


## THE DETERMINANTS OF LONG RUN ECONOMIC GROWTH IN NIGERIA



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### ABSTRACT

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The paper investigated the determinants of the long-run economic growth in Nigeria. The data was obtained from the World Development Indicator (WDI) database based on annual time series for the period (1981 to 2014) on real gross domestic product, government consumption expenditure, inflation and population growth rate. Consequently, Autoregressive Distributed Lags (ARDL) Model was employed for the analysis. The study found cointegrated relationship among the variables. The Error Correction Model (ECM) revealed that the speed of adjustment to restore equilibrium is 0.85 which suggests that there is a stable long run relationship. The policy implication of this finding is that the Nigerian government should give more emphasis on improving its level of technology, investing in research and development, increasing the stock of human capital, and build up its capital stock in order to boost economic growth.

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**Contribution/ Originality:** This study is one of the very few studies which have investigated the determinants of long run economic growth in none cross-country situation using ARDL model. Also, it contributes to the existing literature in the area.

## 1. INTRODUCTION

Economists have long been interested in finding answers to the reasons behind the wide gaps that exists among the nations of the world in terms of economic growth and output per capita. Many variables have been considered as the key determinants of growth of modern economies. This increased the interest in identifying the underlying causes of such improvements, and different variables have been identified as possible sources of growth in the literature during the last fifty years: output, productivity, average human capital and knowledge were used in various models to capture economic growth (see, La Torre and Marsiglio (2010)). The neoclassical economists led by Solow (1956); Swan (1956); Cass (1965) and Koopmans (1965) identified the accumulation of physical capital as crucial in explaining growing economies in their exogenous growth models. They postulated that there will be conditional convergence of economic growth rates and GDP per capita among the countries of the world. However, Arrow (1962); Romer (1986); Lucas (1988) and others developed endogenous growth models in which they identified the evolution of human capital and ideas as the key feature driving growth in the long-run. They argued that steady growth can be generated endogenously without any exogenous technical progress. Subsequently, testing the relevance of exogenous versus endogenous growth models has been a priority for exploring the determinants of long-run growth as pointed out by Huh and Kim (2013).

In recent times the excitement centered on endogenous growth theories in which long term growth was determined by government policies and other variables. Hence, capital was broadened to include human components and to allow for spillover

effects of innovations (Romer, 1986; Lucas, 1988). Thus, it is assumed that the absence of diminishing returns meant that the accumulation of capital could sustain growth indefinitely, although the rate of growth and investment might not be Pareto optimal (Barro, 1996). Moreover, subsequent empirical works on growth across countries and regions have not received its main inspiration from the new theories. Rather, the standard applied framework derives more from the older, neoclassical model, as extended to incorporate government policies (including institutional choices that maintain property rights and free markets), accumulation of human capital, fertility decisions, and the diffusion of technology. In addition, Jones (1995); Kocherlakota and Yi (1996); Lau and Sin (1997) and Lau (2008) found that endogenous growth models are not consistent with data in a number of developed countries. It is surely an irony that one of the lasting contributions of endogenous growth theory is that it stimulated empirical work that demonstrated the explanatory power of the neoclassical growth model (see, Barro (1996)).

Notably, there are several variables that characterize long-run growth; investment and output are at the root of both exogenous and endogenous growth models as pinpointed by Huh and Kim (2013). The experiences from developing countries that have achieved such growth acceleration indicated that the drivers of growth differ across countries (Breisinger *et al.*, 2009). Also, Boakye (2012) observed that, all these models treat countries as if they have similar social and political environments. However, since countries differ considerably in terms of the level of socio-political development and maturity, and since the economic outcome is influenced immensely by the socio-political environment, this kind of treatment makes these models incomplete, and thus renders their predictions less accurate. Again, Acemoglu (2012) opined that economic growth is beyond the growth of aggregate output only but also about the fundamental transformation of an economy, ranging from its sectoral structure, to its demographic and geographic makeup, and perhaps more importantly, to its entire social and institutional fabric.

Most empirical studies have focused on cross-country variations, testing the relevance of exogenous and endogenous growth models in determining long-run growth. However, in this study we restrict ourselves to one country, Nigeria with the aim of testing which of the exogenous growth variables as outlined in Barro (1996) are significant in determining long-run economic growth. A study of this nature is important for policy analysis and formulation as well as triggering further research in the area.

## 2. LITERATURE REVIEW

The exogenous neoclassical theory was developed by Solow (1956); Swan (1956); Cass (1965) and Koopmans (1965). It is a class of long-run economic models set within the framework of neoclassical economics. It attempts to explain long-run economic growth by looking at productivity, capital accumulation, population growth and technical progress. It postulates a continuous production function linking output to the inputs of capital and labour which leads to the steady equilibrium of the economy. The model postulates that the growth rate of output in a steady state is exogenous and is independent of saving and technical progress. If savings increases, output per worker increases by increasing capital per worker but growth rate of output is not affected. Growth in per capita income can be achieved by either increase in savings or decrease in population. In the absence of technical progress, growth per worker will cease due to diminishing returns to capital. The turning point of the theory was introducing the concept of conditional convergence. That is, all countries having similar characteristics like savings, population, technology will reach the same steady state of growth rate in the long-run.

