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Productivity Growth, Wages and Employment Nexus: Evidence from Nigeria

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Abstract:

The nexus amongst productivity growth, employment and wages have generated debate in literature. Nigeria has witnessed increase in economic growth rate in the last decade which some scholars termed as jobless as unemployment has been growing all along. Therefore, this study joins this debate to investigate the impact of the growth on labour market performance in Nigeria using auto-regressive distributed lag (ARDL). The main advantage of this approach lies in the fact that it can be applied irrespective of whether the variables are I (0) or I (1). The ARDL revealed that using the RGDP (productivity growth), E (employment) and RW (real wages) as dependent variable, there is an existence of long run relationship. Also, it was showed that the output growth does not translate into employment gains both in the short and long-run while the influence of wages is not statistically significant. The implication is that the wages do not adjust to reflect the cost of living both in the short and long-run. The work suggested amongst others that government should aim to integrate employment and wages into the growth system both in the short and long run through targeting variable such as interest rate.

Keywords: productivity growth; wages; employment; Auto-Regressive Distributed Lag (ARDL)

JEL Classification: E23; J01; J64; J21; C21

Introduction

Over the years there had not been consensus among economists, policy makers and government agencies regarding the nexus of productivity growth, wages and employment rate, because the relationship between these variables have not be ascertained widely in the literature with respect to the time frame perspective. Recent statistics provided by the Central Bank of Nigeria (2015) suggest that economic growth was on the increasing trend until the first quarter of 2016, when it was decreasing (trading economics 2016). Despite the fact that the growth rate of the economy was on the increase, the rate of unemployment has been increasing yearly. Thus, the Economic growth has not been inclusive.

Unemployment rate published by Nigeria National Bureau of Statistics (NBS) is 23.9% in 2011 up from 19.7% in 2009. In 2014, the unemployment rate was 6.4% and later increased to 7.5% in the first quarters of 2015 (it can be noted that the sharp drop in the unemployment rate is due to the redefinition of unemployment by the Nigeria Bureau Statistics, NBS). Despite the low unemployment rate between the period of 2014 and 2015, rate of

underemployment stands at 17.9% in 2014 and reduced to 16.6% in the first quarter of 2015. Various scholars in literature have focused on examining the relationship between macroeconomic performance and labour market performance with less emphasis on employment and wages. This paper investigates the relationship between productivity and labour market performance in respect to the time frame perspectives.

1. Literature review

This section focused more on evidence from empirical literature. Oloni, Asaleye, Abiodun and Adeyemi (2017) examine the relationship between inclusive growth and employment in Nigeria using vector autoregressive model. The findings of the scholars showed that agricultural output have negative effects on employment and poverty.

It was suggested by Oloni *et al.* (2017) that Nigerian government should aim at promoting pro-poor growth by investing in the agricultural sector. Tamasauskiene and Stankaityte (2013) evaluated the relationship between wages and labour productivity in Lithuania. Their results show that regional dissimilarities of labour productivity are greater than wages. Correlation analysis was carried out by the scholars and they found that the correlation coefficient between wages and productivity showed that dissimilarities of wages were higher than that of labour productivity.

Strauss and Wohar (2004) show that there is long-run relationship between real wages and productivity at the industrial level for a group of manufacturing industries in the United States over the period 1956 – 1996, and the increases in productivity were associated with a less than unity increase in real wages.

Using Geweke's linear feedback technique, Meghan (2002) estimated the relationship between wages and productivity for several industrialised countries to distinguish between conventional and efficiency wage behaviours'. The results suggested that efficiency wages were being paid in Canada, Italy and the UK. In contrast, Sweden, the US and France exhibited no efficiency wage setting, with very negligible wages and productivity feedback measures. The study also found that economic institutions such as worker unions played an important role on the wage-productivity settings for this group of industrialized countries.

Sobeck (2014) worked on wages and labour productivity across developed economies between the years 1999 to 2013. In his analysis, it was observed that relationship between wages, compensation, labour productivity and the labour income share often depends on how certain variables are measured. His work shows the trends in the relationship between these variables for developed economies between 1999 and 2013. The countries are Poland, Canada, Norway, Sweden, and Spain among others. In his work CPI (consumer price index) and GDP deflator were used. The scholar observed that, in half of developed economies, the relationship between wages, compensation and labour productivity depends on the concept of wages or compensation used and/or the type of deflator. And also in the other half of developed economies, the choice of deflator and concept (wages versus compensation) are irrelevant. In 5 of the 11 countries, wage and compensation growth with either inflator always exceeds that of labour productivity growth, the opposite is observed in 6 countries. Since wages represent a proportion of compensation which varies from country to country, the relationship between wages and labour productivity may not be the same compared to compensation and labour productivity. The scholar also stresses that in most cases, trends in wages (deflated by the GDP deflator) and labour productivity serves as a reasonable proxy for trends in compensation. In other words, trends in wages and labour productivity generally follow trends in the labour income share.

Ho and Yap (2001) analysed both the long-run and short-run dynamics of wage formation in the Malaysian manufacturing industry as a whole and also for 13 selected sub-sectors of the industry using the Engle-Granger co integration test. They found a positive long-run relationship between labour productivity and real wages and a negative relationship between unemployment and real wages, and no significant relationship of union density on real wages. Furthermore, the short-run dynamic model revealed a negative relationship between real wages and labour productivity suggesting that labour productivity gains did not bring about higher wages in the short run. The main drawback of the methodology applied in this study is that the authors used the Engle-Granger two step procedure to test the co integration relationship among four variables, namely, real wages, productivity, unemployment and union density.

