AUTOREGRESSIVE DISTRIBUTED LAG MODELING OF THE EFFECTS OF SOME MACROECONOMIC VARIABLES ON ECONOMIC GROWTH IN NIGERIA

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Abstract

Research background: The relationship between inflation rate, unemployment rate, interest rate and real gross domestic product per capita in Nigeria. However, there seems to be a short-run or long-run relationship among the macroeconomic variables.

Purpose: This study investigated the long and short run impacts of the inflation rate, unemployment rate and interest rate on real gross domestic product per capita (RGDPPC) (proxy for economic growth).

Research methodology: This study applied a linear dynamic model Autoregressive Distributed Lag (ARDL) modeling technique to analyze the short-run dynamics and long-run relationship of economic growth in Nigeria over the sample period between 1984 and 2017 using annual secondary data extracted from the World Bank Development Indicators Report.

Results: The empirical results showed that there was a long-run relationship between the inflation rate, unemployment rate and interest rate on real gross domestic product per capita (proxy for economic growth) in Nigeria. The results further revealed that only the unemployment rate had a significant positive impact on real gross domestic product per capita in the long-run and the inflation rate had a significant negative impact on real gross domestic product per capita in the short-run.

Novelty: Therefore, the study concluded that the unemployment rate and inflation rate proved to have significant impacts on economic growth in the long-run and short-run respectively. The formulation of policies to reduce unemployment through the adoption of a labour concentrated technique of production, entrepreneurship development and policy to keep the inflation rate a single digit.

Keywords: ARDL, inflation, interest, long-run, RGDPPC, short-run, unemployment

JEL classification: J21, P43

Introduction

The ultimate goal of different measures of economic growth is to provide a report card for the government to see how their economy is doing and measure economic performance at an instance or over time. Real gross domestic product per capita (RGDPPC) as one of the measures for economic growth is defined as the average of individual incomes in the economy adjusted for inflation (Jim, 2019). The relationship between economic growth and macroeconomic variables (determinants) has long been a trendy issue of discussions in the literature on economic development (Nihat, Emrah, 2013). Research on economic growth being undertaken in both theoretical and applied work, focuses on macroeconomic policies to achieve stable prices (low inflation), low levels of debt (both foreign and domestic), a free market economy, low rate of unemployment and an open economy (Mbulawa, 2015).

The problem of unemployment is peculiar and on the increase in developing countries as a result of different economic problems facing most of them. The National Bureau of statistics (NBS) defines unemployment in Nigeria as a percentage of the labour force that was available for work but did not work in the week prior to the survey period for at least 39 hours. Feridun and Akindele (2006) recognised unemployment as one of the major challenges the Nigerian economy is faced with. Udabah (1999) identified a key rationale for a low standard of living amongst underdeveloped countries as the relative scarce, unproductive and ineffective exploitation of labour compared with developed nations. Fadayomi (1992), Osinubi (2006), contended that unemployment is created from the inability to create and satisfactorily use the nation's labor assets particularly within the rural sector. The Nigerian government and international organisations are focused on lessening the rate of unemployment within the 21st century, in order to devoid the nation of more dangerous acts than existing ones (Olawunmi, Adebayo, 2017).

On the other hand, inflation can be defined as a significant and continuous increase in the general price level over a period of time (James, 2019). Periods of high inflation, translates to the diminishing value of the domestic currency which impacts on the economy negatively (Folorunso, Abiola, 2000). Effort by the government of Nigeria to curb the increase in unemployment and rising price levels, has seen the formulation of several macroeconomic policies geared towards economic growth with regards to interest rate, exchange rate and inflation rate have been the central focus of the policy makers and their development partners (Jelilov, Obasa, Isik, 2016).

