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10 November 2025

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Abstract
Most studies on Okun's Law focus on mean effects using ordinary least squares or dynamic models, with limited use of quantile regression. This leaves unexplored how output growth impacts unemployment across different points of the unemployment distribution. By applying a static quantile regression framework, this study fills this gap in analyzing the unemployment problem and its key determinants in Nigeria from 1991 to 2024. The findings showed that aggregate GDP growth reduces unemployment, with stronger effects at higher quantiles. However, results showed a weaker-than-expected Okun's Law coefficient, reflecting the non-inclusive nature of Nigeria's economic growth. Sectoral analysis reveals that while Agriculture and Industry exert limited effects, the Construction and Services sectors significantly reduce unemployment, particularly through key activities such as Professional & Scientific Services, Trade, Real Estate, and Health. Government consumption largely worsens unemployment, whereas net FDI inflows foster job creation. The results highlight the need for structural transformation and policy realignment towards productive investments that strengthen the employment intensity of growth.

Keywords: Unemployment, Quantile, Okun's Law, Aggregate Output, Sectoral Growth
JEL Classification: C21, J64, O13, O14

1. Introduction
Unemployment remains a global economic challenge and a critical impediment to socio-economic progress. Beyond representing a significant waste of human capital, it entails welfare losses through reduced output, lower income, and diminished well-being (Akinboyo, 1987; Raheem, 1993). The need to mitigate the adverse effects of unemployment has made its reduction a central objective of development strategies in many developing economies, including Nigeria.

Nonetheless, unemployment concerns policymakers in both developed and developing countries because of its detrimental effects on economic welfare, social stability, and overall quality of life. Prolonged unemployment can result in financial hardship, poverty, homelessness, and family disintegration, ultimately eroding society's social fabric (Oniore et al., 2015).

Despite numerous policy efforts to address unemployment, it persists—particularly among Nigeria's youth population. According to the National Bureau of Statistics (NBS, 2024), the youth unemployment rate stood at 6.5% in the second quarter of 2024, the highest among all age groups. This reflects a persistent gap between labour supply and the economy's absorptive capacity. The more pressing concern, however, lies in the structure of employment: over 90% of Nigerians are engaged in the informal sector, while fewer than 15% are involved in formal paid jobs (NBS, 2024). This implies that a large proportion of the population—about 85%—can be described as the working poor. Although agriculture remains Nigeria's largest employer of labour, evidence indicates an inverse relationship between agricultural productivity and poverty, suggesting that employment in the sector does not necessarily translate into improved living standards (World Bank, 2014). This underscores the need to revitalize other productive sectors to generate decent and gainful employment opportunities for unemployed youths.

Furthermore, the theoretical foundation for analyzing the unemployment–output relationship originates from Arthur Okun's (1962) pioneering work, which established that a 3% increase in gross national product (GNP) corresponds to a 1% decline in unemployment. This inverse relationship, widely known as Okun's Law, has become a benchmark for assessing the employment responsiveness of growth. However, empirical findings have been mixed. Some studies found no significant relationship between economic growth and unemployment (see Akeju & Olanipekun, 2014; Bankole & Fatai, 2013; Babalola et al., 2013). Conversely, others established long-run relationships between unemployment and macroeconomic variables such as population, government expenditure, and real GDP (see Khumalo et al., 2015; Oniore et al., 2015; Folawewo et al., 2017), with many of these studies employing the Autoregressive Distributed Lag (ARDL) approach to estimate such relationships.

Meanwhile, recent evidence suggests that Okun's Law coefficients vary across sectors (see Apap & Gravino, 2017; Raifu, 2023; Adekunle et al., 2025). Moreover, the effectiveness of sectoral growth in reducing unemployment depends on the distribution of unemployment across the lower, middle, and upper quantiles (Kraim, 2023). This study contributes to the literature by examining Okun's Law at both the aggregate and sectoral levels across unemployment quantiles in Nigeria. To the best of the authors' knowledge, this empirical exercise is among the first to assess whether the distribution of the unemployment rate influences Okun's Law coefficients and to identify the sectors most effective at reducing unemployment across quantiles in Nigeria.

The remainder of this paper is organized as follows: Section 2 reviews the relevant empirical literature; Section 3 outlines the theoretical framework; Section 4 discusses the methodology and data; Section 5 presents and analyzes the empirical results; and Section 6 concludes the study.

2. Brief Literature Review

The critical role of unemployment and output growth in the economy has prompted researchers and analysts to revisit, extend, and reexamine the validity of Okun's Law, which describes the unemployment–output nexus, under various contexts and scenarios. Numerous studies have tested Okun's Law across countries with mixed results. Early work by Moosa (1997) examined G7 countries and found support for the theoretical predictions, reporting that the Okun's Law coefficient was higher in North America and lower in Japan. Similarly, Elshamy (2013) identified an inverse relationship between unemployment and output growth in Egypt, while Doğru (2013) confirmed the law in the Eurozone, noting that Okun's coefficients in the USA and other developed countries were generally higher than those in the Eurozone. Chutto (2020) validated Okun's Law for Mauritius but observed limited evidence of long-run cointegration between the variables.

