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# **Economic Growth and Unemployment Issues in Ten (10) Selected West African Countries: A Panel Data Analysis**

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### **Author's contribution**

*The sole author designed, analysed, interpreted and prepared the manuscript.*

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## **ABSTRACT**

The economic growth of nations continue to be one of the main issues that economists have been interested in analyzing. In effect, several theories have emerged to explain the growth of nations including the Okun's law which tests the relationship between economic growth and unemployment. Using the World Bank Dataset, the study tested the validity of Okun's Law in West Africa by employing fixed effect regressions to control for inconsistencies of the OLS estimates due to omitted variable bias. The random and time-fixed effect regressions confirm the validity of the Okun's Law in West Africa. The time-fixed effect regression shows that, economic growth will decline by 0.311 annually for every unit increase in the rate of unemployment. Time variant effects such as changes in policy provides a stronger case for the effect of unemployment rate volatility on the growth of these economies. It is therefore recommended that, various stakeholders adopt efficient fiscal and monetary policies aimed at lowering the rate of unemployment thereby expanding economic growth. One of such policies could be the reduction of the high corporate tax rates in the region that is bedeviling African countries by preventing industries and businesses from being built.

*Keywords: Panel data; economic growth; Okun's Law; business start-up procedures; prevalence of undernourishment and instrument variable (IV).*

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## 1. INTRODUCTION

The fundamental causes of economic growth continue to be one of the main issues that economic science seeks to analyze. Economic growth serves as a welfare indicator of countries, denoting the growth in the amount of goods and services produced in a country over a given time period. The three most significant elements for an economy overall are productivity, income distribution and unemployment Carree and Thurik [1]. One of the successful tools in achieving high economic growth has been the reduction in unemployment. This tool is powerful especially for developing countries. Thus, unemployment serves as a very crucial macroeconomic tool in the hands of policy makers to affect how their economies will perform.

There have been several economic theories to explain the relationship between these two variables. One of such theories is the Okun's Law, Okun [2], which contends that growth and unemployment are inversely related. Sir Arthur Okun revealed that unemployment reduced in years with high growth but increased in years with low growth.

This paper therefore tested the validity of the Okun's law in West Africa. Specifically, the study investigated into the effect on economic growth of fluctuations in unemployment rate in the ten developing economies in West Africa.

### 1.1 Significance of the Study

The study adds to the seldom existing literature by empirically testing the validity of the Okun's Law in West Africa. The findings of the study will greatly offer significant decision-making references for policy makers and stakeholders in the area of employment and growth. The

analysis made in this paper introduces new empirical insights into this topic.

### 1.2 Research Objective

The main objective of the study was to test the validity of the Okun's Law in these ten West African economies. Specifically, the study sought to;

- A. Estimate the effect on Economic growth due to fluctuations in unemployment.

### 1.3 Research Question

- A. Does the Okun's law of the negative effect of unemployment rate on economic growth apply in West Africa?

## 2. METHODOLOGY

The study employed macro level annual secondary data to estimate the impact of unemployment on the growth (GDP annual growth) of some selected developing West African economies. The data was generated from the World Bank data base (World Bank Indicators), World Bank [3], for the periods, 2004 to 2017 for countries including, Ghana, Nigeria, Liberia, The Gambia, Cote D'Ivoire, Burkina Faso, Niger, Sierra Leone, Benin and Togo. Stata 12 was used for the statistical analysis. These 10 countries were selected due to the prevalence of unemployment within such economies as well as data availability, thus, the analysis from the study provided more insights into the crucial fluctuations of these fundamental macroeconomic indicators.

According to Baltagi [3], the use of panel data sets have increased in 2000s due to its numerous advantages. In this paper, we regressed GDP annual growth on the rate of unemployment using panel data.

$$Y_{it} = \alpha + \beta_1 Unem_{it} + \beta_{j+1} X_{it} + \delta_t + \varphi_i + U_{it}, i = 1, \dots, 10 \quad t = 1, \dots, T$$

$Y_{it}$  = GDP annual growth for country  $i$  at period  $t$ .

$Unem_{it}$  = Unemployment rate for country  $i$  at period  $t$ .