Inyama (2013) studied the link among inflation, interest and exchange rates on economic growth in Nigeria. The ordinary least square method was used to a data set of 1979–2010 for each of the variables. It was established that inflationary rate is negatively related with real gross domestic product while a positive relationship existed for exchange rates and interest rates though not being significant. However, the impacts of an expanding interest rate on the economic growth of Nigeria have remained questionable (Acha, 2011). This research therefore examines the extent of the impact to which macroeconomic variables like inflation rate (INFR), unemployment rate (UNEMR), and interest rate (INTR) have on real gross domestic product per capita (RGDPPC) (proxy for economic growth) in Nigeria in the 20th through to the 21st century. The following sections are literature reviews, research methods, analysis, and discussion of the results, conclusion and recommendation.

1. Literature Review

The investigation of the impact of inflation rate on economic growth in Nigeria from 1970 to 2011 showed a bi-directional relationship between inflation rate and economic growth in the economy (Osuala, Osuala, Onyeike, 2013). Real gross domestic product (RGDP) and inflation rate are the variables used in the study. More so, Umaru and Zubairu (2012) carried out a similar study on the impact of inflation rate on economic development in Nigeria using data from the years 1970 to 2010 while testing for stationarity and causality. All variables were stationary at first difference and the gross domestic product (GDP) granger caused inflation as revealed by the result. Following the result of no co-integration (no long-run relationship) between inflation and economic growth; a high correlation coefficient established a strong relationship between inflation and gross domestic product (GDP) (proxy for economic growth) in Tanzania from 1990 to 2011 as examined by Kasidi and Mwakanemela in 2013. The results also displayed the negative impact of inflation on economic growth in Tanzania.

Several studies have been carried out to examine the relationship between economic growth and unemployment. However, different results were obtained due to the econometric techniques, the countries researched, data and period of the study used. Okun's Law expresses a positive relationship between economic growth and employment or a negative relationship between economic growth and unemployment rate. This law simply put, say that a one percent (1%) increase in gross domestic product (GDP) will result in a 0.3–0.5 percent decrease in unemployment (Meyer, Tasci, 2012). On the one hand, both the creation and protection of jobs are required to guarantee income and wealth creation and on the other hand, rising levels of unemployment leads to socioeconomic problems (Kitov, Kitov, 2011). Onwachukwu (2015) examined the time series data from 1985 to 2010 for macroeconomic variables real gross domestic product (RGDP), inflation rate and unemployment rate in Nigeria. The study employed the Augmented Dickey Fuller technique and the ordinary least squares (OLS). The result showed a significant and an insignificant negative effect of unemployment rate and inflation rate on economic growth in the Nigerian economy. The negative impact of unemployment and inflation rate on economic growth in Nigeria is in line with the empirical findings from the studies of Bakare (2012) and Ogueze and Odim (2015).

The stable state of macroeconomic policies is essential to realize its set goals and objectives which is effective growth and development in the economy (Orji, Orji-Anthony, Okafor, 2015). Inconsistencies in the Real Gross Domestic Product (RGDP) have resulted in an irregular inflation rate in Nigeria in recent years (Jelilov, Obasa, 2016). Aminu, Manu and Salihu (2013) looked at the combined impact of inflation rate and unemployment rate on economic development in Nigeria from 1986 to 2010 by employing similar techniques as Inyama in the year 2013. The Granger causality test result revealed that unemployment and inflation granger causes real gross domestic product (RGDP) in the economy of Nigeria.

Expansionary monetary policy refers to the swift increase in the total supply of money in the economy, and contractionary monetary policy decreases the total money supply in the economy, or increases it gradually (Essien et al., 2016). For the purpose of decreasing unemployment, the Central Bank has embarked on an expansionary monetary policy which excites the domestic economy, while increasing interest rates aims at mitigating the effect of inflation when a contractionary monetary policy is adopted (Engler, 2011), while monetary policy on domestic economic activities and employment has been established (Altavilla, Ciccarelli, 2009; Saymeh, Orabi, 2013).

