Unemployment and Economic Growth in Nigeria: An ARDL Verification of Okun's Law

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A b s t r a c t

The Nigerian economy has been ravaged by a growing wave of unemployment in the last decades which has left behind frustrated macroeconomic policies and programmes. This has made the need for a lasting economic solution very imperative. The main target of this study is to validate Okun's law in Nigeria using annual time series data on unemployment and GDP from 1985 to 2021. The diagnostic test of the Unit Root point out that the variables are I(0) integrated at level and I(1) at first differences. Using an ARDL Model, the results show that both in the short and the long-runs, unemployment rate has a negative and significant effect on GDP growth in Nigeria. This result validates okun's law that argues that if GDP grows to its potential the unemployment rate declines while if the growth rate is low or even negative the unemployment rate increases. The results of the Toda and Yamamoto causality tests show there is no causality between the unemployment rate and GDP growth rate but a unidirectional causality exists between GDP growth and foreign direct investment over the study period. Therefore, the government should encourage young Nigerians to engage in agricultural productivity, to increase the output of goods and services which in turn will reduce the unemployment rate across the country.

Keywords: *Okun's law, Economic growth, Unemployment, Inflation, Foreign direct investment, and Interest rate*

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Background to the Study

One of the great challenges of the Sub-Saharan African economy today is the higher rate of unemployment because it is seen as a great problem to global economic growth and development. In recent years, both developed and developing countries have witnessed these economic challenges (Adjemian and Rojas, 2010). As a result, Okun (1962) using US data drew the conclusion that there exists a negative relationship between unemployment and output. Along these lines, the law claims that, when GDP grows to its potential, the unemployment rate is expected to decline while if the GDP growth rate decline or become negative the unemployment rate increases, as was the case in the U.S economy. In this regard, Okun's Law has been widely accepted in macroeconomics literature. Consequently, from the 1960s many economists began to question the validity of Okun's Law globally. This is because, in each of the last three periods that the U.S economy slips into recessions, it results in what is termed a "jobless recovery" in which the unemployment rate does not fall as predicted by the Okun's Laws (Anoğlu and Tanga, 2016).

In addition, many economists found that the relationship between unemployment and GDP further broke down during the Great Recession of 2008-2009, when there was little correlation across countries between the changes in output and unemployment (IMF, 2010). Therefore, the Okun coefficients may change over time because the relationship between unemployment and output growth may depend on laws, technology, preferences, social customs, and demographics. Some economists have suggested that labor market reforms have made most industrialized countries more like the United States, with smaller Okun coefficients (Lee, 2000).

Unemployment is one of the macroeconomic problems which every country has to wrestle with and a symptom of economic illness and macroeconomic disequilibrium. Therefore, a loss of a job is a symptom of a reduced standard of living and psychological distress (Aghino and Howith, 1994). In this connection, the situation in Nigeria today has changed bringing into focus the need to shift emphasis and restructure the macroeconomic objectives to increase the GDP growth rate which in turn may reduce unemployment. The Nigerian economy with a high level of unemployment implies that it can increase poverty and discontent and hence easily break up the pillar of national unity and cohesion (Ogueze and Orji, 2015). Besides, unemployment constitutes a serious problem in Nigeria resulting to vices like insurgency, kidnappings and armed bandits who have ravaged the economy leaving behind steam of bloodshed and massive destruction of vulnerable people and communities. Unexpectedly, the growing rate of unemployment in Nigeria is indeed worrisome (Felix and Moukhtar, 2022).

The Central Bank of Nigeria (CBN) has employed different monetary policy measures to reduce the unemployment rate but instead the Nigerian economy has witnessed increasing levels of unemployment (Johnbosco, 2020). It is based on this background and connection that the objective of this study is to employ the linear ARDL approach to establish whether Okun's trend exists in Nigeria using data from 1985-2021. After this introduction, the remaining part of the research is structured as follows: Section two presents the reviews of the literature on economic growth and unemployment. Section three highlights the methodology. Section four

analyzes and interprets the results and section five covers the conclusion and policy recommendations.

Review of Literature
Theoretical framework

This study adopted Okun's law (1962) that relates output and unemployment. On the basis of data obtained from the U.S economy, Okun noted that the ratio of changes in output to those of unemployment is around 3, due to a short-run increase in employment returns, and to a situation where some workers drop from the labour force when laid off, rather than appearing as unemployed. He specifically, argues that if GDP grows to its potential the unemployment rate declines while if the growth rate is low or even negative the unemployment rate increases. This was applicable in the U.S economy, unlike many developing countries. So, to illustratively, if the potential rate of GDP growth is 2%, Okun's law implies that GDP must grow at about a 4% rate for one year to achieve a one percentage point reduction in the rate of unemployment over that period. There are three 'different version' of Okun's law which relates unemployment rate to the GDP growth rate, and a `gap version' which relates unemployment rate to the output gap. There is a lot of literature that cover all the versions. In this study, the `gap version of the model will be adopted to keep with our objectives of examining the impact of unemployment on potential output growth.