In the Nigerian context, findings have also been mixed. Studies by Akeju & Olanipekun (2014), Bankole & Fatai (2013), and Babalola et al. (2013) found no empirical support for Okun's Law, whereas Ayinde et al. (2018) confirmed its existence in Nigeria. Building on Moosa's (1997) framework, Benos & Stavrakoudis (2020) analyzed unemployment and output residuals across the G7 countries and found a strong relationship in the US, France, Canada, the UK, and Germany, but a weaker one in Italy and Japan. Similarly, Ibragimov & Ibragimov (2016) reported stability of Okun's Law in Belarus, Kazakhstan, Moldova, Russia, Ukraine, and Uzbekistan, while Palombi et al. (2015) identified a medium-run Okun's effect across UK regions, with smaller coefficients relative to other areas.

Sectoral analyses have provided further insights. Apap & Gravino (2017), using quarterly data from Malta (2000–2012), found that unemployment in the Services sector responds more strongly to output changes than in the Manufacturing sector. Goto & Bürgi (2021) showed that while sectoral coefficients are not significant determinants of aggregate Okun's coefficients, they are proportional to aggregate coefficients in countries such as the UK, US, Japan, and Switzerland. In Nigeria, Raifu (2023) and Adekunle et al. (2025) found an inverse relationship between sectoral growth and unemployment, with services exhibiting the strongest employment-reducing effect. However, Adekunle et al. (2025) also highlighted that sectoral impact coefficients were generally smaller than the traditional Okun coefficient.

Additionally, most past studies have focused on estimating either the Difference or Gap version of Okun's Law at the aggregate or sectoral level, emphasizing short- and long-run relationships between output and unemployment. While these studies recognize that the impact of output is not uniform across sectors, limited attention has been given to the heterogeneous effects of sectoral output on unemployment across different quantiles of the distribution in developing countries, including Nigeria. This study seeks to address this gap by identifying which sectors are most effective in reducing unemployment, particularly at the upper quantile, thereby providing evidence to guide policy priorities in tackling Nigeria's unemployment challenge.

3. Theoretical Framework

This study relies on Okun's Law, named after the renowned economist Arthur Okun, as its theoretical framework. The derivation of Okun's Law proceeds as follows. The relationship between changes in unemployment and output derives from a production function for the economy and from ancillary relationships in the labour market. In natural logs, the production function[1] is written as:

$$y = \alpha(k + c) + \beta(\gamma n + \delta h) + \tau \tag{1}$$

Where y is output, k is the capital input and c is its utilization rate, n represents the number of workers, h is the number of hours that they work; α and β are output elasticities of capital and labour, respectively, and γ and δ are the contributions of workers and weekly hours to the total labour input; τ is a disembodied technology factor.

Potential output, denoted by y^*, is also produced from the same production function, but with inputs at their equilibrium or long-run sustainable values, also indicated by (*). Thus, the output gap in any period, defined as $y - y^*$, is

$$y - y^* = \alpha(k - k^*) + \alpha(c - c^*) + \beta\gamma(n - n^*) + \beta\delta(h - h^*) + (\tau - \tau^*) \tag{2}$$

If l is the natural log of the supply of workers, the unemployment rate is defined as

$$u = l - n \tag{3}$$

With the natural rate, u^*, representing equilibrium in the labour market. Here, labour supply equals the sum of employed workers and "equilibrium" vacancies or

$$u^* = l^* - n^* \tag{4}$$

The natural rate can change over time as participation rates or other demographic factors change. Assuming that $\tau - \tau^*$and $k - k^*$, but letting the utilization of that capacity differ between actual and optimal levels

[1]See Prachowny (1993)

Replacing n and n^* in eq. (2) from eq. (3) and eq. (4), respectively, we have

$$y - y^* = \alpha(c - c^*) + \beta\gamma[(l - u) - (l^* - u^*)] + \beta\delta(h - h^*) \quad (5)$$

Removing the brackets and collecting like terms yields

$$y - y^* = \alpha(c - c^*) + \beta\gamma(l - l^*) + \beta\gamma(u - u^*) + \beta\delta(h - h^*) \quad (6)$$

From eq. (6), the term $\beta\gamma$ is the link between unemployment rates and output changes.

Further, Okun defines potential output as the amount of goods and services that can be produced at "full employment". If this is meant to define $u - u^*$, then y can still deviate from y^* unless $c - c^*$, $l - l^*$, and $h - h^*$ as well. If, for instance, the labour market for workers is at equilibrium but there is "abnormal" overtime, the output gap will be positive. It is important not to interpret $y = y^*$ as implying labour-market equilibrium; there may be excess supply of workers combined with unusually high overtime hours. In light of these circumstances, it is vital to rename Okun's law as "Okun's theory" and to conduct formal tests of the specific hypotheses it entails (Prachowny, 1993).