Marika and Hector (2009) studied the role of wage-productivity gap in economic activities. It carried out this study using some developed countries and a few developing countries such as France, Germany, Spain, Japan, United States of America (USA) and others. The scholars' find out that the labour share is negatively associated with employment even when the conventional assumption of a unitary long-run elasticity of wages with respect to productivity holds.

Sharpe, Arsenault and Harrison (2008) studied the relationship between labour productivity and real wage growth in Canada and OECD countries and in their work it was observed that the most direct mechanism by which labour productivity affects living standards is through real wages, that is, wages adjusted to reflect the cost of living. Between 1980 and 2005, the median real earnings of Canadians workers stagnated, while labour productivity rose 37%.

Malley and Molana (2007) studied the relationship between output, employment and efficiency wages using the G7 countries to observe this relationship. They constructed a stylized model of the supply side with goods and labour market imperfections to show that an economy can rationally operate at an inefficient, or 'low-effort', state in which the relationship between output and unemployment is positive. Data was used from the G7 countries over 1960-2001 and their findings reveal that only German data strongly favour a persistent negative relationship between the level of output and rate of unemployment. The consequence of this is that circumstances exist in which market imperfections could pose serious obstacles to the smooth working of expansionary and/or stabilization policies and a positive demand shock might have adverse effects on employment.

Andres Bosca, Domenech and Ferri (2009) worked on Job creation, productivity growth and labour market reforms in Spain using Dynamic Stochastic General Equilibrium (DSGE). The DSGE model was used with price rigidities, and a labour market search frictions Mortensen-Pissarides, to assess the effects of the change in the growth model on unemployment. It was assumed by the scholars that the vigorous demand shock that has been mostly responsible for recent low growth of the economy and Spain will be successfully substituted by a productivity shock as the main driver of Spain's economic growth in the future. They analyse the impact of several reforms in the labour market and evaluate their interaction with the new growth model. Their work concludes that changes in the economic structure do not make labour reforms any less necessary, but rather the opposite if employment will be increased.

Deepankar and Duncan (2011) studied the dynamics of output and employment in US economy. Real output is conventionally measured by the scholars as value added corrected for price inflation. The scholars noted that there are some industries in which no independent measure of value added is possible and existing statistics depend on imputing value added to equal income. Indexes of output that exclude these imputations are closely correlated with employment over the whole period, and remain more closely correlated during the current business cycle. The work by the scholars' offer insights into deeper structural changes that have taken place in the US economy over the past few decades, it shows economically significant reduction in the coefficient relating employment growth and output growth over the business cycles since 1985. Some of this change is due to sectoral shifts toward services, but an important part of it shows a reduction in the coefficient or the goods and material value-adding sectors.

Gros (2010) examines the relationship between wages and productivity growth. The scholar findings show long run positive relationship between wages and productivity. Mishel and Shierholz (2011) describe that there is a widening gap between growth rates of productivity and wages. Mishel and Shierholz show that labour compensation growth was particularly low in the private sector, while the growth of average wages was particularly weak for college educated public sector workers.

Harrison (2009) reports a similar divergence between the growth of real earnings and productivity in the US and Canada. From the empirical review of developing countries, the following conclusions are also drawn, in developing countries empirical studies by scholars show that growth in real wage suppresses employment creation (Nir Klein 2012, Fafchamps *et al.* 2008, Gilaninia, Monsef and Mosaddegh 2014, Barletta, Castillo, Pereira, Robert and Suarez 2014).

In conclusion, evidence from both developed and developing economies have shown that the relationship among productivity growth, wages and employment differs across regions and the effects are attributed to different

time perspectives. This study aimed at investigating the relationship among these variables in Nigeria using Auto Regressive Distributed Lag (ARDL). The increases in unemployment rate in Nigeria have motivated the study to examine the nexus among wages, productivity and employment. Unlike, other studies, the inclusion of wages distinguished the study from previous studies in Nigeria. Real wages have been identified in literature as the channel in which living standards can be affected through the productivity growth (Bruce 2002, Sharpe, Arsenult and Harrison 2008). Though some studies in Nigeria have used ARDL to examine economic growth, employment and trade openness among others. For example: Lawal, Nwanji, Asaleye and Ahmed (2016) that examined the nexus of economic growth, financial development and trade openness. Nigerian government have introduced different programmes and policies to improve labour market performance and welfare. Despite all these attempts, unemployment and low income still remain macroeconomic issues for policy makers. So the question is, given the dynamic nature of these programmes and policies, what is the impact of productivity growth on labour market performance? This is main thrust of this study.

2. Theoretical framework and research method

2.1. Theoretical framework

The theoretical framework of this study is built on the Phillips curve. Friedman (1968) stated that if employees bargain over real wages, there could not exist, a long-run trade-off between inflation and unemployment. Algebraically, it starts from the following equation:

$$w_t - P_t^e = w_{t-1} - P_{t-1} + \Delta prod + a - b_1 u_t \tag{1}$$

where: w_t is the wage rate at time t; P_t^e is the equilibrium price at time t; *prod* is the output; u_t is the unemployment rate; w_{t-1} and P_{t-1} are pervious wage rate and prices respectively; a is the inflation rate.