$X_{it}$  = control variables including FDI, trade openness, cost of business, population growth and business start – up procedures

$\delta_t$  = Time variant factors affecting GDP (Time – Fixed Effect)

$\varphi_i$  = Country Fixed Effect.

$\beta_1 = \text{the coefficient on unemployment}$

$\beta_{j+1} = \text{the coefficients on the control variables.}$

Ibragimov and Ibragimov [4], pointed out, the traditional approach of the Okun's coefficient that is obtained by regressing the log of GDP growth on the log of unemployment using OLS fails to account for the endogeneity of the explanatory variables, thereby failing to produce consistent estimates. To correct for this inconsistency arising from omitted variable bias, the study employed the fixed effect regressions using the model specified above.

Inconsistencies of the estimates due to the problem of endogeneity might be as a result of simultaneous causality running from the effect on economic growth of fluctuations in unemployment rate and backwards. For instance, high economic growth comes with improved conditions and stable economic environments which are necessary to create mass employment, thereby reducing the rate of unemployment. To correct for this inconsistency, the study explored a possible instrument variable that might be valid in estimating the coefficient on unemployment thereby correcting for endogeneity if there is any.

Even though there are several missing values in the sample of the variables chosen, however, the variables are unlikely to suffer from sample selection bias since the values are missing only at random and not in any way related to the sample selection process related to the value of the dependent variable (GDP annual growth) Stock and Watson [5].

Based on the Okun's law Okun [2], we expected the coefficient ( $\beta_1$ ) on unemployment to be negative. This school of thought contend that, increased unemployment reduces the growth of economies.

### 3. LITERATURE REVIEW

#### 3.1 Theoretical Review

##### 3.1.1 Unemployment theories

The concepts of economic growth and unemployment are the most important variables based on which all economies are choosing and implementing economic policies.

There are several theories explaining the relationship between unemployment and economic growth. However, only one of the theories is explained here.

The Okun's Law focused basically on the explanation of the relationship between unemployment and economic growth in any given economy. The theory argued that unemployment has a negative relation with economic growth in any given economy. It suggested that a percentage decrease in unemployment rate leads to 3 percent increase in economic growth. In testing the validity of Okun's theory, Kwami [6], found that Okun's theory of unemployment indeed showed the existence of negative relationship between unemployment and economic growth.

The Keynesian unemployment theory otherwise known as cyclical or deficient demand theory of unemployment explained by the Keynesian school posits that, ineffective demand in an economy is a primary cause of unemployment in which those that are willing to work at a prevailing wage rate are unable to find job at a given time [7,8]. According to this theory, as the demand for goods and services decrease, production level reduces implying that few hands will be needed in the production process. Keynes also emphasized that since the number of unemployed labor force exceeds job availability, even if full employment is achieved, some labor force will still remain jobless due to mismatch in the economy. This theory holds that, government intervention through increased spending in an economy is necessary to expand aggregate demand and hence increase employment thereby leading to reduced unemployment.

One other influential theory that explains unemployment is the Marxist theory propounded by the Marxist school headed by Karl Max. The theory was propounded in 1863. The theory holds that unemployment in any economy is inherent due to insatiable nature of capitalist system. Capitalist manipulates the labor market by causing unemployment that results to low demand for labor and wages. The theory therefore suggested that the best way of reducing unemployment is by abolishing capitalism and then shift to socialist economic system.

**Table 1. Description of variables in the model**

<b>Variables</b>	<b>Description</b>
<b>Annual GDP growth</b>	Continuous: It denotes the percentage growth rate of GDP at the market price based constant local currency.
<b>Unemployment rate</b>	Continuous: Representing the number of people who are actively searching for jobs at the existing wage rate but cannot find any. Expressed as a percentage of the total labor force modelled by the International Labor Organization (ILO) estimate.
<b>Population growth (% annual)</b>	Continuous: The percentage growth in population from one year to the next.
<b>Trade openness</b>	Continuous: Usually called trade-to-GDP represents the relevance of international trade in the growth of economies. It is calculated by dividing the aggregate of a country's exports and imports by its GDP.
<b>FDI</b>	Continuous: Denote the net inflows of foreign investments in an economy.
<b>Business start-up procedures</b>	Continuous: This also denote the procedures required to start a business, including interactions to obtain necessary permits and license and to complete all inscriptions, verifications and notifications to start operation. Index Mundi [7]
<b>Cost of business (% of GNI per capita)</b>	Continuous: This is the cost to register a business normalized by representing it as a percentage of GNI per capita. Index Mundi [7]
<b>Prevalence of undernourishment (PoU)</b>	Continuous: An indicator that has been adopted to measure progress towards SDG target 2.1. It is an estimate of the population whose habitual food consumption is insufficient to provide the dietary energy levels that are required to maintain a normal active and healthy life. It is expressed a percentage.

