Challenging the Validity of Okun's Law: Empirical Evidence in West Africa using Random Effect Panel Data Model

K. A. Lawal[1] ; K. Jimoh[2]

Department of Physical Sciences,
Al-Hikmah University, Ilorin, Nigeria.
E-mail: aduakemi@yahoo.com[1]; jimkaminsha@alhikmah.edu.ng[2]

Abstract — **The validity of Okun's law has been tested by several researchers over the years, but its validity in West Africa has a whole remained blur. Panel data on unemployment was regressed on economic growth using the Random Effect Panel Least Square Model technique. It was found out that a percent increase in GDP would lead to about 0.5% decrease in unemployment, which is in consonance with the Okun's law. Hence, it is recommended that the effect of macroeconomic policies should be implemented to ensure a speedy economic growth and reducing unemployment to its barest minimum, which is a pointer to increasing aggregate demand and output growth in the long run.**

Keywords: Okun's law, unemployment, economic growth, West Africa, Panel data.

I. Introduction

Unemployment has been a major challenge to many countries which they have endeavoured to reduce, as it could be used as a pointer to gauge the level of development of any nation in the world. This prompted Arthur Okun in 1962 to run analysis on the relationship between unemployment and economic growth using USA as a case study.

The empirical findings of Okun's states that the relationship between unemployment and economic growth is inverse as 1% percent increase in economic growth would lead to about 3% decrease in unemployment.
Thus, the Okun's law is continually being used as a rule of thumb to test for the relationship between unemployment and economic growth over the years. Meanwhile, Okun's law was consistent with the relationship between unemployment rate and real production for many decades.

Even if the negative relationship between the "gap" of unemployment rate and the increase in real production has been quite stable, the absolute value of Okun's coefficient seem to vary in different time periods and from country to country (Dritsaki & Dritsakis, 2009).

In spite of West Africa being blessed with inexhaustible natural resources, the high rate of unemployment is nothing to write home about. As at 2017, Cape Verde, Mauritania, Mali, Senegal and Gambia are the top 5 west African nations with the highest unemployment rate and low GDP value (World Bank, 2017). The increased GDP in Nigeria does not fundamentally prompted a reduction in unemployment. This could be traced to the over-dependence of the country on the oil sector which brings in the highest revenue to the country but the sector's employment rate is very poor. Also, embezzlement and misappropriation of public funds by the government is also another reason as public funds are not being channeled to the grassroots for the creation of employment opportunities.

Extant literature have tried to test the validity of Okun's law in various countries, but there was no consensus amongst them. The invalidity of Okun's law could be cited in the works of Lal *et al* (2010), Kreishan (2011); Sikiru *et al* (2013) and Akeju and Olanipekun (2014). Contrastingly, Hussein *et al* (2010) and Ahmed and Abdelaziz (2014) confirmed the validity of Okun's law in their research. In addition, the Okun's coefficient varies amongst various researches which could be cited in the works of Yerdelen (2011); AbdulKhaliq *et al* (2014); Mohseni and Jouzaryan (2016) and Rahman and Mustapha (2017).

In conclusion, the literature on the applicability of Okun's law in West Africa as a whole remained blur. Hence, the aim of this research is to test the validity of Okun's law in West Africa from 1991 to 2017.

II. Empirical Review

Numerous researches have been conducted to test the validity of Okun's law. Abraham & Ozamhoka (2017) empirically examined the relationship between unemployment and economic growth in low income countries in Sub-Saharan Africa (SSA).