2. Research Method

2.1. Data

For the study of the impact of inflation rate, unemployment rate and interest rate on real gross domestic product per capita (proxy for economic growth) in Nigeria, an autoregressive distributed lagged modeling technique was employed to study time series data over a thirty four (34) year period from 1984 to 2017. The Autoregressive Distributed Lagged (ARDL) model enables the dependent variable to be explained by the independent variables and their lags; and also its own lag. Data on inflation, unemployment and interest are expressed in percentages while data on real gross domestic product per capita is expressed in value. All data were extracted from the World Bank Development Indicators Report (Last updated 30/01/2019) except for data on unemployment rate which was extracted from the National Bureau of Statistics (2019). Inflation was measured as the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The unemployment rate was measured as the percentage of the active labour force that were willing to work and looking for job but without a job to total active labour force in the population. Interest rate was measured as the lending bank rate that usually meets the short-term and medium-term financing needs of the private sector. Real gross domestic product per capita was measured as gross domestic product at purchaser's prices divided by a mid-year population. Data is in constant local currency. The required ARDL model, pre-estimation and post-estimation diagnostics techniques necessary for taking decisions and arriving at a satisfactory conclusion is specified below.

2.2. Model Specification

The Autoregressive Distributed Lag Model (ARDL) model plays a key role when faced with making a vital economic decision from previous data. Change in economic variables may bring change in other economic variables beyond the time (Kripfganz, Schneider, 2018). This is termed as changes distributed over future periods. This is a model containing the lagged values of the dependent variable, the current and lagged values of the regressors as explanatory variables. It is often necessary for a stationary (unit root) test to be conducted to ascertain that no variable is integrated of order 2 i.e. $I(2)$. The ARDL model can be specified if the variables are integrated of different orders. That is, a model having a combination of variables with $I(0)$ i.e. level stationary variables and $I(1)$ i.e. 1st difference stationary variables order of integration (Nkoro, Uko, 2016). The ARDL model can also be used if all the variables are integrated

of order one i.e. stationary after the first difference I(1). The general model of the ARDL (p, q) is as follows:

$$y_t = \varphi + \sum_{i=1}^p \alpha_i y_{t-i} + \sum_{i=0}^q \beta_i x_{t-i} + \varepsilon_t \quad (1)$$

Or broken down as:

$$y_t = \varphi + \alpha_1 y_{t-1} + \dots + \alpha_p y_{t-p} + \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \dots + \beta_q x_{t-q} + \varepsilon_t \quad (2)$$

where:

y_t – dependent variable (RGDPPC_{*t*}),

y_{t-i} – lag of the dependent variable (RGDPPC_{*t-i*}),

x_t – independent variable (INFR_{*t*}, UNEMR_{*t*}, INTR_{*t*}),

x_{t-i} – lag of the independent variable (INFR_{*t-i*}, UNEMR_{*t-i*}, INTR_{*t-i*}),

p – optimal lag order associated with the dependent variable in years,

q – optimal lag order associated with the independent variable in years,

φ – Constant,

α_i – coefficient for dependent variable (coefficients for short-run),

β_i – coefficient for Independent variable (coefficient for long-run),

ε_t – error term.

Variables used to assess the significance of the relationship between the macroeconomic variables and the economic growth of Nigeria, are in their natural log form. The growth model can be represented mathematically as:

$$LN\text{RGDPPC} = f(LN\text{INFR}, LN\text{UNEMR}, LN\text{INTR}) \quad (3)$$

The linear relationship of equation (3) could be stated as:

$$\ln(\text{RGDPPC}) = \varphi + \beta_1 \ln(\text{INFR}) + \beta_2 \ln(\text{UNEMR}) + \beta_3 \ln(\text{INTR}) + \varepsilon \quad (4)$$

Where RGDPPC (Real gross domestic product per capita) is the dependent variable, φ is the intercept term, β_1 is the coefficient of INFR (Inflation rate) (independent variable), β_2 is the coefficient of UNEMR (Unemployment rate) (independent variable), β_3 is the coefficient of INTR (Interest rate) (independent variable) and ε is the unexplained part of the actual data and fitted line by the regression equation known as the error term.

2.3. Pre-Estimation Tests

Pre-estimation tests are parametric tests and carried out are the stationarity test (Augmented Dicker Fuller test), co-integration test (ARDL Bounds test) and optimal lag length determination.

