



Open Access

**Gulf Journal of Advance Business Research**

ISSN 3078-5294 (Online), ISSN 3078-5286 (Print)

*FE Gulf Publishers.*

<https://fegulf.com>



## **Industrial and service sectors' growths: an empirical investigation of the effects on income inequality in Nigeria**

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Volume No: 2

Issue No: 6

Page No: 285-299

Received: 06-10-24

Accepted: 30-11-24

Published: 29-11-24

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DOI: <https://doi.org/10.51594/gjabr.v2i6.51>

### **Abstract**

This study empirically investigated the implications of industrial and service sectors' growths on income inequality in Nigeria from 1985 to 2022, using data sourced from the Central Bank Nigeria Statistical Bulletin and the World Bank's Development Indicators. The causal variables which include growth rates in the construction, manufacturing, mining and service sectors were regressed on Gini index as proxy for income inequality. The Autoregressive Distributed Lag (ARDL) estimation procedures were employed. The pre-diagnoses of Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root revealed I(1) and I(0) mixed orders of integrations and the ARDL bounds cointegration established a long-run equilibrium relationship among the variables. The estimated current period short-run ARDL results indicated that construction and service sub-sectors' growth rates had positively significant influences on the level of income inequality in Nigeria, growth rate in the manufacturing sub-sector exerted negatively significant effect and that of mining sub-sector positively but insignificantly impressed on income inequality while the one year lagged short-run results established that all the regressors negatively and significantly influenced income inequality level in Nigeria. The long-run results revealed that while all the explanatory variables appeared positive, construction and manufacturing sub-sectors' growth rates had insignificant effects on income inequality in Nigeria. These findings were validated by the applied post-diagnostic tests. The study concluded that the immediate past year's growth rates of the industrial and service sectors significantly moderated income inequality in Nigeria during the sampled period. It is consequently recommended among others that government should encourage reinvestment of economic growth gains from the referred sectors to ensure employment driven growth performances for sustained curtailing of income inequality in Nigeria.

**Keywords:** Industrial Sub-sector, Service Sub-sector, Sub-sectors' Growths, Income Inequality, Autoregressive Distributed Lag (ARDL) Procedures, Nigeria.

## INTRODUCTION

The structure of the Nigerian economy at independence in 1960 was centred on the export of primary agricultural products with minimal industrial activities. Industrial operations were predominantly by multinational companies engaged in commerce, particularly the importation and distribution of manufactured goods. The colonial economic policy did not prioritize the development of local industrial base (Egwaikhide, 2001 and Banjoko, 2012). Industrialization, which entails the deliberate and sustained application of technology, infrastructure, and managerial expertise to production activities has been a focal point of economic development efforts (Okafo, 2005). It encompasses sectors such as manufacturing, construction and mining, among others. Over time, Nigeria's economic growth has been associated with services-led industrialization, emphasizing the role of the services sector as a driver of economic transformation (Gordon and Gupta, 2004).

Income inequality is a significant economic challenge in Nigeria. The country ranks among the 30 nations with the most unequal distribution of income (British Council, 2012). Despite GDP growth, only a small portion of the population benefits from economic expansion, while a large percentage remains in poverty (Okonjo-Iweala, 2013). High levels of poverty and inequality have been recorded since the 1980s, with studies revealing an increase in the income inequality coefficient from 38.1% in 1985 to 44.9% in 1992 (Canagarajah et al., 1997). Nigeria's labour market is characterized by high unemployment, underemployment and a large informal sector, which exacerbates income disparities (Alayande, 2003).

The 1970s oil boom spurred urban migration, leading to an increase in labour supply in urban areas that exceeded the absorption capacity of the formal economy. This, coupled with the economic downturn in the 1980s, prompted the introduction of the Structural Adjustment Programme (SAP). The SAP's effects, including the devaluation of the Naira and high inflation, led to significant declines in real income and purchasing power. Industries faced reduced demand, accumulating unintended inventories and cutting down their workforce. These economic disruptions heightened the unemployment crisis and exacerbated income inequality (Nnnanna et al., 2003).

Despite being Africa's largest economy, Nigeria's wealth distribution remains highly unequal. Over the past four decades, the wealth gap between the rich and poor has widened. While Nigeria has seen moderate economic growth, this has not translated into equitable income distribution. The richest Nigerians control a disproportionate share of the country's wealth, while more than half of the population lives in poverty (Oxfam, 2017). The Economic Recovery and Growth Plan (ERGP) of 2017 aims to leverage growth in services, industry, and other key sectors to address poverty and inequality. However, much progress has not been realised in curtailing the apparent inequality in wealth distribution. Therefore, this study meticulously examines the effects of industrial sector (the construction, manufacturing, and mining sub-sectors) and the service sector growths on income inequality in Nigeria. By investigating how these sectors influence the distribution of income, the study aims to identify pathways for achieving inclusive economic growth.