Using the Panel Least Squares techniques, the results revealed that there is a negative relationship between unemployment and economic growth in the low-income countries in SSA which is consistent with the Okun's law. Yerdelen (2011) also examined empirically the short and long run effects of unemployment and economic growth in Europe. From the empirical results, there is a long run relationship between unemployment and economic growth, but the long run coefficients obtained are lower compared to the coefficient obtained from Okun. Findings also showed that the validity of the Okun's law and the direction of the relationship between unemployment and economic growth vary among the European countries. In addition, Lal, Muhammad, Anwer, & Adnan (2010) re-examined the validity of Okun's law in some Asian countries using the Error Correction Model (ECM) technique. The empirical evidence revealed that the Okun's law is not applicable in some Asian developing countries. Furthermore, Javeid (2005), Khan *et al* (2012) and Akram *et al* (2014) conducted a research in Pakistan, their results showed that there is a negative relationship between unemployment and economic growth which in fact confirms the validity of Okun's law. Sikiru, Jimoh, & Idris (2013) used the first difference approach to determine the validity of Okun's law in Nigeria. It was revealed that the model's coefficient carries positive sign which is not consistent to the Okun's law.

Simbowale (2005), Akeju and Olanipekun (2014), Abu (2017) and Bankole & Fata (2013) research works contradicted the Okun's law. Their findings showed that unemployment is positively related to economic growth i.e. increase in GDP leads to an increase in unemployment rate in Nigeria. It was concluded that the Okun's law is not valid in Nigeria due to the country's overdependence on oil as its major source of revenue which leads to high GDP and high unemployment rate since the economy is not

diversified. Ajie *et al* (2017) empirically investigated the impact of unemployment on the Nigerian economy from 1981 to 2015. By using the autoregressive distribution lag (ARDL) and other econometric tools of analysis, findings revealed that unemployment has an insignificant negative impact on economic growth.

III. Methodology

3.1 Theoretical Framework

Two methods were postulated in measuring Okun's coefficient; the gap method and the first difference method. The gap method is written as:

$$\frac{\bar{Y} - Y}{Y} = c(u - \bar{u}) \qquad \dots \qquad (1)$$

where Y = actual output, $\bar{Y}$ = potential output, u = actual unemployment, $\bar{u}$ = natural unemployment, and c = factor relating changes in unemployment and economic growth. Since, the gap method of Okun's law is difficult to use in practice because $\bar{Y}$ and $\bar{u}$ can only be estimated, not measured. The difference method is commonly used.

$$\frac{\Delta Y}{Y} = k - c(\Delta u) \qquad \dots \qquad (2)$$

where Y and c are defined above, ΔY = the change in the actual output from one year to the next, Δu = change in actual employment from one year to the next and k = average annual growth rate of full employment output.

3.2 Model Specification

In accounting for the nexus between unemployment and economic growth, the model in this study is adapted from the work of Sikiru *et al*. (2013). The model is given as:

$$dlog(GDP_{it}) = \gamma_0 + \gamma_1 d(UNEMP_{it}) + \varepsilon_{it} \dots (3)$$

where GDP_{it} = Gross Domestic Product for individual West African Countries and $UNEMP_{it}$ = unemployment rate for individual West African countries. Also, γ_0 and γ_1 are parameter estimates, i and t are indices for individual countries and time and ε_{it} = white noise error term.

3.3 Sources of Data

This study used panel data for economic growth and unemployment from 1991 to 2017. The data were obtained from World Bank Indicator (WDI) Database.

3.4. Analysis and Results

3.4.1 Levin, Lin and Chu Panel (LLC) Unit Root Test

The Levin, Lin and Chu (2002) test treats panel data as being composed of homogeneous cross-sections, thus performing a test on a pooled data series. The LLC test for unit roots in panel data is computed based on the following model:

$$y_{it} = \rho_i y_i + \sum_{j=1}^{\rho_i} \emptyset_{ij} \Delta y_{it-j} + \zeta_{it}\gamma + \varepsilon_{it}$$

Where i=1…N and t=1…T, ζ_{it} is the deterministic component and ε_{it} is a stationary process. Under the homogeneity assumption, the LLC test assumes that $\rho_i = \rho$ for all i and that $\varepsilon_{it} \sim$ iid $N(0,\sigma_u^2)$.