Stationary Test (Augmented Dicker Fuller) (ADF)

Time series data is said to be stationary when its value tends to revert to its long-run average value and its other properties like the variance and co-variance of the data series are not affected by the change in time (i.e. time invariant) (Shrestha, Bhatta, 2018). The most common method for testing unit root for parametric analyses is the Augmented Dickey Fuller (ADF) test. Let's assume we have a series y_t for testing the unit root. The ADF model tests the unit root as follows:

$$\Delta y_t = \mu + \delta y_{t-1} + \sum_{i=1}^k \beta_i \Delta y_{t-i} + \varepsilon_t \quad (5)$$

where:

$$\delta = \alpha - 1,$$

α – coefficient of y_{t-1} ,

Δy_t – first difference of y_t i.e. $y_t - y_{t-1}$.

Co-integration Test (ARDL Bounds Test)

There is co-integration between two or more variables if there exists a form of the equilibrium relationship spanning the long-run (Shrestha, Bhatta, 2018). The Bounds test is guided by the assumption of stationary variables at level I(0), at the first difference I(1) and never at the second difference I(2) (Giles, 2013). To perform the bounds test for co-integration, the conditional ARDL (p, q_1, q_2, q_3) model with 4 variables. This will be the hypothesis for the bounds test:

$$H_0: b_{ji} = 0 \text{ where } j, i = 1, 2, 3, 4,$$

$$H_1: b_{ji} \neq 0$$

i.e. The null hypothesis shows that the coefficient of the long-run equation are all equal to zero which implies there is no co-integration against the alternative hypothesis which shows that the coefficient of the long-run equation are all not equal to zero, which implies there is co-integration. If there is no co-integration, the ARDL (p, q_1, q_2, q_3) models will be specified as:

$$\begin{aligned} \Delta \ln RGDPPC_t = & a_{01} + \sum_{i=1}^p a_{1i} \Delta \ln RGDPPC_{t-i} + \sum_{i=0}^{q_1} a_{2i} \Delta \ln INFR_{t-i} + \\ & + \sum_{i=0}^{q_2} a_{3i} \Delta \ln UNEMR_{t-i} + \sum_{i=0}^{q_3} a_{4i} \Delta \ln INTR_{t-i} + \varepsilon_t \end{aligned} \quad (6)$$

If there is co-integration, the error correction model (ECM) representation is specified as:

$$\begin{aligned} \Delta \ln RGDPPC_t = & a_{01} + \sum_{i=1}^p a_{1i} \Delta \ln RGDPPC_{t-i} + \sum_{i=0}^{q_1} a_{2i} \Delta \ln INFR_{t-i} + \\ & + \sum_{i=0}^{q_2} a_{3i} \Delta \ln UNEMR_{t-i} + \sum_{i=0}^{q_3} a_{4i} \Delta \ln INTR_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \end{aligned} \quad (7)$$

where:

λ – speed of adjustment parameter with a negative sign which shows convergence in the long-run else the model is explosive,

ECT – the error correction term, the ordinary least squares (OLS) residuals series from the long-run co-integrating regression,

$a_{1i}, a_{2i}, a_{3i}, a_{4i}$ – the short-run dynamic coefficient of the model's adjustment long-run equilibrium.

Where we have the differences (Δ), it captures the short-run and where we have the ECT , it captures the long-run. The short-run causal effect is represented by the statistical significance of the t -statistic on the explanatory variables (short-run coefficients). If the t -statistic of the coefficients $a_{1i}, a_{2i}, a_{3i}, a_{4i}$ is significant, then we can know the direction of causality from the regressor to the dependent variable (Giles, 2013). The long-run causal effect is captured by the significance of the λ , which is the parameter for the error correction term (ECT). If λ is significant then it tells us that there is a long-run causality among the variables.