Empirical Literature Review

At the global level, Stober (2015) assessed the relationship between output and unemployment in the United Kingdom from 1971-2013. The results show there is a negative correlation between the output and unemployment as suggested by Okun's law. In contrast, Soylu, Çakmak, and Okur, (2018) investigated the relationship between economic growth and unemployment in Eastern European Countries for the period 1992-2014 within a panel data framework. The result shows that unemployment is affected positively by economic growth in Eastern European Countries. In the Asian context, Saleh and Mohammad (2017) empirically investigated the relationship between the unemployment rate and economic growth in the Jordanian economy from 1982-2016. The study adopts descriptive statistics, and the empirical results obtained from the study indicate a negative relationship between unemployment and GDP in the Jordanian economy.

In Africa, Sibusiso and Hlalefang (2018), investigated the trends and impact of unemployment on economic growth in South Africa using quarterly data over the period 1994 Q1 to 2016 Q4. The Auto-Regressive Distribution Lag (ARDL) bounds test approach is applied. The empirical results obtained confirmed that there is a negative relationship between unemployment and economic growth both in the long and short runs. Similarly, Anoğlu and Tanga (2016), estimated the coefficient and validity of Okun's law in some emerging economies during the period 1990-2014. The Fully Modified OLS was adopted and the empirical results show that Okun's law is not valid for Turkey, South Africa, and Brazil.

In the case of Nigeria, Abiodun and Basiru (2013) estimated the Okun's coefficient, and check the validity of Okun's law in Nigeria, using the time series annual data during the period 1980-

2008. Engle-Granger co-integration test and Fully Modified OLS were employed. The empirical pieces of evidence show that there is a positive coefficient in the Regression, implying that Okun's law interpretation does not apply to Nigeria. In line with the above study, Olanipekun and Akeju (2014) tested the relationship between economic growth and unemployment in Nigeria by using econometric techniques to determine the relationship between economic growth and unemployment in the short and long run. The results show that there is a positive relationship between economic growth and unemployment in Nigeria during the study period.

More so, Ogueze and Orji (2015) examined the impact of unemployment on output growth with the use of data from the Central Bank of Nigeria for the years 1970 to 2010 to capture the effect of the structural adjustment programme. The results of the empirical analysis show that unemployment has a negative impact on the real gross domestic product in Nigeria. Lastly, Udude and Nnachi (2017) examined the relationship between unemployment and economic growth in the case of Nigeria between 1980 and 2013, using the Autoregressive Distributed Lag Approach. The result implies that Okun's law is not applicable in Nigeria.

A review of the previous study shows that unemployment may have either positive or negative effects on economic growth depending on the period and methodology used. This inconclusive result indicates that there is still a need for further research on this study area in Nigeria. Indeed, this study becomes imperative and unique because it covers the period of COVID–19 induced economic recession, policies and programmes that particularly targets GDP growth and reduction of unemployment in Nigeria. The result here will be significant as it will reveal some economic technicalities when conscious policies targeted at an exogenous shock to major macroeconomic variables like GDP and unemployment occurs.

Data and Methodology
Source of Data
In this study, time series data were used spanning from 1985 to 2021 The annual data was drawn from the World Bank database and the Central Bank of Nigeria reports on selected variables such as Gross Domestic Products, unemployment rate, inflation rate, foreign direct investment, and interest rate in Nigeria.

Model Specification
The econometric model is expressed as follows:
$$\text{GDPG}_t = \beta_0 + \beta_1 UNR_t + \beta_2 INFR_t + \beta_3 FDI_t + \beta_4 INTR_t + \mu_t \ldots\ldots\ldots\ldots\ldots (1)$$

Where GDPG= Gross domestic product growth rate
UNR=Unemployment rate
INFR= Inflation rate
FDI= Foreign direct investment
INTR= Interest Rate
The μ = Stands for stochastic disturbance term or error term (μ) which captures those factors affecting unemployment but are not taken into account

The t = Time-series as well as βo = Constant or the intercept depicting the unemployment rate when the independent variables are equal to zero.