*Source: WDI Data*

### 3.1.2 Growth theories

There are several theories that explain the growth of an economy including the Classical theory of economic growth. For instance, in the popular book by Adam Smith, "An Inquiry into the Nature and Causes of the Wealth of Nations", he noted that, the wealth of nations is determined by labor efficiency and the accumulation of capital. This theory is a sharp contrast to the Keynesian thought of causes of economic since it rules out the role of government intervention in economies. For economies to achieve increased growth levels, Smith [9] pointed out that, such economies should accumulate more capital which is a condition for division of labor and specialization. This model also explains the crucial role of division of labor and specialization on the economic growth of countries.

Other important theories include the neoclassical growth model Solow [10]. This model explains that the growth of an economy hinges on the accumulation of capital by such an economy. The model holds technological growth and the growth in labor to be determined exogenously. To substantiate, the model holds that, labor grows at a constant rate. The model therefore posits that, the growth in population and savings rate are key in determining the growth rate (growth rate per capita income) of an economy. Indeed, the savings and investments of an economy accumulate as capital and thus, countries with higher savings rate and lower capital cost are expected to have higher growths per capita income.

The other growth model to discuss in this paper is the Endogenous growth model. This model was also put forward by Romer [11]. The difference between this model and the neoclassical model is that, this model treats technological progress as an endogenous outcome while the neoclassical treats technological progress as exogenous. The endogenous growth model holds that, the technological progress of an economy is well explained by the accumulation of knowledge in the country. Thus, what takes the center stage of this model has to do with the fact that, the growth of an economy is driven by the technological progress of an economy which in turn is also driven by the accumulation of knowledge. Indeed, we can infer from this model that, countries that spend a large percentage of their GDP on education are expected to be more productive than countries that spend less

percentage of their GDP on education. This model therefore recognizes the significant role that investment in human capital possesses on economic growth.

Other growth theories include the Keynesian growth theory propounded by John Maynard Keynes in his popular book, "The General Theory of Employment, Interest, and Money." in 1936 Keynes [12]. The theory became popular after the classical school failed to explain the great depression in 1929. This model advocates for government intervention in an economy to help expand aggregate demand through its (governments') increased spending leading to increased economic growth.

### 3.2 Empirical Review

Although there is a significant literature on the relationship between economic growth and unemployment, however, the effect of economic growth over unemployment varies among periods and countries. Some selected literature based on the study area are; Özel et al. [13] investigated the economic growth, productivity and unemployment data for seven industrialized countries (G7) for the period of 2000 to 2011 using panel data analysis. In addition to the period mentioned, two sub-periods (2000-2007 and 2008-2011) in which the effect of global financial crisis was felt most have been analyzed. Pre and post crisis periods have been compared, and the results of the study revealed that, while the productivity and economic growth variables have significant and strong effect on reducing unemployment in the pre-crisis era, this effect of productivity becomes insignificant and small after the crisis.

Additionally, Kukaj [14] also investigated the relationship that exists between unemployment and growth in GDP in 7 Western Balkan countries. The study produced similar result by proving the negative effect of unemployment on GDP growth which served as a proxy for economic growth. This study employed the effective effect model, the random effect pattern and the Hausman Taylor Recording on secondary data from 2001 to 2015.

Realizing the harmful impact of unemployment on economic growth, Victoria [15] studied the causality between the two variables. Using an annual data from 1981 to 2016 in Nigeria, the study shows a unidirectional VAR causality running from the effect of unemployment

fluctuations on economic growth. This implies that, economic growth does not granger cause unemployment.