Optimal Lag Length Determination

The choice of appropriate lag length is vital in autoregressive modeling because we want to have Gaussian error terms (i.e. standard normal error terms that do not suffer from non-normality, autocorrelation, heteroscedasticity etc.) (Nkoro, Uko, 2016). The selection of optimal number of lags can be determined using proper model order selection criteria such as the Akaike Information Criterion (AIC), Schwartz Bayesian Criterion (SBC) or the Hannan-Quinn criterion (HQC). The value of the general ARDL ($p, q_1, q_2, \dots, q_k$) model is given by:

$$AIC_p = (1 + \log 2\pi) - \frac{\eta}{2} \log \sigma^2 - P \quad (8a)$$

$$SBC_p = \log(\delta^2) + \left(\frac{\log n}{n}\right)P \quad (8b)$$

$$HQC = \log \delta + \left(2 \log \frac{\log n}{n}\right)P \quad (8c)$$

where δ^2 is the Maximum Likelihood (ML) estimator of the variance of the regression disturbance, n is the number of estimated parameters and $p = 0, 1, 2, \dots, P$, where P is the optimum order of the model selected (Nkoro, Uko, 2016).

2.4. Post Estimation Tests

Autocorrelation Test

One of the assumptions of the classical model is that the disturbance term relating to any observation is not influenced by the disturbance term relating to any other observation; however, if there is such dependence, there exist the autocorrelation Gujarati (2005). Symbolically

$$E(\varepsilon_i, \varepsilon_j) \neq 0, \quad i \neq j.$$

With the advantages of the Breush-Godfrey test (also known as the LM test) over the Durbin-Watson d test, we shall employ the use of the Breush-Godfrey test to check for the presence of autocorrelation in our disturbance term in this study.

Heteroscedasticity Test

An important assumption of the classical linear regression model is that the variance of each disturbance term ε_i , conditional on the chosen values of the explanatory variables, is some constant number equal to σ^2 Gujarati (2005). This assumption is known as homoscedasticity or equal variance. Symbolically,

$$E(u_i^2) = \sigma^2, \quad i = 1, 2, \dots, n.$$

For the purpose of this study, we shall be employing the Breusch-Pagan-Godfrey test to check for heteroscedasticity in our disturbance term.

Normality Test for Residuals (Histogram and Jarque-Bera Test)

In order to ensure that our model satisfies the assumption of the classical normal linear regression model, it is important to check one of the assumptions known as the normality of the disturbance term, ε_i . The Jarque-Bera (JB) test of normality is an asymptotic test based on OLS

residuals. It computes the skewness and kurtosis measures of the OLS residuals and uses the following test statistic:

$$JB = n \left[\frac{S^2}{6} + \frac{(k-3)^2}{24} \right] \quad (9)$$

where:

n – sample size,

S – skewness coefficient,

k – kurtosis coefficient.

The null hypothesis states that the residuals are normally distributed. If the p-value of the JB statistic in the application is sufficiently low, which can occur if the value of the statistic is very different from zero, one can reject the null hypothesis otherwise we do not reject the null hypothesis (Gujarati, 2004).

Parameter Stability Test (CUSUM Graph)

The check for the stability of the estimated parameters from the regression model in the study is an important post-estimation check. A Cumulative Sum (CUSUM) test is employed to help check if the coefficients of the regression are changing systematically or changing suddenly respectively (Bhatti et al. 2004). The Hypothesis is:

H_0 : parameters are stable (which is desirable),

H_1 : parameters are not stable (which is not desirable).

The decision rule states that if we find the blue line between or within the red line in our CUSUM, we accept the null hypothesis (H_0) and reject the alternative hypothesis (H_1). Alternatively, if the blue line crosses the red line in our CUSUM graph, we reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1).

3. Analysis and Discussion of the Results

3.1. Graphical Representation

The graph represents a glance of the downward and upward movement of the individual variables with time. It is an indication of the increase or decrease of the effect of the selected macroeconomic variables within the study period.

Figure 1. Graphical Representations of Macroeconomic Variables (1984–2017)

Source: authors' computation (2019)

3.2. Determination of Optimal Lag Length

For annual data, one or two lags usually suffice for the determination of optimal lag length (Jeffrey, 2012). The outcomes of the optimal lag length determination from lag one (1) and lag two (2) and their corresponding Akaike information criterion (AIC), Schwarz Criterion (SC), Hannan-Quinn Criterion values and selected ARDL models are presented in Table 1. The decision for the selection of the optimal lag length lies on the lag length with the minimum AIC value. From the result, the autoregressive distributed lag order of two (2) is selected based on the minimum AIC value of -4.265036 .