## LITERATURE REVIEW

### **Kaldor's First Law /Theory of Industrial Sector**

Kaldor's First Law, also known as Kaldor's First Fact, was propounded by Nicholas Kaldor in 1961. Kaldor, a prominent British economist, observed that the share of national income allocated to the industrial sector tends to remain relatively stable over time, despite fluctuations in the overall economic growth (Kaldor, 1961). This theory is based on several key assumptions. Firstly, it assumes that the industrial sector, which includes manufacturing and heavy industries, is characterized by high productivity growth. Secondly, it posits that the service sector, while growing, does not exhibit the same level of productivity growth as the industrial sector. Lastly, Kaldor's First Law assumes that the demand for industrial goods is income-elastic, meaning that as incomes rise, the demand for these goods increases proportionally (Kaldor, 1961).

The implications of Kaldor's First Law for income inequality are significant. If the industrial sector maintains a stable share of national income, it suggests that the benefits of productivity growth in this sector are broadly distributed across the economy. However, the service sector, which often employs a larger proportion of the workforce, particularly those with lower skills, may not see the same level of income growth. This can lead to a widening gap between the incomes of workers in the industrial and service sectors. For instance, high-skilled workers in the industrial sector may experience substantial wage increases due to productivity gains, while low-skilled workers in the service sector may see only modest or no wage growth (Kaldor, 1961).

Moreover, Kaldor's observations highlight the importance of structural changes in the economy. As the service sector expands, it can absorb more labour, but the lack of significant productivity growth in this sector can limit its ability to generate higher wages. This can exacerbate income inequality, as the industrial sector, which is more capital-intensive and technologically advanced, continues to dominate in terms of income generation and wage growth. Therefore, policies aimed at enhancing productivity in the service sector, such as investment in education and technology, could play crucial role in mitigating income inequality (Kaldor, 1961).

In summary, Kaldor's First Law underscores the persistent role of the industrial sector in economic growth and income distribution. While the industrial sector's share of national income remains stable, the service sector's slower output growth can contribute to income inequality. Addressing this issue requires a multifaceted approach, including efforts to boost activities in the service sector and ensure that the benefits of economic growth are more equitably distributed.

### **Fisher-Clark's Service/Three Sector Theory**

Fisher-Clark's Service/Three Sector Theory, proposed by Irving Fisher and Colin Clark in the early 20th century, provides a framework for understanding the structural transformation of economies over time. Fisher initially introduced the concept in 1935, and Clark expanded on it in 1940, dividing the economy into three primary sectors: primary (agriculture and natural resources), secondary (manufacturing and industry), and tertiary (services) (Fisher, 1935; Clark, 1940). The theory is built on several key assumptions. Firstly, it assumes that as an economy grows, the share of the primary sector in total employment and output declines, while the share of the secondary sector initially increases and then stabilizes. Secondly, the tertiary sector, or the service sector, is expected to grow significantly, eventually becoming the dominant sector in terms of employment and output. Lastly, the theory posits that this structural shift is driven by

changes in consumer demand and technological advancements, which lead to higher productivity in the primary and secondary sectors (Clark, 1940).

The implications of Fisher-Clark's Service/Three Sector Theory for income inequality are multifaceted. As the economy transitions from the primary to the secondary sector, and then to the tertiary sector, the distribution of income can be affected in various ways. In the initial stages of industrialization, the secondary sector often experiences rapid productivity growth, leading to higher wages and reduction in income inequality. However, as the economy matures and the service sector becomes more prominent, the dynamics can change. The service sector is typically more labour-intensive and less capital-intensive, which can result in lower productivity growth and, consequently, lower wage increases compared to the industrial sector (Clark, 1940).

This shift can lead to a bifurcated labour market, where high-skilled workers in the industrial and high-end service sectors earn significantly more than low-skilled workers in the broader service sector. For example, professionals in finance, technology, and healthcare often command higher salaries due to their specialized skills and the high productivity of their sectors. In contrast, workers in retail, hospitality, and other low-end service sectors may face stagnant wages and limited opportunities for advancement, contributing to a widening income gap (Fisher, 1935; Clark, 1940).