The Autoregressive Distributed Lag Model (ARDL)
The Bound test was done using a critical value divide into the lower limit and upper limit, test statistics are expected to fall above the lower and upper limits for cointegration to exist. The lists of the variables were checked to know which of the variables will be integrated at levels 1(0) and differences in first order 1(1).

The ARDL equation is thus stated below.

$$\Delta GDPG_t = \beta_0 + \beta_1 \sum_{i=1}^{n} \Delta UNR_{t-1} + \beta_2 \sum_{i=1}^{n} \Delta INFR_{t-1} + \beta_3 \sum_{i=1}^{n} \Delta FDI_{t-1} + \beta_4 \sum_{i=1}^{n} \Delta INTR_{t-1} + \beta_5 ECM_{t-1} \dots\dots.2$$

The coefficient of the error correction (ECM_{t-1}) will indicate the percentage of the error corrected each year that is, the speed of adjustment. In equation 2 above the signs of β_2, to β_5 are expected to have a negative relationship with the GDP growth rate.

Empirical Results and Discussion
Unit Root Test
At this pre-estimation stage, the study employed the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root test, and the results are presented as follows:

Table 1: Results of ADF and PP Unit Root Tests

Unit root tests				
Augmented Dickey-Fuller (ADF)			Phillips Perron (PP)	
Level				
Variables	Constant Without Trend	Constant With Trend	Constant Without Trend	Constant With Trend
LGDPG	-4.3918*	-4.3278*	-11.9401*	-3.8004**
LUNR	-0.4192	-2.9771	-0.3134	-2.5648
LINFR	- 2.4351	-0.8635	-2.7664	-3.0054
LFDI	-4.0537*	-4.2567*	-3.9685*	-4.0510*
LINTR	-1.2009	-2.8174	-1.4914	-2.5123
First Differences				
LGDPG	-4.4992	-4.4336	-14.6321	-6.2998
LUNR	-6.8525*	-3.9641*	-6.7834*	-7.0269*
LINFR	-3.1089**	-4.2917**	-7.0912*	-6.6274*
LFDI	-1.7767	-1.7226	-1.6348	-1.6184
LINTR	-7.3613*	-3.8747**	-8.0807*	-22.1478*
Note: * and ** denotes significant at 1% and 5% significance levels respectively.				

Source: Researcher's Computations from E-views 9, 2022.

Table 1 show that GDP growth and foreign direct investment are stationary at levels 1(0) while the unemployment rate, inflation rate, and interest rate are stationary at their first difference

1(1). The ARDL framework is adopted which was developed by Pesaran and Shin (1999) and Pesaran et al. (2001).

ARDL Cointegration Test
From the results of the Unit Root Test in Table 1 the variables are integrated at both level and first difference, the research proceeds to check if a long-run relationship exists between the macroeconomics variables as presented in Table 2.

Table 2: Results of ARDL Bound Test

F-statistic	6.8967	4
Level of significance	The critical value I(0) Bound	The critical value I(1) Bound
10%	2.45	3.52
5%	2.86	4.01
1%	3.74	5.06

Source: Researcher's Computations from E-views 9, 2022.

In Table 2, the result of the cointegration test implies that the series are co-integrated and moving together in a long-term period, as the F-statistics value, 6.8967 is greater than the lower and upper critical value of the Pesaran table at a 1% level of significance.

Short run Error Correction Model
Since the study establishes a long-run cointegration among the variables, it proceeds to estimate the short-run relationships, and the results are presented in Table 3.

Table 3: Short-run Coefficient with Dependent Variable GDPG

Cointegrating Form			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
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D(UNR)	-0.2539	0.1372	-1.8501	0.0757
D(INFR)	-0.1521	0.0315	-4.8308	0.0001
D(INFR(-1))	0.1582	0.0314	5.0425	0.0000
D(LFDI)	-1.5299	0.6733	-2.2723	0.0316
D(INTR)	-0.1724	0.1163	-1.4825	0.1502
C	12.2430	1.8916	6.4721	0.0000
CointEq(-1)	-0.7864	0.1209	-6.5039	0.0000

Source: Researcher's Computations from E-views 9, 2022

The results of short-run ARDL in table 3 show that the unemployment rate has a negative and significant effect on GDP growth at a 10% level of significance. Also, indicate that an increase in the unemployment rate by 1% would reduce GDP growth by 2.5%. However, inflation has a negative and significant effect on GDP growth at a 1% level of significance. An increase in inflation by 1% would decrease GDP growth by 15%. Foreign direct investments have a

negative and significant effect on GDP growth at a 5% level of significance. As expected, the short-run error correction term for the model ECM (-1), has a coefficient value (-0.79) with a negative sign, less than one, and is statistically significant at a 1%. Again, the speed of adjustment back to equilibrium stood at 79% respectively during the study period.