Two studies that pioneered testing the validity of Okun's law are Adams & Coe (1989) for the US economy and Ford & Rose (1989) for the Canadian economy. Both studies adopted a production function generically similar to eq. (1) above. However, they then added an equation to represent Okun's Law, which can be written as[2]

$$(u - u^*) = -\vartheta(y - y^*) + \varphi Z \quad (7)$$

Where Z represents a vector of additional variables considered appropriate for the determination of the unemployment gap. This specification (eq. 7) is similar to eq. (6) when the latter is re-expressed as:

$$u - u^* = \frac{\alpha}{\beta\gamma}(c - c^*) + (l - l^*) + \frac{\delta}{\gamma}(h - h^*) - \frac{1}{\beta\gamma}(y - y^*) \quad (8)$$

Eq. (8) relies on the production function based on eq. (1) and on the definition of the unemployment rate. Equations (7) and (8) would only be consistent with each other if the coefficient ϑ is constrained to equal $1/_{\beta\gamma}$ and if the vector of variables Z is exactly $(c - c^*)$, $(l - l^*)$, and $(h - h^*)$, with parameters constrained to equal each of those shown in eq. (8)[3].

Following the predictions of Okun's law, eq. (8) shows that a negative relationship exists between the unemployment gap and the output gap. When actual output is greater than the potential output

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[2]See Shin et al (2014)
[3]See Prachowny (1993)

(which implies a move towards achieving full employment), the unemployment rate is said to be decreasing in relation to its natural rate. However, when actual output is less than potential output (which implies a move away from full employment), the unemployment rate is said to be rising relative to its natural rate. As a result, a standing hypothesis is that keeping the potential output and the natural rate of unemployment constant, an increase in output is expected to generate a fall in the unemployment rate, and vice versa.

4. Methodology & Data

Building on the Difference version of Okun's Law and the dynamic and average-effects model employed by Adekunle et al. (2025), this study hypothesizes that the impact of output on unemployment varies not only across economic sectors but also across different quantiles of the unemployment distribution. Unlike Adekunle et al. (2025), who focused on a dynamic framework (ARDL model), the present study adopts a static quantile regression approach. The unemployment model is specified to include the primary explanatory variables—aggregate output and sectoral growth—alongside key control variables, allowing for a comprehensive assessment of factors influencing unemployment dynamics.

$$unr_t = \alpha_0 + \alpha_1 growth_t + \mu_t \quad (9)$$

Overall Economy and Broad Sectors: $growth = \{rgdp\_g, agr\_g, ind\_g, ser\_g\}$ (10)

Key Industrial Sub-sectors: $growth = \{man\_g, con\_g\}$ (11)

Key Services Sub-sectors: $growth = \{trade\_g, pro\_g, transp\_g, ict\_g, finance\_g,$
$estate\_g, edu\_g, hlt\_g\}$ (12)

Controlling for other variables – including net FDI inflows and government expenditure - to have a semblance of eq. (7), Equation 9 becomes:

$$unr_t = \alpha_0 + \alpha_1 growth_t + \alpha_2 gcons_t + \alpha_3 net\_fdi_t + \mu_t \quad (13)$$

Moreover, the quantile regression approach employed in this study was proposed by Koenker & Bassett (1978) in a panel-data setting. Quantile regression provides estimates of the linear relationship between explanatory variables and a specified quantile of the dependent variable. One important special case of quantile regression is the least absolute deviations (LAD) estimator, which corresponds to fitting the conditional median of the response variable.

A typical quantile regression can be specified as:
$y_t = x_t' \beta_\tau + \varepsilon_t$ and $Quant_\tau(y_t/x_t) = x_t' \beta_\tau$ (14)

Where y_t is the response variable (the unemployment rate, in this case); x_t is a vector of explanatory variables (which, in this case, are aggregate GDP growth, broad sector growth and sectoral growth, government consumption expenditure, and net FDI inflows); β_τ is a vector of parameters; ε_t is a vector of disturbance terms; $Quant_\tau(y_t/x_t)$ identifies the τ^{th}conditional quantile of y_t given x_t. This study uses three quantiles: the 25^{th}, 50^{th}, and 75^{th}. Moreover, the data on the variables of interest (see Table 1) were obtained from two sources (domestic and external) over the period from 1991 to 2024, based on data availability.

Table 1: Data Description and Sources

Variable	Definition & Measurement	Data Source
unr	Unemployment Rate (%)	World Development Indicators
rgdp_g	Real Gross Domestic Product (GDP) growth (%)	Computed from the CBN Statistical Bulletin
agr_g	Agricultural sector growth (%)	Computed from the CBN Statistical Bulletin
ind_g	Industrial sector growth (%)	Computed from the CBN Statistical Bulletin
ser_g	Services sector growth (%)	Computed from the CBN Statistical Bulletin
man_g	Manufacturing sector growth (%)	Computed from the CBN Statistical Bulletin
con_g	Construction sector growth (%)	Computed from the CBN Statistical Bulletin
trade_g	Trade sector growth (%)	Computed from the CBN Statistical Bulletin
pro_g	Professional & Technical Services sector growth (%)	Computed from the CBN Statistical Bulletin
transp_g	Transport sector growth (%)	Computed from the CBN Statistical Bulletin
ict_g	Information & Communications Technology sector growth (%)	Computed from the CBN Statistical Bulletin
finance_g	Financial & Insurance sector growth (%)	Computed from the CBN Statistical Bulletin
estate_g	Real Estate sector growth (%)	Computed from the CBN Statistical Bulletin
edu_g	Education sector growth (%)	Computed from the CBN Statistical Bulletin
hlt_g	Health sector growth (%)	Computed from the CBN Statistical Bulletin
Gcons	General government consumption expenditure (% of GDP)	World Development Indicators
net_fdi	Net foreign direct investment inflows (% of GDP)	World Development Indicators