Table 1. ARDL Method of Optimal Lag Length Selection

Lag length	Akaike Information Criterion	Schwarz Criterion	Hannan-Quinn Criterion	Selected ARDL Model
1	-4.265036	-3.947595	-4.158226	(1, 1, 1, 0)
2	-4.265036	-3.947595	-4.158226	(1, 1, 1, 0)

Source: authors' computation (2019).

3.3. Stationary Test (Augmented Dickey Fuller Test) ADF Test

The estimation results of the unit root test through the application of the Augmented Dickey-Fuller (ADF) stationarity test at 5% critical value is shown in Table 2. The estimation results revealed that all the variables i.e. RGDPPC, INFR, UNEMR and INTR were not stationary at level; and yet, became stationary after first differencing at 5% critical value. This was supported by Phillips-Perron and KPSS tests.

Table 2. Augmented Dickey-Fuller (ADF) Unit Root Test

At Level					At First Difference				
Variable	ADF Statistic	Phillips-Perron	KPSS	Remark	Variable	ADF Statistic	Phillips-Perron	KPSS	Remark
RGDPPC	1.284480	-1.603091	0.164193	N	RGDPPC	-3.400208	-3.807256	0.116380	S
INFR	-0.714494	-2.578665	0.128939	N	INFR	-3.717547	-7.528620	0.500000	S
UNEMR	0.237397	-2.160956	0.101822	N	UNEMR	-5.240932	-5.161010	0.098359	S
INTR	-0.102704	-2.447156	0.142222	N	INTR	-2.798068	-5.935061	0.087077	S

N – non-stationary; S – stationary.

Source: author's computation (2019).

3.4. Bound Testing

The ARDL Bound test for Co-integration compares the F-statistic value to the upper I(1) and lower I(0) critical bound values as shown in Table 3 below to determine the existence of co-integration among the variables. There exist no presence of co-integration among the variables if the F-statistic is less than the lower critical bound I(0), there is co-integration if the F-statistic value is greater than the upper critical bound I(1) and the result is inconclusive if the F-statistic value falls in between the lower I(0) and upper I(1) bound critical value. For this study, the F-statistic value is greater than the upper critical bound value at all the significance levels, and thus, it was concluded that there exists a unique long-run relationship among the variables.

Table 3. ARDL Bounds Test For Co-integration

Test Statistics	Value	K
1	2	3
F-Statistics	8.769639	3
Critical Value Bounds		
Significance	I(0)	I(1)
10%	2.72	3.77

1	2	3
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source: authors' computation (2019).

3.5. Result of the ARDL Estimation

Table 4 shows the result of the ARDL model which allows the simultaneous estimation of the short-run and long-run coefficients of the model. With the discovery of a long-run relationship among the variables, the study proceeds with estimating the ARDL model to investigate the long-run relationship and short-run dynamics among real gross domestic product per capita (RGDPPC) (proxy economic growth) and its focus variables which are inflation rate (INFR), unemployment rate (UNEMR) and interest rate (INTR). The estimation results indicated that the coefficient value of inflation rate (INFR) is -0.013450 with its associated p-value being 0.1271 , which implies that inflation rate has a negative and insignificant impact on real gross domestic product per capita (RGDPPC) in Nigeria in the short-run. More so, the coefficient

Table 4. Autoregressive Distributed Lag (ARDL) Model (1984–2017)

Dependent Variable: D(LNRGDPPC)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	1.431401	0.380640	3.760512	0.000900
LNRGDPPC(-1)	-0.132561	0.031724	-4.178530	0.000300
LNINFR(-1)	0.003496	0.010219	0.342082	0.735000
LNUNEMR(-1)	0.057041	0.011033	5.170162	0.000000
LNINTR(-1)	0.036735	0.022851	1.607570	0.120000
D(LNINFR)	-0.013450	0.008534	-1.576039	0.127100
D(LNUNEMR)	0.011401	0.015930	0.715709	0.480500
LNINFR	0.026370	0.075941	0.347237	0.731200
LNUNEMR	0.430299	0.067876	6.339446	0.000000
LNINTR	0.277118	0.188357	1.471239	0.153200
R-squared				0.990494
Adjusted R-squared				0.988300
F-statistic				451.509600
Prob(F-statistic)				0.000000

