



Re-visiting Economic Growth and Unemployment Nexus with the Role of Renewable Energy in Nigeria

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Abstract

Unemployment is a monster that knows no national boundary but developing countries like Nigeria are the hard-hit. This study examined the relationship between economic growth and unemployment within the Okun's framework by accounting for the role of renewable energy in Nigeria. The objective of the study is to ascertain the validity of Okun's law in Nigeria. The study covered the period between 2003-2023 using annual time series data and employed the ARDL bounds testing approach. The study contributed to the literature by incorporating renewable energy in shaping the nexus between unemployment rate and economic growth in Nigeria. The stationarity test results confirmed that the variables have mixed order of integration and are cointegrated. The findings showed that there is long run significant negative relationship between economic growth and unemployment but in the short run economic growth increase unemployment. Renewable energy provides significant negative impact on unemployment but insignificant impact in the long run. The error correction term is significantly negative consistent with the priori expectation. The study recommends for consistent growth measures as well as more investments in to renewable energy sector towards unemployment reduction.

Keywords: Unemployment, Economic Growth, Renewable Energy and Okun's Law **JEL Classification:**

Contribution to/Originality Knowledge

1.0 Introduction

Promoting rapid economic growth and reducing unemployment remained top priority for national governments across the globe. This is because unemployment has negative consequences such as economic slowdown, decline in income and social instability, (Borhan et al., 2023). Thus policymakers strive to keep balance between the level of unemployment and growth to enlarge the citizen's welfare. Unfortunately, in Nigeria, while the rate of economic growth maintain an interesting trend in recent years that does not match with an increase in employment in the country as indicated by rising unemployment rates. According to the National Bureau of Statistics (2024) unemployment and underemployment was 23.1% and 16.6% respectively. However, the recent 2024 report of the same agency showed that the overall level of unemployment rate in the country increased by 5% which aggregated the hurdle to 45% and largely affect the youth. With these ugly developments social vices like human trafficking are likely to increase.



To increase job opportunities therefore, it is important to promote economic growth and successive government in Nigeria have deployed different strategies in this direction and in recent the rate of economic growth remain impressive except for some few years. For example, the county's economy grew by 4% in the year 2021 but subsequently declined by 2% across the year 2022 and 2023 respectively while projection for 3.1% (IMF, 2024). To sustain the growth performance, energy is paramount and efforts are being made to improve on the level of energy supply in the country by promoting renewable energy sources.

The International Renewable Energy Agency (2023) revealed that, renewable energy does not only compliment energy supply but also ginger production and employment generations while achieving global climate and sustainable development objectives. Thus, the country continue to strive in improving the renewable energy supply with an average of 1.76% growth between 2015 and 2019 but later declined to 1% in the year 2021. This has helped complement the total energy supply from the non-renewable sources and could have an impact on economic growth and consequent unemployment reduction.

The extant literature has ignored the role of renewable energy in investigating the Okun's law especially in developing economies such as Nigeria. Therefore, the current paper contributes to the economic growth-unemployment literature by investigating the role of renewable energy in shaping the Okun's law. Therefore, the remainder of the paper is designed as follows: section two reviewed the related literature; sections three provide the methodology; section four provides the empirical results and discussions; section five finally conclude the work.

2.0 Literature Review

The Okun's laws explain the relationship between unemployment and economic growth postulating that economic growth has an inverse relation with unemployment. It postulates that a 1 percent increase in economic growth decrease unemployment rate by 3% (Okun's, 1962).

Sizeable number of studies was conducted to test the validity of the Okun's law using panel and time series data. For instance, Tumanoska (2020) employed ARDL bounds attesting approach focusing on a panel of countries and the results validate the Okun's law. In a similar manner, Altunöz (2019) examined the relationship between real output and unemployment rate for Euro zone and revealed that, the Okun's law is valid. Soylu et al., (2018) sampled Eastern Europe by estimating OLS using a time frame between 1992 and 2014 and studied economic growth and unemployment and found an inverse relationship.