5. Empirical Results & Discussion

5.1 Preliminary Analysis

Table 1 presents the summary statistics for all variables used in this study over 34 years. The average unemployment rate stood at 4.04%, while real GDP growth averaged 3.98%. At the broad sectoral level, the Services and Agriculture sectors recorded the strongest growth, averaging 5.81% and 5.51% respectively, whereas Industry posted the weakest growth at 0.91%. The subdued performance of the Industrial sector is mainly attributable to modest growth in Manufacturing (2.09%), while Construction performed relatively well, averaging 5.70%. The robust growth in the Services sector is driven by several key sub-sectors, including Information & Communications Technology (ICT) at 13.71%, Financial & Insurance at 6.05%, Trade at 5.39%, and Transport at 5.15%. This strong performance aligns with the fact that Services contribute over 50% of Nigeria's total real GDP, while Agriculture and Industry together account for less than half. Other sub-sectors considered in this study—Real Estate, Professional & Technical Services, Education, and Health—have average growth rates below 5%. Government consumption expenditure averaged 4.55% of GDP, while net foreign direct investment (FDI) inflows averaged 1.28% of GDP. Based on standard deviation, the most volatile series are the growth rates of ICT, Transport, and Financial & Insurance, reflecting the presence of outlier values. In contrast, the unemployment rate and net FDI inflows are the least volatile variables, indicating relative stability over the sample period.

Table 2: Descriptive Statistics

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Unr	34	4.041	0.591	3.000	5.700
rgdp_g	34	3.982	3.699	-2.037	15.329
agr_g	34	5.513	9.038	1.128	55.578
ind_g	34	0.913	4.705	-8.850	12.160
ser_g	34	5.806	4.871	-2.222	19.998
man_g	34	2.088	8.691	-17.51	21.797
con_g	34	5.704	5.968	-7.684	15.714
trade_g	34	5.399	7.636	-8.493	36.651
pro_g	34	3.926	3.925	-7.919	18.681
transp_g	34	5.154	11.951	-30.170	49.690
ict_g	34	13.713	14.552	-1.040	77.670
finance_g	34	6.052	10.265	-26.930	29.570
estate_g	34	3.987	5.433	-9.220	11.980
edu_g	34	4.853	7.182	-13.570	31.570
hlt_g	34	4.544	4.284	-1.790	13.040
gcons	34	4.547	2.797	0.911	9.448
net_fdi	34	1.280	0.851	-0.039	2.900

Source: Authors's Computation

Table 3 presents the correlation coefficients for all variables used in this study. Consistent with expectations, the unemployment rate exhibits a negative association with all explanatory variables; however, the correlations are statistically significant only for total real GDP growth, Services, one of the Industrial sub-sectors (Construction), selected Services sub-sectors (Trade, Professional & Technical Services, Real Estate, Education, and Health), and net FDI inflows. This underscores the employment-generating potential of these sectors and sub-sectors. All sectors and sub-sectors, except Financial & Insurance, show a statistically significant correlation with total GDP growth. The weak linkage between the Financial & Insurance sector and overall economic growth suggests that, despite its strong growth performance, the sector has limited support for productive activities, as evidenced by weak or negative correlations with other key sectors. Moreover, government consumption expenditure displays only a weak correlation with economic growth, whereas net FDI inflows are positively associated with GDP growth. There are also notable inter-sectoral linkages: Agriculture with Manufacturing, Manufacturing with Construction, Construction with Real Estate, Trade with Transport, ICT with Health, and Education with ICT. While the correlations between sectoral growth and government consumption expenditure are mixed, net FDI inflows generally exhibit a positive—and occasionally significant—association with sectoral growth, except for Financial & Insurance.

Table 4 reports the stationarity status of the variables using the Augmented Dickey-Fuller (ADF) unit root test. Most variables are stationary at levels (I(0)) and require no differencing, except for the growth rates of Services, Health, and Education, as well as government consumption expenditure and net FDI inflows, which are integrated of order one (I(1)) and require first differencing to achieve stationarity. Since this study focuses on the static relationships between output and unemployment rather than short- and long-run dynamics, cointegration testing is not conducted, and the static quantile regression results are presented in the following section.