Furthermore, the theory suggests that the transition to a service-based economy can also be influenced by changes in consumer preferences. As incomes rise, consumers tend to spend a larger proportion of their income on services rather than goods. This increased demand for services can drive the expansion of the tertiary sector, but it may not necessarily lead to equitable income distribution. The service sector's growth can be uneven, with high-end services expanding more rapidly than low-end services, further exacerbating income inequality (Clark, 1940).

In summary, Fisher-Clark's Service/Three Sector Theory provides a valuable lens for examining the structural changes in an economy and their effects on income inequality. While the transition from primary to secondary sectors can initially reduce inequality, the subsequent dominance of the service sector, particularly its low-productivity segments, can lead to a more pronounced income gap. Addressing this issue requires policies that enhance productivity and skill levels across all sectors, ensuring that the benefits of economic growth are more evenly distributed.

### **Empirical Review**

Khan et al. (2021) examined the existence of a linear or nonlinear effect of inflation and sectoral economic growth on income inequality using a balanced panel data of 92 developing countries for the period of 1990–2014. Design/methodology/approach section includes several steps as below: first, the functional form of the model using panel data for investigating the contribution of economic sectors in income inequality; second, to estimate the relationship between income inequality and sector growth: testing the Kuznets hypothesis; third, to estimate the relationship between inflation and income inequality base on general functional form of the model proposed by Amornthum (2004); fourth, a panel Granger causality analysis based on a VECM approach. Findings showed that first agricultural growth and then industrial growth have a dominate impact in reducing income inequality in our sample but, the service sector growth has positive effects. The results confirm the existence of Kuznets inverted "U" hypothesis for

industry growth and Kuznets "U" hypothesis for service sector growth. Further, the result showed that sector growth and inflation affect income inequality in the long-run.

Pertiwi et al., (2021) used quantitative approach with a secondary type of data. This article used panel regression with Random Effect Model (REM) by combining cross-section data from 33 provinces in Indonesia and time-series data from 2014-2019. The causality between economic growth and EQI is calculated by using Granger Causality. The result shows that (1) economic growth and income inequality have a negative significant relationship toward EQI, but poverty hasn't affected to EQI, (2) There is no causality between economic growth and EQI because EQI cannot affect economic growth. Rizk (2003) used data from 1980, 1990 and 1995 to analyse the effects of growth in the service sector on income inequalities for 77 nations around the world. Statistical models examine the effects that the state, through redistribution efforts, has on income inequality. Results of random effects models show that 1) service sector growth has a positive relationship with income inequality, 2) that level of development has a strong positive relationship with income inequality, and 3) that redistribution efforts have had little impact on income inequality over time.

Raesyesa (2020) explored the relationship between growth in economic sectors, specially manufacturing, service, and agriculture, towards income inequality. Furthermore, it utilizes panel data for low-middle income ASEAN countries. The result shows that the share of agricultural sector in GDP has a significant and negative relationship with income inequality. In fact, the effect is robust for the incorporation of control variables. Therefore, it underlines the importance of agricultural sector development for reducing inequality and also for fostering ASEAN economic integration

Eneji et al., (2020) examined industrial sector performance and poverty reduction in Nigeria, using time series data spanning 1981 to 2018. Econometric techniques of Granger causality test and Ordinary Least Square were employed in the study. The estimated results revealed that aggregate industrial output had positive impact on poverty reduction in Nigeria so did aggregate industrial employment. The Granger causality test results revealed that aggregate industrial output granger caused poverty rate, poverty rate granger caused aggregate industrial employment, and aggregate industrial output granger caused aggregate industrial employment all depicting a unidirectional causality.

Samuel and Aram (2020) evaluated the determinants of industrialization; generalized method of moments (GMM) methodology was employed in this study to analyse the panel model for 35 African countries from the time period of 1980-2020. This study aimed to fill the void in the context of African countries by describing the linkage between industrialization and several regressors consisting of socioeconomic indicators as well as institutional and political variables. The results of the study showed that for the whole considered region economic development, labour market flexibility, financial development and the real effective exchange rate (REER) were the key drivers of the industrialization.

Barat et al., (2020) explored the relationship between growth in economic sectors, specifically on manufacturing, service, and agriculture, towards income inequality. Furthermore, it utilizes panel data for low-middle income ASEAN countries. The result showed that the share of agricultural sector in GDP has a significant and negative relationship with income inequality. In fact, the effect is robust for the incorporation of control variables. Therefore, it underlines the

importance of agricultural sector development for reducing inequality and also for fostering ASEAN economic integration

Parsa et al. (2019) measured how much the industrial sector suppresses the development process to be sustainable in Iran. We employ a quadratic-log form of regression model to test the Industrial Environmental Kuznets Hypothesis. In addition, they use a Vector Auto-Regressive model to estimate the nexus among the industrial growth, income inequality, environmental pollution, and energy consumption in Iran during 1971 and 2014. The results confirmed the Industrial Environmental Kuznets Hypothesis. Moreover, they showed that all the three variables present the same response to the shock in the industrial growth since all the responses are increasing. It provides preponderance of evidence for the incompatibility of industrial growth with social, environmental, and resource development in Iran.