### **3.2.1 Testing the validity of the Okun's Law**

The influential work by Moosa [16] shows that the Okun's law is valid for G7 countries, and that, unemployment and economic growth were inversely related. To prove this, the study employed the OLS, the rolling OLS and the SUR methods for the G & countries and found that, the Okun's coefficient was high in North America but low for Japan. One possible explanation to this varying results was the differences in labor market rigidities for different countries.

Soylu et al. [17] also carried out an investigation into the relationship between economic growth and unemployment in the Eastern European countries for the period of 1992 to 2014 within the panel data framework. In this study, the relationship has been examined in the context of Okun's Law. Panel unit Root, pooled panel OLS and panel Johansen co-integration test were applied respectively. The results indicates that, the economic growth and unemployment series were stationary at first level, and unemployment affect negatively by the economic growth, in other words 1% increase in GDP will result in a decrease of unemployment rate by 0.08%.

Andrei and Adrian [18] also tested the validity of the Okun's law in Romania using quarterly data from 2000 to 2008. The study also observed the validity of the Okun's law in Romania showing that, for every percentage rise in unemployment, real GDP growth subsequently declines by roughly a half percentage point.

Lal et al. [19] estimated and tested the Okun's law in some Asian countries using data from 1980 to 2006. Employing the Engle granger cointegration test and the error correction model, the study found the okun's law not to hold for some Asian countries.

Similarly, Fatai and Bankole [20] employed the Engle granger cointegration test and the fully modified OLS to an annual time series data from 1980 to 2008. The study also found the Okun's law not to apply in Nigeria. The coefficient on unemployment was positively significant rather than being negative as theorized by sir Okun.

In South Africa, Phiri [21] however found the Okun's law to be valid. The study relied on the

momentum threshold autoregressive model (MTAR) to evaluate the nonlinear reversion existing between economic growth and unemployment.

Moreover, Marinkov and Geldenhuys [22] also confirmed the validity of the Okun's law to hold in South Africa using annual data from 1970 to 2005. This study employed various detrending methods and observed a significant relationship between cyclical unemployment and cyclical output where symmetric estimates ranged from -0.77 to -0.16 while the asymmetric estimates ranged from -0.77 to -0.18.

## **4. RESULTS AND DISCUSSION**

Table 2 indicates that, indeed the 10 selected countries are developing countries with annual GDP growth ranging from as low as -20.5988 (recorded in Sierra Leone in 2015) to as high as 20.7157 units of local currency. GDP annual growth averaged 4.6918 in local currency for the 10 countries with a standard deviation of 4.2583. The extremely low GDP growth rate recorded in Sierra Leone is interestingly not surprising, after the country suffered from two major economic shocks on February, 2015 and March, 2015. The country was hit by several Ebola attacks killing some number of people as well as the armed bands' removal of his personal security guards leading to the seeking of asylum by the country's vice president in the U.S.

Out of the 140 rate of unemployment recorded among the 10 selected countries, the least rate of unemployment recorded was .32 to as high as 9.45. The rate average a value of 3.8375 for those countries from 2004 to 2017 with 2.4120 standard deviation.

With respect to annual percentage growth in population, the region has seen an increase in population as high as 4.52% annually to as low as 1.7849%. This shows an alarming nature of population increases in West Africa. Average annual percentage population growth was 2.8370% over the period with 0.5188 standard deviation.

Additionally, the summary statistics shows how these countries are continuously exposing themselves to the world. Trade with the outside world has expanded to 311.35% from 20.7225% of GDP. Implying that, international trade contributes immensely to the economic growth of these countries.

**Table 2. Summary statistics for economic growth, unemployment rate and other included variables**

Variables	Number of observations	Mean	Standard deviation	Minimum	Maximum
Annual GDP growth	140	4.6918	4.2583	-20.5988	20.7157
Unemployment rate	140	3.8375	2.4120	.32	9.45
Population growth (% annual)	140	2.8370	.5188	1.7849	4.5151
Trade openness	140	74.7343	45.3086	20.7225	311.3541
FDI	140	6.9304	14.4517	-1.0381	103.3374
Business start-up procedure	128	7.7421	2.6390	3	13
Cost of business	116	152.4379	228.3859	3.7	1491.6
Prevalence of undernourishment (PoU)	130	18.13462	9.888077	5.3	40

Source: Authors' computation based on WDI data

Moreover, these countries have seen growth in FDI. FDI net inflows as a percent of GDP has expanded dramatically from as low as -1.0381% of GDP to 103.3374% of GDP. Average FDI pegged at a value of 6.9304% over the period with 14.4517% standard deviations. This might be due to the relative stability in environmental conditions over the period. For instance, FDI was mostly negative from 2004 to 2009 in Benin until it (FDI) began to increase due to the discovery of oil in the country.

