that the errors were normally distributed, as its chi-square value of (1.7) is not statistically significant. Finally, the model stability lies within the 5% bound, as shown in Figure 1.5, which confirms the stability of the model.

The diagnostic results address the concern regarding Gini coefficient and political stability variables mentioned in the data and description section.

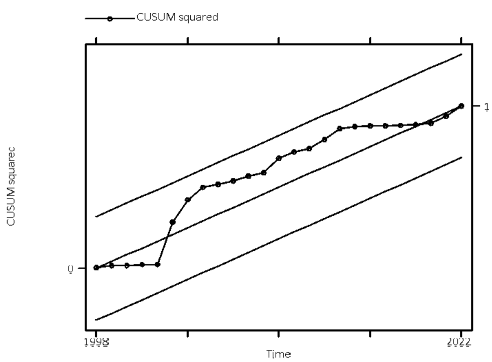

Figure 3 : Cusum Stability – Linear
(Created with Stata, data from WDI (2024))

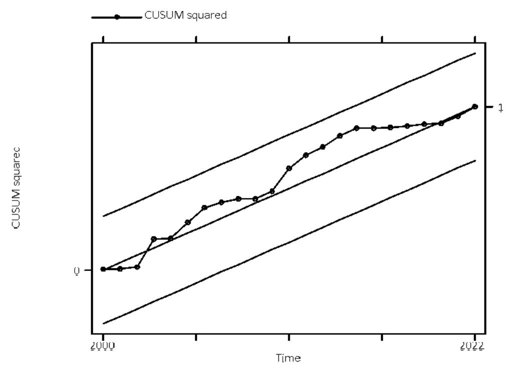

Figure 4 : Cusum Stability – Quadratic
(Created with Stata, data from WDI (2024))

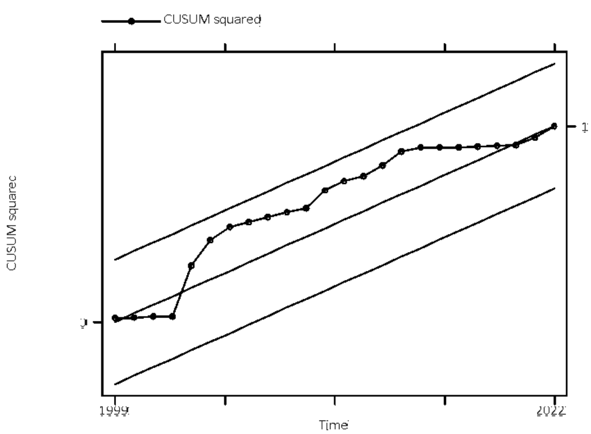

Figure 5 Cusum Stability – Cubic
(Created with Stata, data from WDI (2024))

6. Conclusion and Recommendation

This study aimed to investigate the relationship between income inequality and economic growth in Nigeria. To achieve this, we conducted short- and long-run estimations, which yielded the following findings. First, from the linear equation result, the research demonstrated that economic growth has no significant influence on income inequality in the long run. The results further suggest that political stability intensifies income disparities in the long run. In addition, inflation and exchange rates were found to be negatively associated with income inequality and were statistically significant. However, in the short term, exchange rates appear to exacerbate income inequality.

Furthermore, in the ARDL short-run model, economic growth is statistically significant and displays a positive association with income inequality. Secondly, the study suggests that, in the short term, Kuznets theory is applicable to Nigeria, as indicated by the inverted U-shaped relationship between economic growth and income inequality. This notion is based on the idea that economic growth can initially worsen income inequality before ultimately improving it in later stages of development. Therefore, we fail to reject the null hypothesis that states that there is correlation between income inequality and economic growth and that Kuznets hypothesis is applicable to Nigeria.

Additionally, the results indicate that List and Gallet's (1999) S-curve theory is not applicable to Nigeria. List and Gallet's (1999) theory is widely regarded as an extension of Kuznets' theory. It is commonly accepted that an increase in per capita income initially contributes to greater income inequality. However, after reaching a certain level, further increases in per capita income lead to less income inequality. Moreover, their findings indicate that for high per capita income levels, beyond the second quartile, the relationship between income inequality and per capita income becomes positive once again.

The immediate policy implications of Nigeria's situation remain uncertain. Should there be a greater focus on redistribution or promotion of growth? It is clear that no single solution works in all situations. Different countries have varying institutions and cultures, as well as varying endowments of labour, capital, and natural resources. Therefore, policies should be tailored to suit the economic and social institutions of a particular country (Bhattarai, 2018). Attempts to address inequality with a poorly designed policy may result in distorted incentives, ultimately undermining growth and harming even the poor (Berg *et al.*, 2012). Nigeria should implement pro-poor policies, including improved economic prospects for the impoverished, better-targeted subsidies, and financial inclusion strategies.

In summary, this study's key findings reveal a correlation between economic growth and income inequality in Nigeria. As a result, it is suggested that Nigeria should adopt policies aimed at reducing income inequality rather than solely depending on the trickle-down idea of the Kuznets theory to take effect within the country.

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Appendices

Appendix 1: ARDL Cointegration Bounds Test

Pesaran/Shin/Smith (2001) ARDL Cointegration Bounds Test								
Linear equation: F = 9.547| t = -5.082								
Critical Values (0.1-0.01), F-statistic, Case 3								
	[I_0]	[I_1]	**[I_0]**	**[I_1]**	[I_0]	[I_1]	[I_0]	[I_1]
	L_1	L_1	**L_05**	**L_05**	L_025	L_025	L_01	L_01
k_5	2.45	3.52	**2.86**	**4.01**	3.25	4..49	3.74	5.06
Critical Values (0.1-0.01), t-statistic, Case 3								
	[I_0]	[I_1]	**[I_0]**	**[I_1]**	[I_0]	[I_1]	[I_0]	[I_1]
	L_1	L_1	**L_05**	**L_05**	L_025	L_025	L_01	L_01
k_5	-2.57	-3.66	**-2.86**	**-3.99**	-3.13	-4.46	-3.43	-4.60