Using a rich, continuous data set on pay differences across economic sectors and regions, Malinowska (2016) investigated the role of the following structural shifts: a dramatic growth in private industry, accompanied by an expansion of the financial sector; expansion of the public sector (likely surrounding EU accession); growth in the education sector; rapid non-agricultural development in rural areas; and reduction in the supply of labour to agriculture. The analysis shows that trends in inequality between regions and industries are consistent with those predicted by these explanations. Aihaji, Said, and Sidique (2015) examined the industrial sector output and its effect on poverty and subsequently inequality in Nigeria using static panel data method of analysis. Their findings revealed that there was no statistically significant influence of industrial sector output on poverty reduction, neither was there any statistical evidence to conclude that increase in poverty leads to higher inequality in Nigeria.

### **Literature Gap**

An extensive review of related empirical studies revealed that the few studies (Abula & Mordecai, 2016; Kabeta & Sidhu, 2016) attempted to look at the sectoral performance away from the growth lens, utilized per capita income as their dependent variable. However, this study argues that per capita income is not the only measure of development as it does not show robust picture of the plight of the poor populace., & as such, they are limited in the sense of leaving out the key indices that shows the true inclusiveness of growth in Nigeria. More so, a greater chunk of the literature relating to the sectoral performance concentrated more on indices like economic growth proxied by real gross domestic product and various sectoral variable outputs as well as variables ranging from public expenditure on the real sector, population, interest rate, gross capital formation, etc. Unlike the other studies that investigated sectoral performance on economic growth, this present study seeks to examine the performance of these sectors using their percentage growth rates on income inequality measured by Gini index in Nigeria over the sampled period of 1985 to 2022.

## **METHODOLOGY**

### **Research Design**

This study adopted the *ex-post-facto* research design as it is non-experimental in nature, and investigated effects of the independent variables (measures of industrial and service sectors) on the dependent variable (income inequality) by using existing annual time series data spanning 1985 to 2022, which were sourced from the Central Bank of Nigeria (CBN) statistical bulletin and the World Bank's development indicators data base.

### Model Specification

To enable analysing the specific objectives of this study, the theoretical foundation of the model to be specified is based on the Fisher-Clark's Service/Three Sector Theory, which posits that transition from primary to secondary sectors initially reduce inequality, the subsequent dominance of the service sector, particularly the low-productivity segments, can lead to a more pronounced income gap. Therefore, in specifying the analytical model for this study, the selected industrial and service sectors' measures are expected to be regressed on income inequality indicator. In addition, specification of the model for this research modified the model of Eneji et al., (2020) who examined industrial sector performance on poverty reduction in Nigeria over the period 1981-2018 by specifying that:

$$POVR = f(\text{INDQ}, \text{INDEM}) \quad (3.1)$$

where POVR, INDQ and INDEM mean poverty rate, industrial output and industrial employment respectively. But for the purpose of this study, a modified single equation multiple regression model is functionally specified as follows:

$$\text{GINI} = f(\text{CONS}, \text{MANS}, \text{MINS}, \text{SERVS}) \quad (3.2)$$

Equation (3.2) above is further transformed to an econometric model for analytical purpose as presented below;

$$\text{GINI} = \alpha_0 + \alpha_1 \text{CONS}_t + \alpha_2 \text{MANS}_t + \alpha_3 \text{MINS}_t + \alpha_4 \text{SERVS}_t + U_t \quad (3.3)$$

Where: GINI = Gini Coefficient, CONS = Construction Sector GDP Growth rate, MANS = Manufacturing Sector GDP Growth rate, MINS = Mining Sector GDP Growth rate and SERVS = Service Sector GDP Growth rate. The expected theoretical outcomes are presented below.