From equation (1), the accelerationist Phillips curve can be written as:

$$\Delta P_t = \Delta P_{t-1} + a - b_1 u_t \tag{2}$$

Inflation rate is the function of unemployment and steady if and only if the unemployment equals to 'Non-accelerating increasing rate of unemployment' (u*). This can be defined as:

$$u^* = \frac{a}{b_1} \tag{3}$$

Nigel and Stefan (2011) established equilibrium in relation to real wages, unemployment, inflation and productivity as follows:

$$(e - p) = b_1 + b_2 u + b_3 prod + b_4 \Delta e \tag{4}$$

where: $(e - p)$ is the real wage; u is unemployment.

The classical theory of the firm justifies the relationship between productivity and real wages. Insider-outsider models of wage bargaining would consider unemployment as non-significant (*b2*=0) except for the case that it was included in the objective function of the labour unions. (*b2*<0), the relationship between inflation and real wages depends on the nature of the wage contracts. Increases in real wages could lead to unemployment growth if firms financed the cost of these increases exclusively. The wages' growth would increase the participation of the population in the labour force thus leading to unemployment growth even with a stable number of jobs. Productivity through 'specialization' affects unemployment through two different mechanisms: an increase in productivity leads to a decrease in the demand for labour for a fixed output level. An increase in unemployment would lead to a

decrease in the aggregate demand; also, an increase in productivity leads to a decrease in the cost of production and lower product prices.

In the equation below, increase in aggregate demand with lower prices could increase employment as stated.

$$u = b_1 + b_2(e - p) + b_3 prod \tag{5}$$

Okun's law specified a positive relationship between employment and output; standard output model also specified a positive relationship between output and the factor inputs (labour and capital); finally, marginal productivity of labour equals to the wage rate.

Equation (5) can be rewritten as follows;

$$E = b_1 + b_2 w + b_3 prod \tag{6}$$

where: E is employment and w is wages, based on okun's law, standard output model and marginal productivity of labour: the three variables of interest (productivity, real wages and employment) can be used as dependent variables.

2.2. Empirical model formulation

The empirical models of the study are derived from the theoretical framework. Model specification begins with a set of structural equations made up of three models of system equations as follows: using employment as dependent variable (Model 1); using wages as dependent variable (Model 2) and using productivity as dependent variable (Model 3). The Auto Regressive Distributed Lag (ARDL) Model using bounds test approach with unrestricted error correction model (UECM) was employed to examine the short and long run relationship between labour market performance (using wages and employment as metrics) and productivity growth in Nigeria. Other variables to be considered in the models included exchange rate, consumer price index and interest rate. The ARDL modelling approach, the unrestricted error correction model for model 1 to 3 is stated in the equations below:

Model 1 Using Employment (E) as dependent Variable

$$\Delta E_{1t} = \alpha_0 + \delta_{11}E_{t-i} + \delta_{12}RGDP_{t-i} + \delta_{13}RW_{t-i} + \delta_{14}XD_{t-i} + \delta_{15}IR_{t-i} + \delta_{16}CPI_{t-i} + \sum_{i=0}^{q}\beta_{1j}\Delta RGDP_{t-j}$$
$$+ \sum_{i=0}^{q}\gamma_{1l}\Delta RW_{t-l} + \sum_{i=0}^{q}M_{1j}\Delta XD_{t-j} + \sum_{i=0}^{q}\psi_{1k}\Delta IR_{t-k} + \sum_{i=0}^{q}\rho_{1n}\Delta CPI_{t-n} + \varepsilon \tag{7}$$

Model 2 Using Wages (RW) as dependent Variable

$$\Delta RW_{1t} = \beta_0 + \delta_{21}RW_{t-i} + \delta_{22}RGDP_{t-i} + \delta_{23}E_{t-i} + \delta_{24}XD_{t-i} + \delta_{25}IR_{t-i} + \delta_{26}CPI_{t-i} + \sum_{i=0}^{q}\beta_{2j}\Delta RGDP_{t-j}$$
$$+ \sum_{i=0}^{q}\gamma_{2l}\Delta E_{t-l} + \sum_{i=0}^{q}M_{2j}\Delta XD_{t-j} + \sum_{i=0}^{q}\psi_{2k}\Delta IR_{t-k} + \sum_{i=0}^{q}\rho_{2n}\Delta CPI_{t-n} + v \tag{8}$$

Model 3 Using Productivity (RGDP) as dependent Variable

$$\Delta RGDP_{1t} = \omega_0 + \delta_{31}RGDP_{t-i} + \delta_{32}E_{t-i} + \delta_{33}RW_{t-i} + \delta_{34}XD_{t-i} + \delta_{35}IR_{t-i} + \delta_{36}CPI_{t-i} + \sum_{i=0}^{q}\beta_{3j}\Delta E_{t-j}$$
$$+ \sum_{i=0}^{q}\gamma_{3l}\Delta RW_{t-l} + \sum_{i=0}^{q}M_{3j}\Delta XD_{t-j} + \sum_{i=0}^{q}\psi_{3k}\Delta IR_{t-k} + \sum_{i=0}^{q}\rho_{3n}\Delta CPI_{t-n} + \mu \tag{9}$$

In equations (7) to (9), the summation terms represented the Error Correction Model (ECM) dynamics and δ_l are the coefficients of the long run multipliers (Poon 2010). Where α_0, β_0 and ω_0 are constant for Model 1, Model 2 and Model 3 respectively: ε, v and μ are the white noise.