Long run Coefficients

After determining the short-run coefficients (Error correction Model), the study also proceeds to estimate the long-run relationships among the variables, and the results are presented in Table 4.

Table 4: Long Run Coefficients with dependent variable GDPG

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNR	-0.287188	0.141999	-2.022463	0.0535
INFR	-0.259451	0.078065	-3.323551	0.0026
LFDI	2.319570	1.446344	1.603747	0.1209
INTR	-0.152772	0.196077	-0.779141	0.4429

Source: Researcher's Computations from E-views 9, 2022.

In Table 4, the results of a long-run coefficient report that unemployment has a negative and significant effect on GDP growth at a 10% level of significance. An increase in the unemployment rate by 1% would reduce GDP growth by 29%. Also, inflation has a negative and significant effect on GDP growth at a 1% level of significance. An increase in inflation by 1% would decrease GDP growth by 26%. Meanwhile, foreign direct investment and the interest rate bear no significant effect on GDP growth in the long run.

Post-Estimation Test

At this stage, different diagnostic tests are carried out to determine the adequacy of the estimates like the normality (Jaque-bera (JB) test for normal distribution of error or the residuals, Serial Correlation, and the Heteroscedasticity test. The results are reported in Table 5.

Table 5: Result of ARDL Diagnostic Tests

Tests	F-statistics	Prob. Value
Normality((Jarque-bera Test Statistics)	4.2751	0.1179
Serial Correlation(Breusch-Godfrey LM Test)	0.0062	0.9945
Heteroscedasticity Test: Breusch-Pagan-Godfrey		

Source: Researcher's Computations from E-views 9, 2022.

The result of different diagnostic shown in Table 5 report that the Jarque-bera Test statistics show all the conditions for normality are met because the F-statistic and probability value of 4.2751(0.1179) is not significant at all levels. This implies that the error term in the model is normally distributed. More so, the result of the Breusch-Godfrey Serial Correlation LM tests shows that the computed F-statistic and p-value is 0.0062 (0.9945), implying there is no serial correlation problem in the residuals since the P-value is greater than the 10% significance level. Meanwhile, the results of the Heteroskedasticity Test: Breusch-Pagan-Godfrey also report that the computed F-statistic and p-value is 1.0385 (0.4337). From this result, it can be seen that there is an absence of Heteroskedasticity in the residuals since the P-value of 0.4337 is greater than a 10% significance level. Therefore, it can be concluded that there is a shred of evidence that the variables are stable and can be considered for predictions and other economic inferences.

Toda and Yamamoto Causality Test Results

The study employed Toda and Yamamoto (1995) to determine the direction of a causal relationship between unemployment and GDP growth in Nigeria from 1985 to 2021. The preliminary test carried out indicates the conditions for the T.Y causality test are satisfied. The tests are presented in Table 6.

Table 6: TY Causality Test

Causality	Chi-sq	df	Prob.
UNR does not Granger cause GDPG	0.1497	2	0.9279
GDPG does not Granger cause UNR	0.8538	2	0.6525
GDPG does not Granger cause INFR	3.2798	2	0.1940
GDPG does not Granger cause FDI	8.0162	2	0.0182**
GDPG does not Granger cause INTR	2.0158	2	0.3650
** represent 5% levels of significance.			

Source: Researcher's computations using E-Views 9 (2022).

The results of the T.Y causality tests are presented in Table 6. The results show there is no causality between UNR and GDPG, GDPG and UNR, GDPG and INFR, GDPG and INTR. Furthermore, the findings revealed a unidirectional causality between GDP growth and foreign direct investment over the study period.

Conclusion and Policy Recommendation

This study employs the ARDL model to validate the application of Okun's law in Nigeria using time series data from 1985 to 2021. The results found that both in the short-and long-runs, unemployment has negative and significant effect on GDP growth during the study period. These results support the works of Ogueze and Orji (2015), Stober (2015), Saleh and Mohammad (2017), and Sibusiso and Hlalefang (2018) which is consistent with the Okun's law. Therefore, Okun's Law is strong and stable in Nigeria despite the outbreak of the Covid-19 recession that slow down economic growth and increase the wave of unemployment. Therefore, the need for a productive macroeconomic policy in an economy that is frequently

shocked by externalities like COVID 19 and international oil price fluctuations is imperative. Therefore, the paper recommends that the government should adopt a prudent policy that will create more job opportunities, especially for the youth to reduce the growing unemployment rate and provide a framework for economic growth and development.

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