Variables	Notations	Expected relationships
GINI COEFFICIENT	GINI	Dependent variable
Construction GDP Growth rate	CONS	-
Manufacturing GDP Growth rate	MANS	-
Minig GDP Growth rate	MINS	-
Service GDP Growth rate	SERVS	-

### Methods of Data Analysis

Technically, to empirically test the specified model, the unit root tests of the individual variables for ascertaining their orders of integration is conducted by applying the Kwiatkowski-Phillips-Schmidt test (KPSS) unit root test. The KPSS is a parametric unit root pre-test and is highly applicable on large sample size (that is when number of observations is greater than thirty  $N > 30$ ). In addition, the ARDL Bounds cointegration test is applied to ascertain if cointegrating relationship exists among the selected variables, (Pesaran, Shin and Smith 2001). It is employed when the unit root analyses establish  $I(0)$  and  $I(1)$  mixed order of integration. This method has three decision options which are existence of cointegrating, no cointegrating and inconclusive relationships, when the calculated F-statistic value is respectively greater than the upper bound  $I(1)$ , below the lower bound  $I(0)$  and between the lower  $I(0)$  and the upper  $I(1)$  bounds. The general model for ARDL Bounds cointegration equation is:

$$Y_t = \Delta_t Y_{t-1} + \dots \Delta_p Y_{t-p} + \delta R_t + U_t \quad (3.4)$$

Where  $Y_t$  = the time series variables under consideration in time t,  $Y_{t-1}$  and  $Y_{t-p}$  = cointegrating equations estimates,  $\Delta$  = First difference operator and  $U_t$  = stochastic error term.

Sequel to establishing long-run relationship among the variables, the ARDL long-run and the short-run dynamic estimations were carried out to examine the theoretical and significance relationship between the dependent and independent variables of the model. Therefore, specification of the ARDL long-run form of the model is presented below;

$$\Delta GINI_t = \alpha_0 + \sum_{i=1}^q \alpha_1 \Delta GINI_{t-1} + \sum_{i=1}^q \alpha_2 \Delta CONS_{t-1} + \sum_{i=1}^q \alpha_3 \Delta MANS_{t-1} + \sum_{i=1}^q \alpha_4 \Delta MINS_{t-1} + \sum_{i=1}^q \alpha_5 \Delta SERVS_{t-1} + \lambda_1 GINI_{t-1} + \lambda_2 CONS_{t-1} + \lambda_3 MANS_{t-1} + \lambda_4 MINS_{t-1} + \lambda_5 SERVS_{t-1} + \delta ECM_{t-1} + \varepsilon_{1t} \quad (3.5)$$

Where:  $\alpha_0$  = constant parameter to be estimated;  $\alpha_1 - \alpha_5$  = short run parameters;  $\lambda_1 - \lambda_5$  = long-run multipliers;  $p$  = optimal lag for each of the dependent variables;  $q$  = optimal lag of the independent variables;  $\Delta$  = first difference operator; and  $\varepsilon_{1t}$  = error terms. Further, the  $ECM_{t-1}$  defines the error correction term determined in the short-run analysis and  $\delta$  serves as coefficient of the error correction term, defining the annual speed of adjustment level from its previous period's disequilibrium to re-establish long-run stability (equilibrium). This coefficient indicator of the ECM is expected to be negative and significant. Nevertheless, the limitation of this method is its unsuitability when all variables are first difference stationary.

In addition, post-diagnostic tests such as: the serial correlation **test** to know whether the residuals are serially independent, the heteroscedasticity test to check for homoscedasticity, the Jarque-Bera normality statistic test to ascertain if all variables are jointly normally distributed, and the CUSUM stability test to check whether the estimated model is stable were conducted to validate the robustness of the model's estimated results.

## RESULTS AND DISCUSSIONS

### Unit Root Results

Following the principle that testing for the unit roots status of data series is a condition to examine the presence of cointegration, the stationarity levels of each series is diagnosed using the KPSS unit root method and the outcomes are reported in Table 4.2 as detailed below:

Table 1

#### KPSS Unit Root Test Results

Variables	KPSS Value at Level	Critical value 5%	KPSS Value at 1st Diff.	Critical value 5%	Order of Integration
CONS	0.514327	0.463000	0.388232	0.463000	1(1)
GINI	0.106855	0.739000	-	-	1(0)
MANS	0.553762	0.463000	0.299963	0.463000	1(1)
MINS	0.481930	0.463000	0.253914	0.463000	1(1)
SERVS	0.405561	0.463000	-	-	1(0)

Source: Researcher's Computation from Eviews 12, (2024).