The symbol Δ represents the first difference operator and q represents the lag length. F statistics will be used to test joint significance of the variable which will be compared with the critical value bounds. The variables are; E represents the level of employment; RGDP represents productivity; RW represents real wages; XD represents real effective exchange rate index; CPI represents consumer price index; IR represents the interest rate.

2.3. Method of research

This section presents the method of research which explains the technique of estimation. This includes the following, unit root test and ARDL (auto-regressive distributed lag).

Unit Root Test

It is necessary to check the Stationarity of the time series of the variables used, without the test of the unit root (if variables are non-stationary), it will give spurious result. The paper employed both the Augmented Dickey Fuller (ADF) and Phillips-perron unit root tests. The equation for the test is as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Y_{t-i} + \varepsilon \tag{10}$$

where: Y_t is the variable that is been examined; ε is the white noise error term.

The test involving whether δ is equal to zero or not. The number of lags to be used was determined using Akaike Information Criterion (AIC) to avoid serial correlation in the error terms.

Auto-regressive Distributed Lag (ARDL)

The main advantage of this approach lies in the fact that it can be applied irrespective of whether the variables are I (0) or I (1). This approach also allows for the model to take a sufficient number lags to capture the data generating process in a general-to-specific modelling framework. Another advantage of the ARDL is that it is not affected by the pre-testing problem implicit in the standard co-integration techniques (*i.e*. the Johansen maximum likelihood or the Phillips-Hansen semi-parametric fully-modified OLS procedures).

Data Sources and Measurement

The data used are obtained from Central Bank of Nigeria statistical bulletin (2015) and Nigeria National Bureau of Statistics. All variables except the employment rate are obtained from Central Bank of Nigeria statistical bulletin while the employment rate is obtained from National Bureau of statistics. Quarterly data are available for CPI, exchange rate, interest rate and GDP. Wages are also transformed into quarterly date using Quadratic match sum, this approach have also been used in literature by the study of Lowe and Grosvenor (2016) that estimated quarterly indicators of economic activity for the states of Eastern Caribbean Currency Union. GDP and RW are in log form. Data for real wages are not available. Wages is then computed using recurrent expenditure minus transfers, social and community cost.

3. Result and discussion

3.1. Unit Root Test

The Augmented Dickey-Fuller test and the Philips-perron test were conducted for each of the variables in the model in order to test for the stationarity and non-stationarity of the data used.

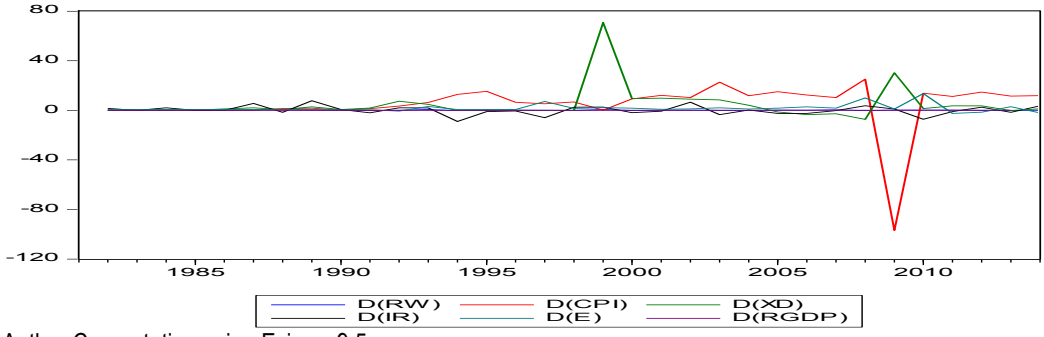
Table 1. Phillips-Perron and Augmented Dickey Fuller Unit Root Result for the variables

Variables	ADF Test Statistics at Levels	ADF Test Statistics at First Differencing	P-P Test Statistics at Levels	P-P Test Statistics at First Differencing	Order of Integration
CPI	-0.641061	-11.65872	-0.555386	-11.72094	I (1)
RGDP	1.168109	-11.34536	1.901508	-11.34534	I (1)
RW	-0.861372	-8.060668	-0.824874	-8.148445	I (1)
XD	-0.097165	-10.46387	-0.145576	-10.40387	I (1)
IR	-3.761159	-11.57059	-3.560311	-12.41976	I (0)
E	0.450155	-12.20939	0.637025	-12.57831	I (1)

Source: Author's computation (2016)

Table 1 above presents the Phillips-Perron and Augmented Dickey Fuller unit result of the variables used. All variables are integrated of order one except variable IR which is stationary at 5% significant level both for Phillips-Perron and Augmented Dickey Fuller Test.

Figure 1. Graph of variables (after first differencing)



Source: Author Computation using Eviews 9.5

The graphical illustration of the variables used after first difference is presented in Figure 1, all variables are integrated of order 1 except interest rate (IR). Though, in the figure above, all the series were integrated of same order.