Contrarily, Levine (2012) using OLS technique analyzed the growth- unemployment nexus in Europe and find out that economic growth played no role in reducing unemployment in Europe as assumed by Okun's theory. However, Rahman (2013) ascertained the relationship among GDP, PGDP, literacy rate and unemployment and the results valids the Okuns law.

Some studies examined the phenomenon using single country other than Nigeria such as the work of Irpan et al., (2016) in Malaysia and revealed inverse relationship between GDP and unemployment, as the economy grow by 3.5% the level of unemployment will reduce by 1%. Likewise Chand, et al., (2017) analyzed economic growth and unemployment rate in India



using ARIMA model, and their findings showed that GDP account for 48% of causes of changes in unemployment rate in the country. Abbas (2014) ascertained the long term unemployment impact of growth in Pakistan and documented an inverse relationship consistent with Alamro and Al-dalaien (2014). In the case of Nigeria, Oniore et al., (2023) examined the impact of economic growth and inflation on unemployment rate in Nigeria and the findings revealed that *Okuns law is not valid contrary to* Raifu (2023).

In a similar manner, Jack and Tuaneh (2022) analyzed unemployment and economic growth to test the Okun's law and its implications for Nigeria and the findings revealed that, unemployment and economic growth are negatively and statistically related thus validating the Okuns law consistent with Abu (2017), Ayinde, et al., (2018) and Michael et al., (2016) but that contrast with the findings of Akeju and Olanupekun (2014).

3.0 Methodology

3.1 Data Sources and Measurement

This study used annual data clutched from 2003-2023 and examined the associations among economic growth, unemployment rate and renewable energy supply in Nigeria. The data for both the regressand (unemployment) was extracted from CBN Statistical Bulletins, (2016 and 2023) while data for economic growth and renewable energy was sourced from World Bank (WDI, 2023). Unemployment rate is measured as percentage of the working age not in employment, renewable energy supply measured as percentage (%) of total energy output, while gross domestic product is measured in billions of USD. However, the data are transformed in to natural logarithms for smooth interpretation.

3.2 Model Specifications

Following the Arthur Okun's, (1962) theory which asserted that, unemployment rate is the function of GDP growth rate. Thereby, the functional relationship model is given as in equation 1as follow:

Where:

UEM stand for Unemployment

GDP represents Gross Domestic Product

However, this study expands the works of Akeju (2014) and Abu (2017) by incorporating renewable energy in our model as in equation 2 below:

 $UEM = f(GDP_t, RE_t)....(2)$

RE stand for renewable energy.



The modified model in an ARDL framework is given in equation 3:

Therefore, the long run and short coefficients with speed and adjustments is specified in equation 4 as follow:

Where: λ_0 stand for the constant term, β_s are the coefficients, α_s represents the short run coefficients, ∂ is the coefficient of the error correction term, \emptyset stands for the error correction term, \in_t is the stochastic term. Before estimating the short and long run models, the preliminary investigations such as descriptive statistics, unit root and cointegration tests were carried out as well as post estimation tests.

4.0 Results and Discussion

Table 1 portrayed the descriptive statistics (common sample) of the indicators deployed. The unemployment rate, economic growth and renewable energy supply mean values stood at 2.79%, 1.49% and 3.1% respectively. While the median values posed at 2.69%, 1.45% and 2.92%. Whereas the maximum and minimum values stand at 3.59%, 2.23%, 3.61% and 1.34%, 0.22% and 2.86% respectively.

	LUEM	GDP	RE
Mean	2.796	1.449	3.075
Median	2.695	1.669	2.915
Maximum	3.597	2.225	3.608
Minimum	1.342	-0.216	2.865
Std. Dev.	0.509	0.636	0.250
Skewness	-0.930	-1.010	0.850
Kurtosis	4.304	3.358	2.311
Jarque-Bera	4.514	3.685	2.941
Probability	0.105	0.158	0.230
Observations	21	21	21

Table 1: Descriptive Statistics

Source: Authors' computation with Eviews 13.

Therefore, the asymmetric distributions are decomposed by the skewness in which UEM and GDP are inversely skewed, while the RE happened to be positively skewed. As for the distribution of the series, the indicators deployed assumed normal distribution.