The KPSS Unit Root test results in Table 4.1 indicated that construction sector growth rate (CONS) is stationary after first differencing, since the KPSS value of 0.388232 is lower than the 5% critical value of 0.463000. Also, manufacturing sector growth rate (MANS) and mining sector growth rate (MINS) followed similar pattern as both KPSS values are lower than the 5% critical value ( $0.299963 < 0.463000$ ) and ( $0.253914 < 0.463000$ ) respectively. This suggests that

shocks in these variables could have long-term effects on income inequality, and its relationship with the Gini coefficient may unfold over time rather than immediately. Conversely, the service sector growth rate (SERVS) and the Gini coefficient (GINI) are both stationary at the level, with KPSS values below the critical threshold (0.405561 for SERVS and 0.106855 for GINI). This suggests that changes in the service sector have more immediate effects on income inequality and do not exhibit the long-term memory or persistence seen in the industrial sectors. Additionally, the stationary nature of the Gini coefficient indicates that income inequality in Nigeria fluctuates around a stable mean without a long-term trend.

### **ARDL Bounds Cointegration Test**

Table 2 below shows the ARDL Bounds cointegration test result.

Table 2

#### *ARDL Bounds Co-integration Test*

	F-STATISTICS	K	Critical value Lower bound 5%	Critical value Upper bound 5%
GINI	5.399792	4	2.56	3.49

Source: Researcher's computation from Eviews 12, (2024).

Note: K denotes number of explanatory variables

Given the evidence of I(0) and I(1) mixed integrations in the variables, the ARDL bounds test method was applied. The results reveal that the F-statistic of 5.399792 exceeds both the lower and upper bounds critical values at a 5% significance level. This strongly indicates a long-run relationship between the dependent variable and the independent variables in the model.

### **ARDL Model Analysis Results**

The ARDL model results presented in Table 4.3 below shows the short-run and long-run how sectoral growths in Nigeria, specifically in the construction (CONS), manufacturing (MANS), mining (MINS) and service (SERVS) sectors influenced income inequality, as measured by Gini coefficient (GINI).

The short-run results as presented in Table 4.3 reveals several dynamic outcomes. The lagged years GINI coefficients (D(GINI(-1)), D(GINI(-2)), D(GINI(-3))) all exhibit significant positive effects on current income inequality, suggesting that previous levels of inequality tend to exacerbate current inequality. Although the magnitude of this effect slightly decreased in lag 2, the coefficients remain positive and significant.

The construction sector (CONS) growth rate in the current period had positive and significant impact on income inequality in the short term, indicating that one percent growth in the construction sector raised income inequality in Nigeria by 0.450 percent. However, at lag 1, construction sector growth indicated negatively significant impact on income inequality, suggesting one percent growth in the sector moderated income inequality by 0.292 percent. In the long-run, the impact of growth in the construction sector on income inequality is positive but not significant, indicating that a percentage rise in the sector's growth had 1.390 percent increasing effect on income inequality but insignificantly. This is in line with Khan et al. (2021) as their study showed positively significant effect on income inequality.

Table 3  
ARDL Short and Long Run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GINI(-1))	0.580800	0.123435	4.705289	0.0003
D(GINI(-2))	0.391039	0.157027	2.490263	0.0260
D(GINI(-3))	0.597143	0.145826	4.094913	0.0011
D(CONS)	0.450919	0.078933	5.712648	0.0001
D(CONS(-1))	-0.292789	0.106817	-2.741037	0.0159
D(CONS(-2))	-0.244738	0.098328	-2.489000	0.0260
D(CONS(-3))	-0.439530	0.107687	-4.081558	0.0011
D(MANS)	-0.568166	0.138300	-4.108219	0.0011
D(MINS)	0.028624	0.026014	1.100352	0.2897
D(MINS(-1))	-0.100271	0.023261	-4.310645	0.0007
D(SERVS)	0.611623	0.084692	7.221697	0.0000
D(SERVS(-1))	-0.373057	0.099162	-3.762094	0.0021
D(SERVS(-2))	-0.099359	0.083568	-1.188964	0.2542
D(SERVS(-3))	-0.366414	0.076205	-4.808261	0.0003
CointEq(-1)*	-0.455524	0.068696	-6.630968	0.0000

### Long run

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONS	1.390751	0.752606	1.847914	0.0858
MANS	0.167506	0.425262	0.393889	0.6996
MINS	0.456484	0.079262	5.759178	0.0000
SERVS	0.958598	0.364568	2.629407	0.0198
C	-101.4483	42.19462	-2.404296	0.0306

$$R^2 = 0.918091; \text{Adj.}R^2 = 0.857738$$

Source: Researcher's computation from Eviews 12, (2024)

The manufacturing sector growth rate, shown as D(MANS) in the short term had significant negative impact on income inequality, suggesting that a percentage addition to manufacturing sector growth actually helped reducing income inequality by 0.568 percent. Conversely, in the long term, the impact of the manufacturing sector growth on income inequality appeared positive and not statistically significant, indicating that one percent rise in manufacturing sector growth raised income inequality by 0.167 percent in Nigeria in the long run. This conforms with Pertiwi (2021) who found negatively significant impact on income inequality.