3.2. Bound Testing for existence of a long-run relationship in Model 1

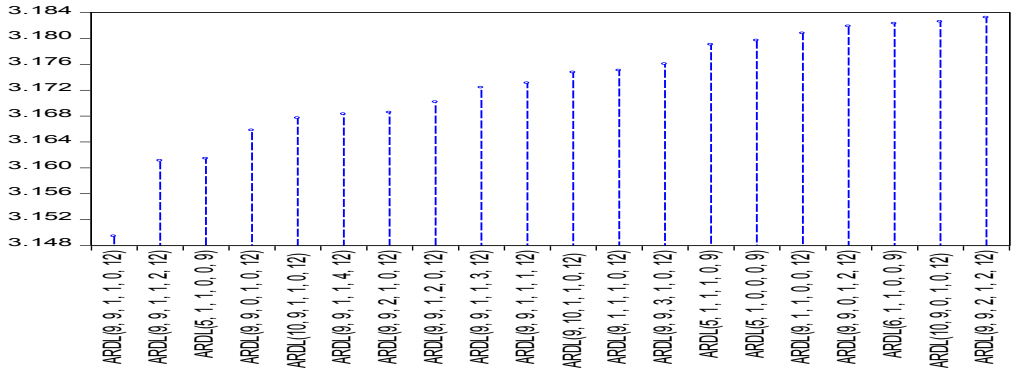
Table 2. ARDL (9, 9, 1, 1, 0, 12) for Model 1

Significance Levels	Critical Value Bounds		F-Statistic Value	K	Hypothesis Testing
	IO Bound	II Bound			
10%	2.08	3.00	5.227570	5	Cointegration exist
5%	2.39	3.38	5.227570	5	Cointegration exist
2.5%	2.70	3.74	5.227570	5	Cointegration exist
1%	3.06	4.15	5.227570	5	Cointegration exist

Source: Author's Computation using Eviews 9.5

Table 2 presents the ARDL bound test, shows the presence of long run relationship between the variables, long run relationship exists when the value of f-statistics is greater than the upper bound. From the table the f-stat is 5.227570, this is greater than the upper bound value which is 3, this means that there is long run relationship between the variables using E as the dependent variable at 10%, 5%, 2.5% and 1% significance level.

Figure 2. Model Selection Criteria for Model 1



Source: Author's computation using Eviews 9.5

Figure 1 presents the 20 model results of the ARDL, from the result, ARDL (9, 9, 2, 1, 2, and 12) has the highest Hannan-Quinn (HQ) Criterion value and ARDL (9, 9, 1, 1, 0, and 12) has the lowest Hannan- Quinn Criterion value. The lower the HQ value of the model, the more appropriate the model. The most appropriate model for this analysis is ARDL (9, 9, 1, 1, 0, and 12).

Table 3. Breusch-Godfrey Serial Correlation LM for Model 1

F-Statistic	0.697410	Prob. F(2,84)	0.5007
Obs* R-Squared	2.025388	Prob. Chi-Square (2)	0.3632

Source: Author's computation using Eviews 9.5

Table 3 presents the Breuch-Godfrey serial correlation LM, from the result the prob. Chi-Square is 0.3632 which is greater than 0.05, therefore the null hypothesis that there are no serial correlations between the variables cannot be rejected. Hence, there is no serial correlation in model 1

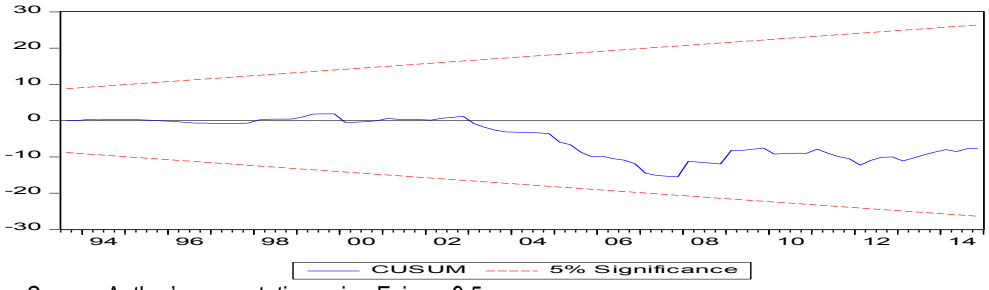
Table 4. Heteroskedasticity Test: ARCH for Model 1

F-Statistic	0.001021	Prob. F(1,121)	0.9746
Obs* R-Squared	0.001038	Prob. Chi-Square (1)	0.9743

Source: Author's computation using Eviews 9.5

Table 4 above presents the Heteroskedasticity, from the result the prob. Chi-Square is 0.9743 which is greater than 0.05, therefore the null hypothesis that there is no Heteroskedasticity between the variables will be cannot be reject.

Figure 3. Stability Test for Model 1



Source: Author's computation using Eviews 9.5

The graph above shows the stability test for Model 1, using CUSUM test, when the line of the variables is in-between the upper and the lower boundaries this means that is stability at 5% level of significance; therefore, the graph above satisfies the above stated condition.