The summary statistics further indicates that, procedures involved in starting a business in West Africa takes as high as 13 in number to as low as 3 in number out of a total 128 observations recorded. This high figure might contribute to the reason why few businesses are built in Africa. Business start-up procedures averaged 7.74 in number from 2004 to 2017 with a standard deviation of 2.64.

Additionally, cost of business increased to 1491.6% from 3.7% of GNI out of a total of 116 observations. From 2004 to 2017, the figure averaged 152.44% of GNI with 228.39 standard deviation.

Lastly, PoU has increased from 5.3% to 40% out of 130 observations. The implication of this is an increased number of people who are not able to maintain active and healthy lives. Most importantly, this will lead to a reduction in labor force in West Africa. From 2004 to 2017, there has been an average of 18.13% PoU with 9.89 standard deviation.

Table 3 reports the random effect model (REM) and fixed effect regressions of the effect on

economic growth of fluctuations in unemployment rate from column 1 to 4. Column 1 reports the REM, which confirms the negative impact of unemployment fluctuations on economic growth.

Just as Arthur Okun found out in the U.S, economic growth of the selected countries is at minimum in periods of high unemployment rate and in periods of low unemployment, economic growth increases.

The result is significant at 10% level, showing that for every unit increase in unemployment rate annually, economic growth is predicted to fall be 0.333 annually, holding other things constant. Kwami [6] also found a similar finding in ten Canadian provinces. The study estimated an average Okun's coefficients of -1.58 and -1.32 under the Hodrick-Prescott detrending method and the quadratic detrending method respectively.

Moreover, the model reveals that the number of procedures involved in starting up a business is key in affecting economic growth in West Africa. The result shows a not surprising inverse relationship between business start-up procedures and economic growth. Indeed, stringent and time-taking processes involved in establishing a business results in delayed production thereby reducing GDP annual growth. The frustrations from bureaucratic processes and red-tapes that prevents people from doing business in West Africa partly contributes to low output. The random effect regression predicts that economic growth in these countries will fall significantly (at 10% level) by 0.313 annually, as procedures involved in starting a business increases by 1.

**Table 3. Random and fixed effects regression estimates of economic growth and unemployment: Data from WDI**

Variables	(1)	(2)	(3)	(4)	(5)	(OLS 1 <sup>st</sup> stage)
	GDP growth (% annual)	GDP growth (% annual)	GDP growth (% annual)	GDP growth (% annual)	Log of GDP growth (% annual)	Unemployment rate (% of total labor force)
Unemployment rate	-0.333* (0.184)	-0.311*** (0.0860)	-0.315 (0.414)	-0.1000 (0.357)	-0.0346* (0.0203)	
Population growth	1.675* (0.931)	0.653 (0.667)	3.236 (2.204)	3.078 (1.738)	0.0970 (0.135)	-1.363** (0.560)
Trade openness	0.0468* (0.0282)	0.0308 (0.0264)	0.0371 (0.0404)	0.0109 (0.0446)	0.00543 (0.00534)	-0.0210* (0.0106)
FDI	0.0933* (0.0547)	0.0871* (0.0460)	0.100* (0.0469)	0.120 (0.0990)	0.0102 (0.00993)	0.0102 (0.0401)
Cost of business (% of GNI)	0.000714 (0.00145)	-6.81e-05 (0.00121)	-0.00126 (0.00322)	-0.00117 (0.00281)	0.000109 (0.000356)	0.00373*** (0.00133)
Start-up procedures	-0.313* (0.160)	-0.567*** (0.172)	-0.231 (0.165)	-0.234 (0.308)	-0.119*** (0.0309)	-0.325*** (0.0699)
Time-Effects	NO	YES	NO	YES	YES	NO
Country-Effects	NO	NO	YES	YES	NO	NO
Undernourishment						-0.117*** (0.0368)
Constant	-0.100 (2.287)	5.134* (2.738)	-4.209 (4.275)	-2.663 (3.165)	1.799*** (0.401)	12.98*** (2.243)
First Stage F-Statistics						10.06
Observations	116	116	116	116	107	107
R-squared			0.088	0.270		0.164
Number of countries	9	9	9	9	9	

Source: Authors' computation based on WDI data

Robust standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$



From the regression, population growth, trade openness and FDI exhibits positively significant (10% level) impact on economic growth.