For the mining sector growth rate, D(MINS) as its current period symbol showed that in the current period, a positive but not statistically significant impact on income inequality is apparent in the short term, with one percent increase in this sector's growth led to 0.028 percent insignificant increase in income inequality. At lag1, however, the mining sector growth exhibited an inversely significant effect on income inequality, suggesting 0.100 percent decrease in the face of one percent growth in the sector. In the long term, the mining sector growth had positive and significant implication on income inequality in Nigeria, indicating that a percent growth in the mining sector contributed to the worsening level of income inequality by 0.456 percent in the long run. This disagrees with Malinowska (2016) who established negatively insignificant impact on income inequality in Nigeria.

Additionally, the service sector growth rate in the current period as symbolized by D(SERVS), appeared as positively and significantly impacted income inequality in the short term. This submits that one percent growth in the service sector aggravated income inequality by 0.611 percent in the sampled period. At lag 1, the service sector growth showed negative effect on income inequality, with significant impact. This implies moderation of income inequality by 0.373 percent. In the long-run, however, the service sector positively and significantly contributed to income inequality in Nigeria, indicating that one percent growth in the service sector exacerbated income inequality by 0.958 percent. This is in agreement with Raeskyesa (2020) who also established directly related significant impact of service sector on income inequality.

The error correction term (CointEq(-1)) is highly significant (-0.455524,  $p = 0.0000$ ) and negative, confirming the existence of a long-run equilibrium relationship between sectoral growth and income inequality. The speed of adjustment suggests that approximately 45.55 percent of disequilibrium from the previous period's shock is corrected annually, indicating a relatively moderate speed of adjustment. The R-squared ( $R^2$ ) value of 0.918091 indicates that the model explains approximately 91.81 percent of the variation in income inequality (GINI) over the long run. This is a very high level of explanatory power, suggesting that growth in these sectors had strong and significant relationship with income inequality. The adjusted R-squared (Adj.  $R^2$ ) of 0.857738, while slightly lower, still shows that 85.77 percent of the variance is explained by the model when accounting for the number of predictors. The high  $R^2$  and adjusted  $R^2$  reflect the model's robustness and reliability.

### Post Diagnostic Tests

Tabulated and discussed in Table 4.4 below are the results of the post model analyses diagnostic tests. The diagnoses below are carried out to ensure that the estimated ARDL model is devoid of the traditional linear regression problems associated with serial dependency, heteroscedasticity, normality or stability.

Table 4  
*Post-Diagnostic Tests' Results*

Test	Null Hypotheses	F-Values	Prob Values	Decision
Breusch-Godfrey LM	Serial correlation does not exist	1.910075	0.1905	Retain null hypothesis
Breusch-Pagan-Godfrey	Homoscedasticity exists	0.741036	0.5866	Retain null hypothesis

**Source:** Researcher's Computation from EViews 12, 2024

The outcomes above revealed that the examined model on the effects of industrial and service sectors' growths on income inequality from 1985 to 2022 are serially independent in error terms and homoscedastic in constant variance.

**Normality Test**

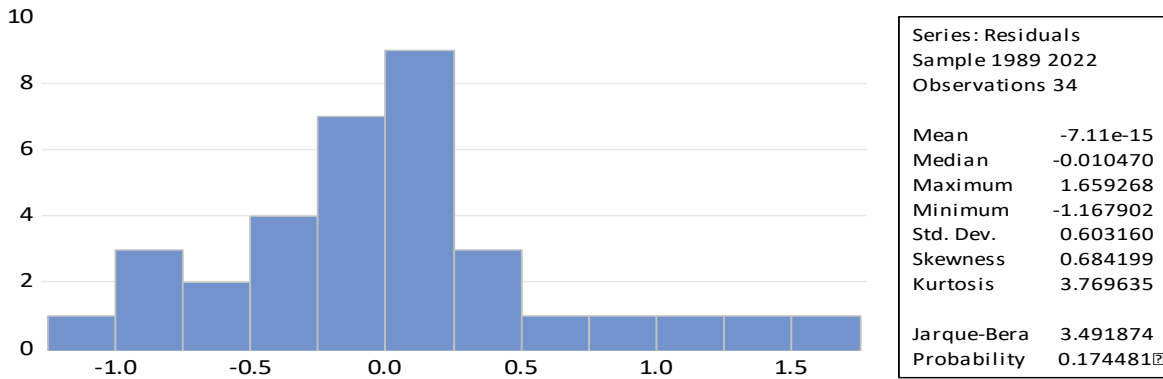


Figure 1: Jarque Bera

Source: Researcher's Computation from Eviews 12, 2024.