3.3. Bound Testing for existence of a long-run relationship in Model 2

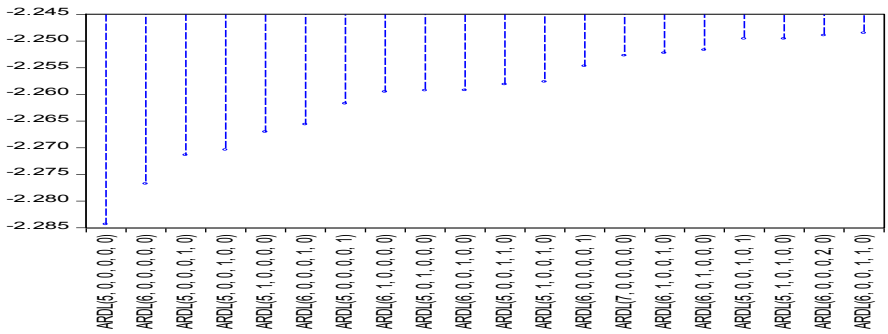
Table 5. F-Statistics for Testing Existence of Long-run in Model 2

Significance	Critical Value Bounds		F-Statistic Value	K	Hypothesis Testing
	IO Bound	II Bound			
10%	2.08	3	3.296199	5	Cointegration exist
5%	2.39	3.38	3.296199	5	Inconclusive
2.5%	2.7	3.74	3.296199	5	Inconclusive
1%	3.06	4.15	3.296199	5	Inconclusive

Source: Author's computation using Eviews 9.5

Table 5 shows the ARDL result using RW as dependent variable, with 5 lags for RW and (0, 0, 0, 0, 0) lag for CPI, RGDP, XD, IR, E respectively. The appropriate Lag length strength was selected by using Hannan-Quinn Criterion. From the table, it can be deduced that Cointegration exists at 10% level of significance. The value of the f-statistic is 3.296199 which is greater than the upper bound value which is 3, this shows that there is long run relationship between the variables using RW as the dependent variable. At 5%, 2.5% and 1%, the result of the inference is inconclusive since the computed F- statistics value is between the lower and upper bound.

Figure. 4 Model Selections for Model 2



Source: Author's computation

Figure 4 presents the 20 model results of the ARDL, from the result, ARDL (5, 0, 0, 0, 0, and 0) has the highest Hannan-Quinn Criterion value and ARDL (6, 0, 0, 1, 1, and 0) has the lowest Hannan-Quinn Criterion value. The most appropriate model for this analysis is ARDL (5, 0, 0, 0, 0, and 0).

Table 6. Breusch-Godfrey Serial Correlation LM for Model 2

F-Statistic	0.725040	Prob. F(2,118)	0.4864
Obs* R-Squared	1.590293	Prob. Chi-Square (2)	0.4515

Source: Author's computation using Eviews 9.5

Table 6 above presents the Breuch-Godfrey serial correlation LM, from the result the prob. Chi-Square is 0.4515 which is greater than 0.05, therefore the null hypothesis that there is no serial correlations between the variables cannot be rejected.

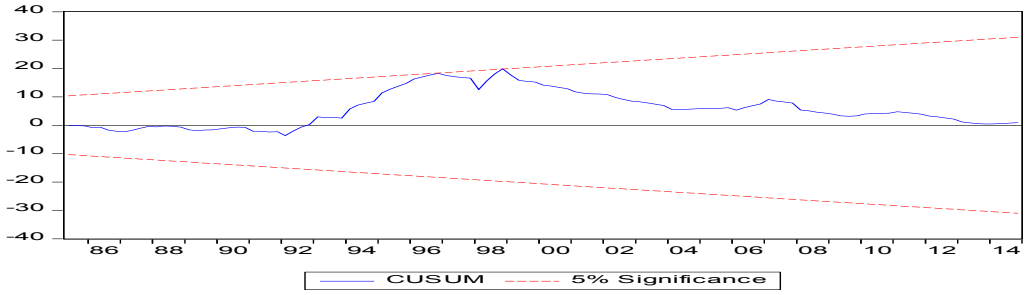
Table 7. Heteroskedasticity Test: ARCH for Model 2

F-Statistic	0.533026	Prob. F(20,90)	0.9448
Obs* R-Squared	11.75553	Prob. Chi-Square (20)	0.9242

Source: Author's Computation

Table 7 above presents the Heteroskedasticity, from the result the prob. Chi-Square is 0.9242 which is greater than 0.05, therefore the null hypothesis that there is no Heteroskedasticity between the variables cannot be rejected.

Figure 5. Stability Test for Model 2



Source: Author's computation using Eviews 9.5

From the graph above, it can be shown that using CUSUM test, the line is in-between the upper and the lower boundaries this means that there is stability at 5% level of significance; therefore, the graph above satisfies the above stated condition, therefore it is significant at 5% level of significance.

3.4. Bound Testing for existence of a long-run relationship in Model 3

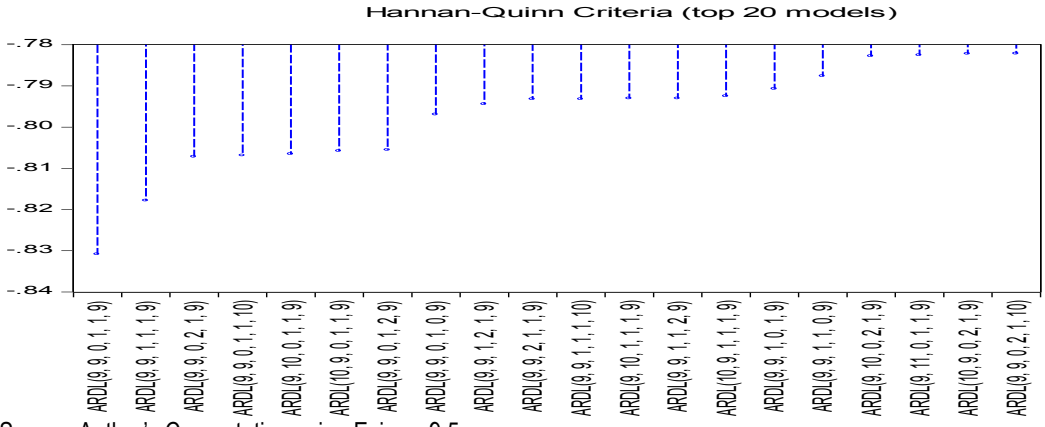
Table 8. ARDL Result (ARDL 9, 9, 0, 1, 1, 9) for Model 3