	LUEM	LGDP	LRE	
LUEM	1			
GDP	-0.146054	1		
RE	-0.145283	0.660568	1	

Table 2: Correlation Analysis

Source: Authors' computation with Eviews 13.

Table 3: Results of Unit Root Test

		ADF Test			
	Level		First Difference		
Variables	t-Statistic	Prob.	t-Statistic	Prob.	
LUEM	-3.6853***	0.0057	-1.9026*	0.0941	
LGDP	-1.5595	0.4839	-3.7361***	0.0022	
LRE	-2.6561* 0.099		-2.1614**	0.0255	
PP Test					
LUEM	-1.6121	0.4583	-5.0633***	0.0008	
LGDP	-1.6524	0.4388	-3.7361***	0.0122	
LRE	-4.7119***	0.0014	-5.324***	0.0004	

Note: ***1%, **5%, *10%. Source: Authors' computation with Eviews 13.

The multicollinearity test is usually done using the coefficient of correlation matric, the high degree of coefficient matric above (0.8) is indicating the element of multicollinearity in the model. As shown in *table 2*, none of the metric coefficients of the explanatory variables is up to (0.8) as signified by the rule of thumb. However, all the explanatory variables are found inverse to the explained variable.

Tables 3 portrayed the unit-root tests using ADF and PP with trends and intercepts respectively. The Schwarz information criterion (SIC) was used for optimum lag-selection, the results showed that unemployment and renewable energy have unit root at level I(0) while economic growth at first difference I(1) as indicated by the asterisk signs which justified the use of ARDL technique.

F-statistic	5%I(0)	5%I(1)	Remark	
11.705	3.1	3.87	Long-run relationship exist	
Source: Authors'	computation with	Eviews 13		

Source: Authors' computation with Eviews 13.

The long run co-integration estimates as depicted in *Table 4* showed that, the F-statistic of the model with 11.71 value is higher than the lower and upper bound critical values with 3.1 and 3.87 respectively. Thus, this study posits that economic growth, renewable energy and unemployment have a long run association.



Long-run				
Variables	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-0.851***	0.566	-3.273***	0.007
RE	-0.552	0.655	-0.843	0.432
Short-run				
С	-4.485**	1.928	-2.326	0.059
D(LUNE(-1))	-1.218***	0.145	-8.405	0.000
D(LUNE(-2))	-1.630***	0.173	-9.407	0.000
D(GDP)	0.441**	0.121	3.642	0.011
D(GDP(-1))	-0.597***	0.113	-5.304	0.002
D(GDP(-2))	-0.902***	0.120	-7.547	0.000
D(RE)	-2.267**	0.666	3.402	0.015
D(RE(-1))	3.704***	0.701	5.288	0.002
D(RE(-2))	1.844**	0.591	3.119	0.021
$ECT_{t-1}(-1)$	-0.648***	0.077	8.380	0.000
D(RE(-2)) ECT _{t-1} (-1)	1.844** -0.648***	0.591 0.077	3.119 8.380	0.021 0.000

Table 5: Long-run and Short run Estimates

Note: Selected Model: ARDL (3, 3, 3) & ***1%, **5%, *10%. Source: Authors' computation with Eviews 13.

As shown in *Table 5* of the computed long run and short run model results respectively that, in the long run the explanatory variables have an inverse relationship with unemployment, in which a 1% increase in Nigeria's gross domestic product (GDP) will reduce unemployment rate by 85% in the long run all things remaining equal. Likewise, a 1% increase in renewable energy supply would correspondingly contract the rate of Nigeria's unemployment by 55% but the coefficient is not significant in the long run.

Moreover, the short run model outcome as displayed in *table 5* showed that (without lags) a 1% increases in Nigeria's GDP will in turn fuel the unemployment rate by 0.44% meaning that in the short run the Nigeria's economic growth is exclusive in nature, while with lags a 1% increase in GDP will in turn reduce unemployment rate by 0.59 and 0.91 accordingly. With respect to the renewable energy output influence, this study explored that, without lag, 1% increase in RE will correspondingly reduce unemployment rate by 2.27%, whereas, with lag a 1% increase in it will fuel unemployment rate by 3.71% and 1.84% respectively.