Table 3: Pairwise Correlation Matrix

Variables	unr	rgdp_g	agr_g	ind_g	ser_g	man_g	con_g	trade_g	pro_g	transp_g	ict_g	finance_g	estate_g	edu_g	hlt_g	gcons	net_fdi
unr	1.00																
rgdp_g	-0.45***	1.00															
agr_g	-0.16	0.63***	1.00														
ind_g	-0.28	0.57***	0.05	1.00													
ser_g	-0.48***	0.76***	0.32*	0.13	1.00												
man_g	-0.17	0.51***	0.32*	0.40**	0.25	1.00											
con_g	-0.44***	0.46***	0.05	0.40	0.42**	0.39**	1.00										
trade_g	-0.39**	0.61***	0.15	0.12	0.91***	0.12	0.24	1.00									
pro_g	-0.55***	0.47***	0.19	0.38**	0.42**	0.34*	0.71***	0.38**	1.00								
transp_g	-0.05	0.46***	0.26	0.12	0.59***	0.11	-0.05	0.69***	0.19	1.00							
ict_g	-0.18	0.45***	0.11	0.16	0.58***	-0.03	0.29	0.42**	0.13	0.25	1.00						
finance_g	-0.22	0.17	0.35**	-0.21	0.13	0.15	-0.17	-0.09	-0.35**	-0.12	-0.01	1.00					
estate_g	-0.61***	0.57***	0.09	0.16	0.82***	0.18	0.67***	0.72***	0.49***	0.34*	0.44***	0.07	1.00				
edu_g	-0.49***	0.55***	0.15	0.39**	0.57***	0.44***	0.67***	0.57***	0.86***	0.34*	0.12	-0.41**	0.53***	1.00			
hlt_g	-0.38***	0.59***	-0.01	0.31*	0.76***	0.47***	0.62***	0.71***	0.55***	0.29	0.29*	-0.17	0.70***	0.74***	1.00		
gcons	-0.02	0.24	-0.15	-0.003	0.40**	0.34***	0.38**	0.33*	0.27	0.03	0.09	-0.001	0.24	0.44***	0.62***	1.00	
net_fdi	-0.34*	0.38**	0.25	0.08	0.48***	0.04	0.49***	0.43**	0.49***	0.11	0.34**	-0.23	0.52***	0.49***	0.51***	0.19	1.000

Source: Authors' Computation

Table 4: The Augmented Dickey-Fuller Test Results

Variable	Level	First Difference	Order of Integration	Remark
unr	-3.765***^{B}	-----------------	I(0)	Stationary
rgdp_g	-3.002**^{B}	-----------------	I(0)	Stationary
agr_g	-5.275***^{B}	-----------------	I(0)	Stationary
ind_g	-4.716***^{C}	-----------------	I(0)	Stationary
ser_g	-0.984^{C}	-9.849***^{C}	I(1)	Nonstationary
man_g	-3.857***^{C}	-----------------	I(0)	Stationary
con_g	-3.429***^{B}	-----------------	I(0)	Stationary
trade_g	-3.295**^{B}	-----------------	I(0)	Stationary
pro_g	-3.114**^{B}	-----------------	I(0)	Stationary
transp_g	-6.621***^{B}	-----------------	I(0)	Stationary
ict_g	-4.262***^{B}	-----------------	I(0)	Stationary
finance_g	-4.919***^{B}	-----------------	I(0)	Stationary
estate_g	-1.961**^{C}	-----------------	I(0)	Stationary
edu_g	-1.396^{C}	-11.675***^{C}	I(1)	Nonstationary
hlt_g	-2.349^{B}	-6.791***^{B}	I(1)	Nonstationary
gcons	-0.236^{C}	-2.029**^{C}	I(1)	Nonstationary
net_fdi	-1.234^{C}	-7.189***^{C}	I(1)	Nonstationary

Note: ***, **, * imply the rejection of the null hypothesis of a unit root at 1%, 5%, and 10%, respectively. Superscripts A, B, and C represent the ADF test regressions with a constant and time trend, with an intercept only, and without an intercept and time trend, respectively. I(.) implies the number of differencing required for a variable to achieve stationarity**.**

Source: Authors' Computation

5.2 Regression Results

5.2.1 Impact of Output Growth on Unemployment Rate – Aggregate Output & Broad Sectors

The study presents the heterogeneous effects of the growth rates of the total real GDP and broad sectors (Agriculture, Industry, and Services) on the unemployment rate in Nigeria across three quantiles, namely the 25th (lower) quantile, 50th (middle) quantile, and 75th (upper) quantile (see Table 5). Results revealed that under the aggregate output scenario, total real GDP growth is unemployment-reducing, with the middle and upper quantiles having larger and statistically significant impact coefficients at the 5-10% level, compared with the lower quantile (see columns 1 to 3). Directionally, the results are consistent with the theoretical expectation, though the coefficients are smaller than Okun's Law coefficient of -3 percentage points: the lower quantile (-0.11 percentage points, derived by multiplying -0.0359 by 3), the middle quantile (-0.16 percentage points), and the upper quantile (-0.15 percentage points). The results align with the findings of Doğru (2013), Elshamy (2013), Wang & Huang (2017), and Chutto (2020).

In terms of the broad sectoral dimension, there is an inverse relationship between the unemployment rate and the growth rates of Agriculture (see columns 4 to 6) and Industry (see columns 7-9), except that the impact coefficients are not statistically significant across the three quantiles for both sectors. This result supports the findings of Adekunle et al. (2025). Conversely, the growth rate of the Services sector is unemployment-reducing at all quantiles. Still, the impact coefficient associated with the upper quantile is the largest and statistically significant at the 5% level (see column 12), compared with the lower and middle quantiles (see columns 10 and 11). At the upper quantile, the impact coefficient (-0.15 percentage points) also falls short of the

Okun's Law coefficient. This suggests that the Services sector is more effective in suppressing greater levels of unemployment, with other broad sectors playing a passive role. This affirms the findings of Apap & Gravino (2017); Raifu (2023), and Adekunle et al. (2025).