Significance	Critical Value Bounds		F-Statistic Value	K	Hypothesis Testing
	IO Bound	II Bound			
10%	2.08	3	3.078088	5	Cointegration exist
5%	2.39	3.38	3.078088	5	Inconclusive
2.5%	2.7	3.74	3.078088	5	Inconclusive
1%	3.06	4.15	3.078088	5	Inconclusive

Source: Author's computation using Eviews 9.5

Table 8 shows the ARDL result using RGDP as dependent variable, with 9 lags for RGDP and 9, 0, 1, 1, 9 lags for CPI, RW, XD, IR, and E respectively. The appropriate Lag length strength was selected by using Hannan-Quinn Criterion. The results of Model 2 and Model 3 are similar. Cointegration exists at 10% level of significance. The value of the f-statistics is 3.078088, greater than the upper bound value which is 3, this show that there is long run relationship between the variables using RGDP as the dependent variable at 10% level of significance. At 5%, 2.5% and 1%, the result of the inference is inconclusive since the computed F- statistics value is between the lower and upper bound.

Figure 6. Model Selection Summary Result for Model 3



Source: Author's Computation using Eviews 9.5

Figure 5 above presents the 20 model results of the ARDL, from the result, ARDL (9, 9, 0, 2, 1, and 10) has the highest Hannan-Quinn Criterion value and ARDL (9, 9, 0, 1, 1, and 9) has the lowest Hannan-Quinn Criterion value. The most appropriate model for this analysis is ARDL (9, 9, 0, 1, 1, and 9).

Table 9. Breusch-Godfrey Serial Correlation LM for Model 3

F-Statistic	0.046611	Prob. F(2,90)	0.9545
Obs* R-Squared	0.131411	Prob. Chi-Square (2)	0.9364

Source: Author's Computation using Eviews 9.5

Table 9 above presents the Breuch-Godfrey serial correlation LM, from the result the prob. Chi-Square is 0.9364 which is greater than 0.05, therefore, there is no serial correlations between the variables.

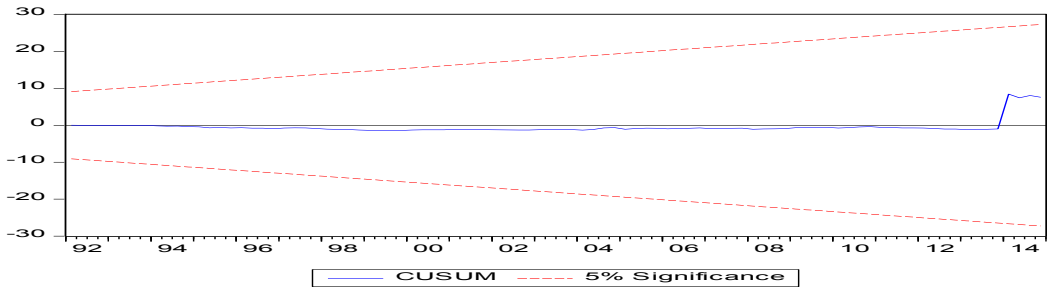
Table 10. Heteroskedasticity Test: ARCH for Model 3

F-Statistic	0.163765	Prob. F(1,124)	0.6864
Obs* R-Squared	0.166187	Prob. Chi-Square (1)	0.6835

Source: Author's Computation using Eviews 9.5

Table 10 above presents the Heteroskedasticity, from the result the prob. Chi-Square is 0.6835 which is greater than 0.05, therefore, there is no ARCH effect among the variables.

Figure 7. Stability test for Model 3



Source: Author's computation using Eviews 9.5

From the graph above, the CUSUM line is in-between the upper and the lower boundaries this means that the model is stable at 5% level of significance.

3.5. Estimated Long-run and Short-run using the ARDL for Model 1, 2 and 3

The bound test results presented above show the existence of long-run relationship in the model examined, since the cointegrating vector is identified. The ARDL model of the cointegrating vector is reparameterized into Error Correction Model (ECM). With the specification of ECM by this study, both the long-run and short-run information are incorporated. The result is presented below (in Table 11). The reparameterized result shows the short-run dynamics and the long-run relationship of the variables for Model 1, 2 and 3.