Therefore, the total coefficients of determination (R-square) of the regressors on regressand as shown in *table 5* is 0.9568 meaning that about 96% of the total Nigeria's unemployment rate both in the long run and short run is accounted by the (GDP and RE) while the remaining 4.32% is attributed to error term respectively. Whereas, the adjusted coefficient (R²-adjusted) is 0.8775 which meant that, about 88% of the total variations in unemployment in Nigeria is explained by (GDP and RE) while the outstanding 12.25% is attributed to non-stochastic error term and ECT_{t-1}(which is deemed to be adjusted within a one year lag) respectively. The error correction term is negative and statistically significant implying that any deviation from the long run equilibrium term will be adjusted by 64% in one year.



	Tests	5% level	Prob.	
Normality test	JarqueBera	0.05	0.954	Normally Distributed
Serial correlation test	B-Godfray	0.05	0.353	Serially Uncorrelated
Heteroskedasticity test	Breush Pagan	0.05	0.412	Homoskedastic
Regression SE test	Ramsey	0.05	0.341	Linearly related.

Table 6	: Results	of Post-Estimation	Test
I able 0	• itebuits	of I obt Estimation	LCDC

Source: Authors' computation with Eviews 13. SE is Specification Error

However, as for the post estimation results; Normality, Serial correlation, Heteroskedasticity and Reset tests which are also displayed in *Table 6* alongside their F-statistics altogether with the p-values against each test. According to the results that, all the null hypotheses governing the decision rules are failed to be rejected meaning that, the model of this analysis is; normally distributed, serially uncorrelated, homoscedastic and linearly related accordingly.

The stability of the model of this analysis is measured in forms of CUSUM and CUSUM of squaresas shown in Figure *1 and 2* respectively below:







According to the plots, both of the CUSUM and CUSUM of squares are within the given critical bounds, meaning that the estimated parameters are stable over the long run which implies that, this model could be use for economic growth and unemployment reduction policies.

Therefore, with respect to the coefficients' signs of the parameters in T*able 5* of the long run and the short run results respectively above, the indicators (GDP and RE) have a direct as well as indirect long run and short run significant/no-significant effects on unemployment rate in Nigeria. In the long run, this analysis affirmed that GDP have a potentiality to reduce unemployment rate in which it's negatively and significantly affected the Nigeria's unemployment rate with about 96% explanatory power signalizing that GDP could be reliable as unemployment reduction instruments/tools in the long ruin Nigeria. However, this finding is in line with the theoretical assertions by Arthur Okun's, (1962) which stated that increase in GDP would lead to reduction in unemployment rate. In addition this study's finding coincided with the prior findings of (Abu, 2017), (Ayinde, et al., 2018) and (Hjazeen & Ozdeser, 2021).



In a similar manner, this study unfolded that renewable energy supply has a statistical substandard capacity to minimize unemployment in the long run respectively. Meaning that renewable energy sector in Nigeria could be use for employment opportunities generation and as well a reduction of unemployment mechanism. This finding is in line with the findings of (Abbas, 2014), (Kalkari & Abeti, 2019) and (Despina & Tumanoska, 2020) whose reaffirmed the validity of Okun's specification in China and Jordan respectively.

5.0 Conclusion and Recommendations

This study concluded that, economic growth and renewable energy significantly and insignificantly reduced unemployment rate in Nigeria respectively. The Okun's law is valid in the long run but does not hold in the short run for Nigeria. Therefore, base on the study's findings, we first recommend that efforts be made to promote consistent growth measures which might include; establishment and improvement of the government owned as well as private enterprises, investment in education more especially the vocational skills, labour motivations and modern technology embracement, this would not only limited to grow the economy but it will in turn guarantee unemployment reduction and creation of multiple job opportunities.

Secondly, the government needs to invest heavenly in renewable energy sector by leveraging on the foreign investment inflows. By doing so, the Nigeria's energy supply would increase, this would in turn leads to the re-waken of some collapsed existing industries, factories and plants as well as small businesses attributed to chronic power shortages, this will leads to so many job creations and establishment for the new, medium and small scale businesses towards a better business cycle.

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