5.2.2 Impact of Output Growth on Unemployment Rate – Key Sub-sectors

In this study, the focus is on two Industrial sub-sectors: Manufacturing and Construction. While the growth rate of both activity sectors is negatively related to unemployment at all quantiles, the impact coefficient is largest and only statistically significant at the 1% level at the upper quantile for the Construction sector (see columns 13-18 in Table 6). Although the impact coefficient (-0.26 percentage points) is smaller than Okun's Law's prediction of -3 percentage points, the Construction sector is observed to be more unemployment-reducing than the overall economy and the broad sectors. The effectiveness of the Manufacturing and Construction sectors in reducing the unemployment rate is well documented by past studies, including Adekunle et al. (2025).

This study also employed eight (8) key Services activities, with results showing an inverse relationship between the growth rates of these sub-sectors and the unemployment rate (see Tables 6-8). Meanwhile, unemployment reduces in response to activity improvements (growth rates) in half of these sub-sectors at the middle and upper quantiles, with impact coefficients being statistically significant at the conventional levels: Trade (see columns 20 and 21 in Table 6), Professional & Scientific Services (see columns 23 and 24 in Table 6), Real Estate (see columns 35 and 36 in Table 7), and Health (see columns 41 and 42 in Table 8); thus, these sub-sectors ae effectiveness in tackling high levels of unemployment.

Even though the eight sub-sectors are associated with impact coefficients that are weaker than the Okun's Law prediction, Professional & Scientific Services recorded the strongest unemployment-reducing effect (0.37 and 0.36 percentage points at the middle and upper quantiles, respectively). However, the remaining four sub-sectors are associated with statistically insignificant impact coefficients: Transport (see columns 25-27 in Table 7), ICT (see columns 28-30 in Table 7), Financial & Insurance (see Tables 31-33 in Table 7), and Education (see columns 37-39 in Table 8). The unemployment-reducing potential of sectors including Trade, Professional & Scientific Services, Education, and Health has been established by Adekunle et al. (2025).

5.2.3 Impact of Control Variables on Unemployment Rate

This study used two control variables: government consumption expenditure and net FDI inflows. Across the aggregate output and thirteen (13) sectoral specifications, government consumption expenditure is associated with mixed results regarding whether recurrent spending is unemployment-reducing or unemployment-worsening at the three quantiles (see Tables 5-8). There are many cases where government consumption expenditure worsens or exacerbates the unemployment problem; this is case under scenarios including Aggregate output (at all quantiles);

Agriculture and Industry (upper quantile); Services (middle and upper quantile); Manufacturing and Construction (middle and upper quantile); Trade and Professional & Scientific Services (middle and upper quantile); Transport and ICT (upper quantile), and Real Estate, Education and Health (all quantiles). In fact, the impact coefficients are statistically significant at the conventional levels at the upper quantile in a few cases: Construction (see column 18 in Table 6); Real Estate (see column 36 in Table 7), and Education (see column 39 in Table 8). This finding aligns with Raifu's (2017) finding that government consumption expenditure positively and significantly influences unemployment in Nigeria.

On the other hand, there are just a handful of cases where recurrent spending is unemployment reducing: Agriculture and Industry (lower and middle quantiles); Services (lower quantile); Manufacturing and Construction (lower quantile); Trade and Professional & Scientific Services (lower quantile); Transport & ICT (lower and middle quantiles), and Financial & Insurance (all quantiles). In this case, the associated impact coefficients are small and not statistically significant at the conventional levels. This suggests that recurrent spending does not significantly reduce unemployment in Nigeria. On a general note, net FDI inflows are unemployment-reducing across many quantiles and sectors (see Tables 5-8), aligning with the findings of Osabohien et al. (2020); Raifu & Afolabi (2022), and Adekunle et al. (2025). In fact, the impact coefficients are statistically significant at the upper quantile in a few cases including Industry (see column 9 in Table 5), Trade (see column 21 in Table 6); Professional & Scientific Services (see column 24 in Table 6), Transport (see column 27 in Table 7), and Health (see column 42 in Table 8).

Table 5: Quantile Regression of Unemployment with respect to Aggregate Output and Broad Sectors

	Aggregate Output			Agriculture			Industry			Services		
	Quantiles			Quantiles			Quantiles			Quantiles		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
rgdp_g	-0.0359***	-0.0520***	-0.0507**									
	(0.0120)	(0.0133)	(0.0239)									
agr_g				-0.00194	-0.00366	-0.00493						
				(0.264)	(0.224)	(0.482)						
ind_g							-0.0189	-0.0189	-0.0405			
							(0.0226)	(0.0217)	(0.0322)			
ser_g										-0.0211	-0.0380	-0.0513**
										(0.0521)	(0.0365)	(0.0190)
gcons	0.00510	0.0152	0.0487	-0.0140	-0.0115	0.0289	-0.0147	-0.00688	0.0403	-0.00649	0.0200	0.0509
	(0.0268)	(0.0181)	(0.0478)	(0.0617)	(0.0510)	(0.160)	(0.0349)	(0.0333)	(0.0468)	(0.0583)	(0.0445)	(0.0467)
net_fdi	0.00781	-0.0909	-0.291	-0.0260	-0.0614	-0.384	-0.0471	-0.149	-0.509**	-0.00756	-0.0313	-0.236
	(0.133)	(0.107)	(0.211)	(0.292)	(0.297)	(0.274)	(0.0929)	(0.152)	(0.214)	(0.171)	(0.119)	(0.159)
Constant	3.897***	4.200***	4.631***	3.878***	4.040***	4.692***	3.934***	4.187***	5.029***	3.975***	4.167***	4.680***
	(0.299)	(0.227)	(0.453)	(0.538)	(0.430)	(1.042)	(0.237)	(0.289)	(0.395)	(0.294)	(0.204)	(0.327)
Observations	34	34	34	34	34	34	34	34	34	34	34	34
Pseudo R-squared	0.1328	0.1775	0.2149	0.0427	0.0802	0.1372	0.0717	0.1186	0.1809	0.0957	0.1773	0.2849