However, as Ibragimov and Ibragimov [4] pointed out, the traditional approach of the Okun's coefficient that is obtained by regressing the log of GDP growth on the log of unemployment using OLS fails to account for the endogeneity of the explanatory variables, thereby failing to produce consistent estimates. To correct for this inconsistency arising from omitted variable bias, the study employed the fixed effect regressions reported in columns 2 and 3. The time effect regression in column 2 accounts for time variant factors such as the effects of policy changes on economic growth. The time effect model produces results similar to the REM. The model points out that, increased rate of unemployment is associated with low economic growth. That is, an increased rate of unemployment by one unit, has the effect of crippling economic growth by 0.311% annually. The implication is that the REM produced an estimated coefficient on unemployment rate that is biased upward. This (time-fixed effect model) model produces an efficient estimate on unemployment rate given that the robust standard errors has reduced from 0.184 to 0.086. It is therefore essentially true to note that, time variant factors such as changes in national policies have tremendous impact on the economic growth of the selected countries. Indeed, economic growth will be boosted by favorable and effective policies (such as fiscal and monetary policies) that aims at reducing unemployment rate. Several studies that have also found the Okun's law to be valid includes, Moosa [16], Andrei et al. [18], Phiri [21] and Marinkov and Geldenhuys [22] employing different methods.

With respect to economic growth and business start-up procedures, increased number of procedures is associated with a reduction in economic growth. The result shows that, for every 1 unit increase in the number of procedures in start-up a business in West Africa, economic growth is expected to fall by 0.567% annually.

The results also shows that FDI has a significant impact on the economic growth of these countries.

Column 3 reports interesting finding of unemployment fluctuations on economic growth. The country-fixed effect regression shows that,

country effects are ineffective in explaining the economic growth of these selected countries. Perhaps there is no so much country differences between the selected countries. For instance, out of the 10 countries, 50% are French West African countries (colonized by France). Perhaps, there is not so much country differences as they are virtually built around the same colonial legacy. Implying that, there are virtually similar institutions, rule of law, social order, and ideology that cuts across these countries.

The model shows that fluctuations in both unemployment rate and business start-up procedures are not significant in explaining variations in economic growth. However, the model shows that FDI still has a 10% statistically significant positive impact in explaining economic growth. The model has an R squared of 8.8% implying that, fluctuations in economic growth is explained by 8.8% variations in the included explanatory variables including country effects.

Column 4 reports results for both time and country effects put together. The results shows that, all the estimated coefficients on the included explanatory variables have no power in explaining variations in economic growth even though the model improves in R square from 8.8% to 27%.

Additionally, the coefficient on unemployment rate might vary from high rates of unemployment increases. This possess serious threat to the linearity assumption that has been relied on so far in this paper. To correct for this misspecification error, the study regressed the log of GDP growth on unemployment rate. Note that, the paper fails to take the log transformation of unemployment rate since unemployment cannot be negative. That is, taking the log of unemployment rate would have produced negative values of unemployment rate since the rate of unemployment are already in low values.

Column 5 reports the time-effects regression of the log of economic growth on unemployment rate. The model produces a stronger efficient estimate on unemployment since robust standard errors is reduced even further from 0.086 to 0.02 (in column 2 to 5). The results shows the negative effect of unemployment rate on economic growth, that, for a 1 unit increase in the rate of unemployment, economic growth is predicted to reduce by 0.0346% ( $100 \times 0.0346/100$ ) annually. This proves further

the upward biasedness of the OLS coefficient on unemployment rate computed using the REM.