As portrayed in Figure 4.1, the Jarque-Bera normality test result indicated that the null hypothesis is not rejected as the JB test statistic's probability value in the model exceed 0.05. This suggests that all the variables employed in the model are jointly normally distributed.

**Stability Test**

The stability test is applied to examine whether or not both long run and short run parameters are stable. The Cumulative sum (CUSUM) tests was used for this purpose. The CUSUM graph for the model as shown below and provides valuable insight into stability of the parameters over the sampled period.

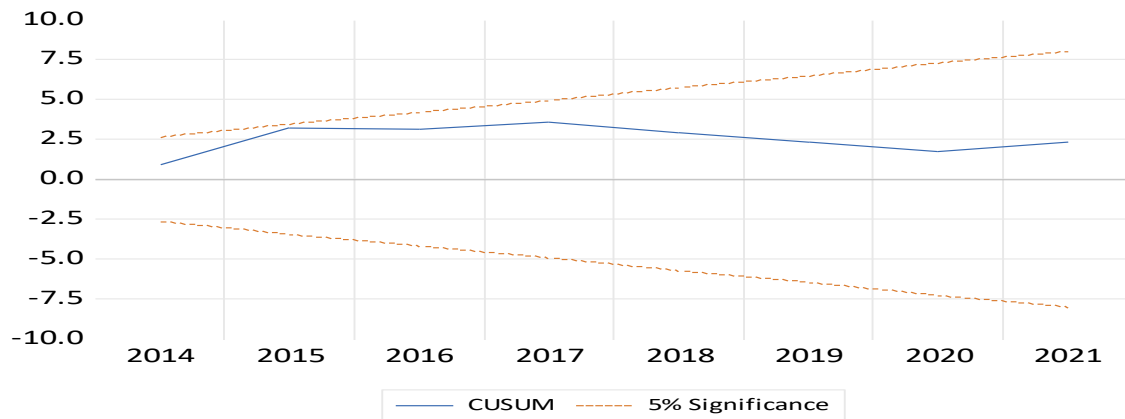


Figure 2: Gini Coefficient graph

Source: Researcher's computation from Eviews 12, 2024

The CUSUM plot result indicated that the model falls within the critical bounds at a 5 percent significance level, implying that the model coefficients remain stable over time. Additionally, the test confirmed the model's stability in the presence of structural breaks. This suggests that the overall model is robust and accurately specified, as the CUSUM plot does not breach the upper or lower critical bounds.

**CONCLUSION AND RECOMMENDATIONS**

**Concluding Remarks**

Empirically explored in this study is the effects of industrial and service sectors' growth on income inequality in Nigeria from 1985 to 2022. This research applied the Autoregressive Distributed Lag (ARDL) estimation procedures to measure how the selected sectorial growth indicators influenced Gini coefficient for Nigeria. Following the empirical results, it is evident

that all the short run immediate past (lag 1) year's values for the variables indicated inverse effects of the adopted sectorial growths indicators on income inequality in Nigeria. The construction and manufacturing sectors, while showing a positive relationship with income inequality, do not significantly impact it. In contrast, the mining and service sectors both significantly and positively impacted income inequality. The researchers thus, concluded that all the immediate past (lag 1) year's values for the industrial and service sectors' variables in the short-run are more contributory to moderating income inequality in Nigeria than the short-run current growths and the long-run growths of the sectors.

### **Policy Recommendations**

Based on the ARDL long-run results regarding the impact of the selected sectors' growth rates on income inequality in Nigeria, this study makes the following recommendations that the Nigerian government should:

- i. Implement stricter regulatory oversight in the mining and service sectors such as the employment of locals in these industries (reduction of expatriate quota) to ensure that wealth generated from these industries benefits a broader segment of the population, thereby reducing the significant positive impact on income inequality in Nigeria.
- ii. Encourage the development of small and medium-sized enterprises (SMEs) in the construction and manufacturing sectors through provision of credit and tax relief. This strategy aims to create more job opportunities and distribute economic gains more evenly, despite the current non-significant impact on income inequality.
- iii. Launch targeted skill development initiatives aimed at equipping the workforce in the construction, manufacturing, mining and service sectors with the necessary skills to advance in these fields. This approach would help in reducing the skill gap and, consequently, the income gap within these sectors.
- iv. Enhance and expand social welfare programs to support individuals and communities adversely affected by income disparities, particularly in regions where mining and service industries are prominent. This includes building of hospitals, building of schools and direct financial support to individuals in these communities.

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