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' Computation

Table 6: Quantile Regression of Unemployment with respect to Key Industrial & Services Sub-Sectors

	Manufacturing			Construction			Trade			Professional & Scientific Services		
	Quantiles			Quantiles			Quantiles			Quantiles		
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
VARIABLES	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
man_g	-0.00433	-0.00985	-0.0195									
	(0.00617)	(0.0111)	(0.0198)									
con_g				0.0108	-0.0415	-0.0866***						
				(0.0328)	(0.0315)	(0.0224)						
trade_g							-0.0105	-0.0142***	-0.0250**			
							(0.0354)	(0.00421)	(0.00980)			
pro_g										0.00964	-0.123**	-0.121***
										(0.100)	(0.0595)	(0.0274)
gcons	-0.00569	0.00107	0.0362	-0.0202	0.0245	0.109***	-0.00734	0.00386	0.0314	-0.0169	0.0170	0.0313
	(0.0263)	(0.0348)	(0.0648)	(0.0427)	(0.0518)	(0.0336)	(0.0411)	(0.0243)	(0.0458)	(0.0277)	(0.0247)	(0.0424)
net_fdi	-0.0562	-0.137	-0.365	-0.0748	-0.00986	-0.120	-0.00629	-0.0682	-0.363**	-0.0554	-0.0340	-0.0911**
	(0.118)	(0.146)	(0.272)	(0.139)	(0.0968)	(0.131)	(0.201)	(0.113)	(0.175)	(0.177)	(0.0697)	(0.0394)
Constant	3.895***	4.150***	4.615***	3.873***	4.130***	4.484***	3.893***	4.127***	4.868***	3.883***	4.536***	4.631***
	(0.272)	(0.249)	(0.470)	(0.312)	(0.162)	(0.272)	(0.315)	(0.230)	(0.370)	(0.468)	(0.219)	(0.135)
Observations	34	34	34	34	34	34	34	34	34	34	34	34
Pseudo R-squared	0.0392	0.1292	0.2014	0.0297	0.1632	0.3303	0.0723	0.1206	0.2193	0.0297	0.1804	0.3677

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' Computation

Table 7: Quantile Regression of Unemployment with respect to Other Key Services Sub-sectors

	Transport			**ICT**			**Financial & Insurance**			**Real Estate**		
	Quantiles			**Quantiles**			**Quantiles**			**Quantiles**		
	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
VARIABLES	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
transp_g	-0.00400	-0.00731	-0.0142									
	(0.0131)	(0.0102)	(0.0109)									
ict_g				-0.00459	0.000309	-0.00272						
				(0.0191)	(0.00530)	(0.0316)						
finance_g							-0.00406	-0.00612	-0.0159			
							(0.00984)	(0.00454)	(0.0296)			
estate_g										-0.0189	-0.0453*	-0.0822***
										(0.0303)	(0.0236)	(0.0157)
gcons	-0.0142	-0.000961	0.0316	-0.00188	-0.00513	0.0345	-0.0158	-0.00222	-0.00771	0.00377	0.00775	0.0551**
	(0.0219)	(0.0251)	(0.0326)	(0.0426)	(0.0267)	(0.0829)	(0.0316)	(0.0253)	(0.0436)	(0.0471)	(0.0286)	(0.0248)
net_fdi	-0.0525	-0.136	-0.347**	-0.0163	-0.0834	-0.362	-0.0577	-0.143	-0.259	-0.0517	0.0156	-0.0681
	(0.0865)	(0.128)	(0.147)	(0.137)	(0.106)	(0.235)	(0.133)	(0.104)	(0.174)	(0.123)	(0.0637)	(0.0529)
Constant	3.939***	4.155***	4.631***	3.854***	4.021***	4.628***	3.949***	4.164***	4.690***	3.954***	4.134***	4.414***
	(0.226)	(0.279)	(0.376)	(0.247)	(0.251)	(0.444)	(0.137)	(0.271)	(0.410)	(0.217)	(0.128)	(0.111)
Observations	34	34	34	34	34	34	34	34	34	34	34	34
Pseudo R-squared	0.0551	0.0849	0.1442	0.0370	0.0634	0.1384	0.0781	0.0932	0.1454	0.0659	0.2366	0.4366