Additionally, business start-up process has a 1% level significantly negative on economic growth in West Africa. Showing that, for a unit increase in the number of procedures involved in starting up a business, economic growth falls by 0.117% annually, all other things being constant.

However, all the other variables are insignificant in explaining economic growth in West Africa.

Inconsistencies of the estimates due to the problem of endogeneity might be as a result of simultaneous causality running from the effect on economic growth of fluctuations in unemployment rate and backwards. For instance, high economic growth comes with improved conditions and stable economic environments which are necessary to create mass employment, thereby reducing the rate of unemployment. To correct for this inconsistency, the study explored a possible instrument variable that might be valid in estimating the coefficient on unemployment thereby correcting for endogeneity if there is any. Daily minimum wages could have served as a valid IV, however there is the lack of data on this variable. The study therefore employed prevalence of undernourishment as the IV. Does undernourishment serve as a valid IV? To answer this, the instrument has to be both relevant and exogenous. A relevant IV correlates with the included endogenous variable. Indeed, undernourishment implies that people are not living healthy lives. The effect is an undercut in total labor force, thereby increasing the rate of unemployment, ceteris paribus. However, the result from the first stage OLS regression of unemployment rate on undernourishment shown in column 5 in table 3 shows a negative relationship between the two variables. The model shows a negatively significant (1% level) effect of undernourishment on unemployment rate. That is, for every unit increase in undernourishment, unemployment rate consequently reduces by 0.177 as a percent of total labor force annually. Even though the coefficient on undernourishment does not have the expected sign, it indicates that undernourishment is a relevant IV since it correlates with unemployment rate.

The other exogenous explanatory variables including population growth, cost of doing business and business start-up procedures also

exhibit a 1% level significant effects on unemployment rate while trade openness is significant at only 10%.

To assess how strong undernourishment correlates with unemployment rate, the study relied on the F statistic testing the coefficient on undernourishment. Following the rule of thumb, Stock and Watson [5], the first stage F statistic is slightly above 10 implying an insufficient correlation between PoU and the rate of unemployment. Thus, the instrument chosen, does not have its expected sign, and is not sufficiently strong to serve as a valid IV since it is insufficient to accurately estimate variations in unemployment rate.

**Table 4. Endogeneity test**

<b>Variables</b>	<b>GDP growth (% annual)</b>
Unemployment rate	-0.199 (0.710)
Population growth	1.379 (0.870)
Trade openness	0.0474 (0.0353)
FDI	0.0944* (0.0544)
Cost of business (% of GNI)	0.000693 (0.00137)
Start-up procedures	-0.324 (0.218)
Residuals	-0.123 (0.678)
Constant	0.356 (7.224)
Observations	107
Number of countries	9

*Source: Authors' computation based on WDI data*

*Robust standard errors in parentheses*

*\*\*\* p<0.01, \*\* p<0.05, \* p<0.1*

To show whether unemployment rate is endogenous or exogenous, the study regressed economic growth on the predicted residual obtained from the first stage OLS regression of unemployment of undernourishment. This test is against the background that, under the null hypothesis the coefficient on the residual equal zero implying that unemployment rate is exogenous (thus, we will not need an IV) against the alternative hypothesis that the coefficient is different from zero and thus, an IV regression is

needed. Table 4 reveals that, the coefficient on the residual is insignificant which implies that, we fail to reject the null hypothesis that unemployment rate is exogenous. Since unemployment rate is not endogenous (exogenous), an IV regression is not needed.

## 5. CONCLUSION AND RECOMMENDATION

The study reveals an essential finding of the negative impact of high unemployment rate on economic growth of developing countries especially in West Africa and Africa at large. This finding confirms the validity of the Okun's law in West Africa showing that, low economic growth in the region is associated with high unemployment rate and in periods where unemployment rate is at minimum, economic growth is high. Interestingly, time variant effects such as changes in policy provides an even stronger case for the effect of unemployment rate volatility on the growth of these economies. It is therefore recommended that, various stakeholders adopt efficient fiscal and monetary policies aimed at lowering the rate of unemployment thereby expanding economic growth. One of such policies could be the reduction of the high corporate tax rates in the region that is bedeviling African countries by preventing industries and businesses from being built.

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## COMPETING INTERESTS

Author has declared that no competing interests exist.

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