Source: authors' computation (2019).

value of unemployment rate (UNEMR) is 0.011401 while its p-value is 0.4805. The result indicates that unemployment rate has a positive and insignificant impact on real gross domestic product per capita (RGDPPC) also in the short-run. This result contradicted Okun's law (Bula, 2014). Furthermore, the coefficient value of interest rate (INTR) is 0.036735 with its p-value being 0.1200, which implies that the interest rate (INTR) has a positive and insignificant impact on real gross domestic product per capita (RGDPPC) in Nigeria in the long-run. The estimation results indicated that the coefficient value of unemployment rate (UNEMR) is 0.430299 with its associated p-value being 0.0000, which implies that unemployment rate has a positive and significant impact on real gross domestic product per capita (RGDPPC) in Nigeria in the long-run. The adjusted R-Square revealed that 98.83% variation in the real gross domestic product per capita is accounted for by the variations in inflation rate, unemployment rate and interest rate. The F-statistic value of 451.5096 with a p-value of 0.0000 revealed the significance and adequacy of the ARDL model.

3.6. Autocorrelation (Breusch-Godfrey serial correlation LM) Test

The Breusch-Godfrey serial correlation LM test shows the absence of a serial correlation in the model as revealed by the results in table 5 below. The probability value of the F-Statistic confirms that the residuals were serially uncorrelated.

Table 5. Breusch-Godfrey Serial Correlation LM Test

Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.229309	Prob. F(2,24)	0.7968
Obs*R-squared	0.618775	Prob. Chi-Square(2)	0.7339

Source: authors' computation (2019).

3.7. Normality Test for Residual (Histogram and Jarque-Bera) Test

The probability value 0.65 which is greater than the 0.05 critical value for the Jarque-Bera test, gave a reasonable cause for the acceptance of the null hypothesis that the error term followed a normal distribution as shown in Figure 2.

Figure 2. Histogram and Jarque-Bera Test For Residual

Source: authors' computation (2019).

3.8. Stability Test (CUSUM Graph)

The result from Figure 3 obviously indicated that the model was stable until 1998 to 2001 which showed a bit of instability after the CUSUM line went beyond the 5% significance line. The result is not desirable as the entirety of the sample period of the study is not stable.

Figure 3. Cumulative sum (CUSUM) Stability Test

Source: authors' computation (2019).

Conclusion and Recommendation

The purpose of this study was to examine the effect of macroeconomic variables inflation rate (INFR), unemployment rate (UNEMR) and interest rate (INTR) on real gross domestic product per capita (RGDPPC) (proxy for economic growth) in Nigeria from 1984–

2017 (34 years) using an ARDL model. Based on the findings, it was found that inflation rate had negative and insignificant effect on economic growth in the short-run and a positive and insignificant effect on economic growth in the long-run in Nigeria. More so, the coefficient of unemployment revealed a positive and insignificant impact on economic growth in the short-run and a positive and significant impact on economic growth in the long-run. The study also revealed a positive and insignificant effect of interest rate on economic growth in Nigeria in the long-run. The findings of this study are in accordance with the findings of Onwachukwu (2015), Kasidi and Mwakanemela (2013), Inyama (2013), Akeju and Olanipekun (2014), Ezi (2014) and Ogueze and Odim (2015); on the other hand, the findings of the study contradict the findings of Sweidan (2004). Moreover, to achieve an all inclusive economic growth in Nigeria, policies geared towards the increase in the level of output in other sectors of the economy with a labour intensive technique of production should be adopted. Policy makers should focus on maintaining inflation at a low rate (single digit), ensuring interest rate stability and improvement of the educational system with an entrepreneurial skill acquisition curriculum so that young school leavers and graduates alike would be more job creators rather than job seekers.

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