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' Computation

Table 8: Quantile Regression of Unemployment with respect to Social Services Sectors

	Education			**Health**		
	Quantiles			**Quantiles**		
	(37)	(38)	(39)	(40)	(41)	(42)
VARIABLES	0.25	0.50	0.75	0.25	0.50	0.75
edu_g	-0.0239	-0.0455	-0.0715**			
	(0.0342)	(0.0345)	(0.0277)			
hlt_g				-0.0327	-0.0546***	-0.0865***
				(0.0274)	(0.0141)	(0.0171)
gcons	0.00810	0.0346	0.104*	0.00955	0.0339	0.107
	(0.0361)	(0.0518)	(0.0598)	(0.0523)	(0.0268)	(0.0772)
net_fdi	0.0440	-0.0596	-0.0892	0.0347	-0.00504	-0.196*
	(0.148)	(0.0973)	(0.0788)	(0.140)	(0.0773)	(0.108)
Constant	3.790***	4.129***	4.236***	3.887***	4.060***	4.426***
	(0.307)	(0.192)	(0.117)	(0.246)	(0.149)	(0.191)
Observations	34	34	34	34	34	34
Pseudo R-squared	0.0672	0.1547	0.3275	0.0766	0.1842	0.2886

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' Computation

6. Conclusion and Policy Implications

This study examined Nigeria's unemployment dynamics between 1991 and 2024 using the quantile regression approach to determine whether Okun's Law relationship varies across different unemployment levels. Under the aggregate output scenario, total real GDP growth was found to reduce unemployment, with the effect stronger at higher quantiles. This suggests that output growth is more effective at lowering unemployment when unemployment is relatively high. However, the weaker-than-expected Okun's coefficient indicates that Nigeria's growth pattern has been largely non-inclusive, with limited capacity to generate broad-based employment opportunities.

At the broad sectoral level, agricultural and industrial growth both exhibit inverse relationships with unemployment, although their effects are statistically insignificant across all quantiles. This outcome implies that while these sectors possess job-creation potential, their actual contribution to employment remains limited due to persistent structural bottlenecks such as low productivity, weak value-chain integration, and infrastructural deficiencies. In contrast, the services sector consistently shows a negative and statistically significant relationship with unemployment, particularly at higher quantiles. This finding highlights the increasing importance of the Services sector in mitigating unemployment pressures during periods of elevated joblessness.

Further analysis of the industrial sub-sectors — specifically Manufacturing and Construction — provides additional insight into employment dynamics. Both sectors show negative relationships with unemployment across the quantiles, but the Construction sector demonstrates the most pronounced and statistically significant effect at higher unemployment levels. This suggests that increased construction activity—often linked to infrastructure development and housing expansion—has a relatively greater impact on reducing unemployment than aggregate or broad-sectoral growth. Although the overall magnitude of the effect remains modest, it implies that labour-intensive industrial activities can effectively contribute to job creation when supported by conducive policy frameworks and investment incentives.

The Services sub-sectors exhibit substantial heterogeneity. Of the eight sub-sectors analyzed, four—Trade, Professional and Scientific Services, Real Estate, and Health—show significant unemployment-reducing effects, especially at the middle and upper quantiles. Among these, Professional and Scientific Services demonstrate the strongest link to job creation, reflecting the growing influence of high-skill and knowledge-driven activities in the Nigerian economy. Likewise, growth in Trade, Real Estate, and Health is associated with lower unemployment, underscoring these sectors' labour-absorbing capacity. Conversely, Transport, ICT, Financial and Insurance, and Education show statistically insignificant effects, suggesting weak or delayed employment transmission mechanisms.

Moreover, the results for the control variables reveal a mixed pattern. In several cases, particularly under the aggregate output, Industry, and Services scenarios, higher government consumption expenditure is associated with rising unemployment, indicating that recurrent spending often exacerbates labour market challenges. Conversely, the limited cases where recurrent expenditure appears to reduce unemployment—mainly at lower quantiles—are economically minor and statistically insignificant. This suggests that fiscal policy in Nigeria exhibits low employment elasticity, particularly when dominated by recurrent rather than capital expenditure. By contrast, net FDI inflows consistently show unemployment-reducing effects across multiple quantiles and sectors. The significant negative relationships observed in the Industry, Trade, Professional and Scientific Services, Transport, and Health sectors underscore the role of FDI in stimulating job creation through technology transfer, industrial expansion, and services-sector development.

Taken together, the findings reveal that Nigeria's economic growth has a modest but positive effect on employment, with the strongest impacts concentrated in the Services, Professional & Scientific Services, and Construction sectors. However, the weak linkage between growth and jobs in Agriculture and Industry highlights the need for structural transformation to shift growth drivers towards labour-intensive and productivity-enhancing activities. Policy interventions should therefore focus on improving the employment elasticity of output through targeted industrial policies, skills development initiatives, and large-scale infrastructure investment. In addition, reorienting government expenditure towards productive capital projects, prioritizing public spending in favour of productive economic activities, and promoting FDI in high-employment sectors could substantially enhance the economy's job-creation capacity. Ultimately, achieving sustained and inclusive growth will require not only macroeconomic stability but also deliberate sectoral strategies that strengthen the connection between output expansion and labour absorption.

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