Table 11. Estimated Long-run and Short-run Parameters

Regressors	Dependent Variable (Coefficients and Probability Value)					
	Model 1 - E		Model 2 - RW		Model 3 - RGDP	
	LR	SR	LR	SR	LR	SR
E			0.0000401 (0.6995)	-0.001134 (0.7609)	-0.079891*** (0.0000)	-0.080471*** (0.0000)
RGDP	-4.078490*** (0.0000)	-4.057743*** (0.0000)	-0.002139 (0.9153)	-0.005306 (0.8927)		
IR	0.080355*** (0.0413)	0.081519 (0.0208)	0.002950** (0.0811)	-0.000500 (0.8621)	0.014292*** (0.0073)	0.013689*** (0.0046)

Regressors	Dependent Variable (Coefficients and Probability Value)					
	Model 1 - E		Model 2 - RW		Model 3 - RGDP	
	LR	SR	LR	SR	LR	SR
XD	0.019646 (0.2535)	0.021525 (0.1827)	1.74E-05 (0.9600)	0.001060 (0.3596)	0.005063*** (0.0285)	0.004346*** (0.0499)
RW	0.640503 (0.1562)	0.260235 (0.8009)			-0.41572 (0.4486)	0.092628 (0.4946)
CPI	0.060784*** (0.0000)	0.060309*** (0.0000)	0.000245 (0.4654)	-0.000220 (0.7449)	0.009196*** (0.00000)	0.009265*** (0.0000)
ECM		-0.030798*** (0.0000)		-0.032492*** (0.0000)		0.251623*** (0.0000)
LR represent Long-run: SR represent Short-run * indicates significance at 10%; ** indicates significance at 5%; *** indicates significance at 1%						

Source: Author's computation using Eviews 9.5
*Note: Probability value are presented in angle brackets

From Table 11 above, in Model 1, the ECM with the value of -0.030798 and a probability value of less than 5%. The coefficient is negative and significant. The ECM shows the speed of adjustment, this implies the existence of convergence in long-term equilibrium. Also, both in the short and long run, there are negative relationships between employment and output. This result contradicts the standard growth theory, Okun's law and the theoretical framework of this study. The implication of the result is that the output gains have not improved employment performance in Nigeria. The growth otherwise can be referred to as jobless growth. This result is in line with the study of Oloni *et al.* (2017) that examined the relationship between Inclusive growth and employment in Nigeria. Wages in short and long-run is not significant; contradicts the work of Andrew *et al.* (2008) that examined the relationship between wages and productivity in Canada and OECD countries.

In Model 2, The ECM value is -0.032492 and a probability value less than 5%. From the result, the coefficient is negative and significant. From this, it can be depicted that there is an adjustment from short run to the long run equilibrium among the variables (RGDP, CPI, RW, XD, IR and E) using RW as the dependent variable. This result was not in line with some of the studies in literature, for example: Gros (2010) shows there is no long-run relationship between wages and productivity; Mishael and Shierbolz (2011) show that there is divergence between wages and productivity in US and Canada. RGDP and E are not significant in Model 2.

In Model 3, ECM value is 0.251623 and a probability value of less than 5%. From the result, the coefficient is positive and significant; this positive coefficient indicates divergence in the long-run using RGDP as the dependent variable. There is a negative relationship between RGDP and E (employment) both in the short and Long-run and no significant relationship between wages both in the short and long run. This result contradicts the result of Ho and Yap (2001) that stressed a positive relationship between output and wages in the long-run and negative relationship in the short-run. Though, using wages as dependent variable, it was observed that there is existence of long-run relationship which was in line with the study of Strauss and Wohar (2004) that examined the long-run relationship between real wages and productivity at industrial level for a group of manufacturing companies in United State. In Model 3, the economic implication of the result is that minimal or no impact has been observed in promoting the wages that adjust to reflect the cost of living, since the channel in which productivity affect living standard is through real wages.

Conclusion

This study examines the relationship between productivity growth (RGDP) and labour market performance in Nigeria. The metrics used for labour market performance are wages (RW) and employment (E). Empirical studies have shown that impact of productivity on wages and employment varies both in developed and developing economies. This study uses autoregressive distributed lag (ARDL) as analytical tool. The augmented dickey-fuller and Philips-Perron technique were used in testing the unit root properties of the series. The unit root tests show that all the series used are non-stationary at 5% level of significance except the interest rate. However, the non-

stationary attained stationary after the first difference. The study specified the Error Correction Model (ECM) to capture both the short-run and long-run dynamics; the associated ECM model takes a sufficient number of lags to capture the data generating process to the specified framework using Hannan-Quinn Criterion. This is necessary to prevent Gaussian error in the ARDL model.

The results from the auto-regressive distributed lag (ARDL) revealed that using the RGDP, E and RW as dependent variable, there is an existence of long run relationship between the variables. Convergence in the long-run equilibrium using E and RW as dependent variables was noted while divergence was noted using RGDP as dependent variable. The sign of relationship between output and employment is negative and vice-versa both in the short and long-run. From the ARDL results the influence of the value of wages is not statistically significant both in the short run and long run. It has been observed in literature that the most direct mechanism by which productivity affects living standard is through real wages. Series of tests was also done to ensure the stability of the data and models respectively. The economic implication of the result is that minimal or no impact has been observed in promoting the wages in adjusting to reflect the cost of living and also, the output growth does not translate into employment gains both in the short and long run.

Based on the findings, it can be concluded that Nigerian government should focus on long term goals especially in trying to promote employment opportunities and increasing level of income. The following suggestions are given: the government should focus on long run policies for employment and wages and also ensure consistency between the policies in order to avoid the complication that occurs as a result of inconsistency in policy making. So there might be need for the government to develop an institutional framework that will ensure this; Government should create appropriate enabling environment to promote a sustained effective aggregate demand in order to maintain the required level of domestic production through targeting variable such as interest rate. Government should aim to integrate employment and wages into the growth system both in the short and long run through their policies; the Government should also be able to maintain competitive and favourable real exchange and interest. Finally, Government should deliberately promote labour- intensive method of production in order to generate more employment particularly in the real sector.

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