Table 1: Panel Unit Root Test

Variables	Levels		First Difference	
	Statistics	Probability	Statistics	Probability
Log(GDP)	1.57426	0.9423	-4.8153	0
UNEMP	-0.7896	0.2149	-6.21205	0

Source: Eview 9 Analysis

The panel unit root test above reveals that the panel data are not stationary at levels since its probability is greater than 5%, hence, the data are stationary at first difference.

3.4.2 Descriptive Statistics

Table 2 shows that the mean and median values of the variables in the data set lie within the maximum and minimum values indicating a high tendency of the normal distribution. The skewness statistic shows that all the variables are negatively skewed. The kurtosis statistic showed that all the variables were platykurtic because the values were greater than 3, suggesting that their distributions were flat relative to a normal distribution.

3.4.3 Correlated Random Effects- Hausman Test and the Wald Test

To determine which model to be chosen amongst pooled OLS regression model, fixed effects and random effect models, there is need to analyse the correlated random effects-Hausman test and Wald test.

Table 2: Table of Descriptive Statistics of the Dataset

Mean	0.042305	0.023632
Median	0.044041	0.0105
Maximum	0.618605	2.000999
Minimum	-0.442791	-3.702
Std. Dev.	0.069017	0.478217
Skewness	-0.44232	-0.934212
Kurtosis	25.6502	13.71438

Source: Eview 9 Analysis

3.4.3.1 Hausman Test

The Hausman test is used to decide whether the fixed effect model or the random effect model is appropriate or not. The hypothesis is stated below:

H_0: Random effect model is appropriate

H_1: Fixed effect model is appropriate

If the probability value is less than 5%, we reject the null hypothesis.

3. 4.3.2 Wald Test

Meanwhile, assume the fixed effect is the right model, to determine the right model between fixed effect and pooled OLS regression model, the Wald test is adopted. The hypothesis is given below:

H_0: Pooled OLS regression model is appropriate Vs.
H_1: Fixed effect model is appropriate

If the probability value is less than 5%, we reject the null hypothesis which supports the fixed effect model.

Table 3: Hausman Test

Test Summary	Chi-Sq. Statistics	d.f	Probability
Cross Section Random	2.2527	1	0.1334

Source: Eview 9 Analysis

From the table above, the probability value is greater than 5%, hence the random effect model is appropriate for the analysis. Since the random effect model is the appropriate model to be used, it is not necessary to conduct the Wald test.

3.4.4 Presentation of Empirical Result

3.4.1 Statement of Hypothesis

H_0: Okun's law is invalid in West Africa
H_1: Okun's law is valid in West Africa

Table 4: Random Effect Panel Least Square Result

Dependent Variable: DLOG(GDP)				
Variable	Coefficient	Std. Error	T-Stat	Prob.
C	0.042	0.0034	12.530	0
D(UNEMP)	-0.0050	0.0071	-0.713	0.476

Source: Eview 9 Analysis

The above results indicate that there is an inverse relationship between GDP and unemployment leading to the acceptance of the alternative hypothesis. Although, the Okun's law coefficient differs as unemployment increase by 1%, the value of GDP will decrease by 0.5%.

IV. Conclusion and Recommendations

This paper challenges the validity of Okun's law in West Africa from 1991 to 2017. In evaluating its objective, the paper adopts the random effect panel model technique to account for the relationship between unemployment and GDP. The empirical result reveals that there exist a negative relationship between unemployment and economic growth which confirms the validity of Okun's law and its applicability in West Africa. Although, the coefficient obtained in this research is not consistent with that of Okun's, which implies that there is need for improvement of Gross Domestic Product (GDP) in West Africa. It is therefore recommended that effective macroeconomic policies should be tailored towards the growth of the economy in order to reduce unemployment to its barest minimum, which is a pointer to increasing aggregate demand and output growth in the long run.

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