Presumably, if countries were inherently at the same level, except for their starting capital they will tend towards convergence in an absolute sense. That is to say, poorer countries will grow faster than richer countries. But if there are differences amongst the countries on issues such as government policy, savings, fertility rate, technology etc., the convergence may occur only in a conditional sense.

The concept of capital in the neoclassical model can be usefully broadened from physical goods to include human capital in the forms of education, experience and health. The economy tends toward a steady state ratio of human to physical capital, but the ratio may depart from its long-run value in an initial state. The extent of this departure generally affects the rate at which per capita output approaches its steady state value. The theory also predicts that in the absence of technological progress, per capita growth will eventually cease. The long-run data for many countries indicate, however, that positive rates of per capita

growth can persist over a century or more and that these growth rates have no clear tendency to decline (Lucas, 1988; Barro, 1996).

One of the major criticisms of the model is that the long-run per capita growth depends on the rate of technological growth and the rate of population growth which is both exogenously determined. Therefore, the exogenous model fails to capture long-run growth, which is obviously a serious deficiency as pinpointed by experts such as Arrow (1962); Romer (1986); Lucas (1988); Barro (1996). The new growth theory is an extension of the neoclassical theory; it introduces endogenous technical progress in growth models. The endogenous growth model emphasized technical progress resulting from the rate of investment, the size of capital stock and the stock of human capital. The theory suggests that the convergence of growth rates per capita of developing and developed countries can no longer be expected to occur. The increasing returns to both physical and human capital imply that the rate of return to investment will not fall in developed countries relative to developing countries. Hence, the reverse may occur. Furthermore, the contribution of both physical and human capital to growth may be larger than the Solow residual model because of the spill-over effect due to investment in research and development (R&D). Therefore, the previous studies concluded that, countries having greater stock of human capital and investing more on R&D will enjoy faster rate of economic growth. These may be the reasons for the slow growth rate of certain developing countries (See, Jhingan (1997)).

Similarly, Ding and Knight (2009) found that the Solow model augmented by human capital and structural change predicts China's economic growth rate quite accurately, and that there are four main determinants of China's extraordinary growth performance. Capital formation has played a major role in China's economic growth, and this view of investment-driven growth is consistent with the out of- equilibrium neoclassical growth theory and in line with explanations for the East Asian miracle' (Krugman, 1994; Young, 1995). In addition, Conditional convergence contributes significantly to growth differences between China and other countries. Economic growth has been intertwined with productivity-enhancing structural change throughout the reform period. Lastly, the low population growth rate resulting from the restrictive population policy makes an important contribution to China's growth performance relative to many other developing countries.

### 3. METHODOLOGY

This study utilized secondary data based on annual time series covering the period 1981 to 2014 which was obtained from the World Development Indicator (WDI) database. The methodology was adopted from the work of Barro (1996) and Autoregressive Distributed Lag (ARDL) model developed by Pesaran *et al.* (2001). The use of this approach has advantage over the conventional method of Johansen and Juselius (1990). It was applied in testing the long run relationship between the variables regardless of whether the variables were integrated of order zero I (0) or order one I (1), the techniques is appropriate for small sample size (Pesaran *et al.*, 2001). Lastly the dynamic Error Correction Model (ECM) was derived from the ARDL model through simple linear re-parameterization.

The functional relationship between RGDP as the dependent variable and GCE, FTR, INF and PPG as the independent variables could be expressed as:

$$RGDP = \beta_0 + \beta_1 GCE + \beta_2 FRT + \beta_3 INF + \beta_4 PPG \quad (1)$$

Where;

RGDP = Per capita Gross Domestic Product (GDP)

GCE = Government Consumption Expenditure

FTR = Fertility rate

INF = Inflation rate

PPG = Population growth

The theoretical expectation of the model is that coefficient  $\beta_3 > 0$  while  $\beta_1 < 0$ ,  $\beta_2 < 0$  and  $\beta_4 < 0$ . The linear transformation of equation (1) gives the econometric model where the error term ( $\mu_t$ ) is assumed to be white noise (i.e.  $iid \sim (0, \delta^2)$ ). Thus, equation (1) becomes:

$$\ln RGDP = \beta_0 + \beta_1 \ln GCE + \beta_2 \ln FRT + \beta_3 \ln INF + \beta_4 \ln PPG + \mu_t \quad (2)$$

Moreover, in order to determine the long-run relationship among the variables of the study we adopted the ARDL Bound to test for cointegration developed by Pesaran *et al.* (2001). The error correction version of ARDL model is presented in equation (3) as follows:

$$\begin{aligned} \Delta \ln RGDP_t = & \alpha_0 + \sum_{i=1}^p \emptyset_i \Delta \ln RGDP_{t-i} + \sum_{i=1}^p \varphi_i \Delta \ln GCE_{t-i} + \sum_{i=1}^p \pi_i \Delta \ln PPG_{t-i} \\ & + \sum_{i=1}^p \gamma_i \Delta \ln FTR_{t-i} + \sum_{i=1}^p \rho_i \Delta \ln INF_{t-i} + \delta_1 \ln GDP_{t-1} + \delta_2 \ln GCE_{t-1} \\ & + \delta_3 \ln PPG_{t-1} + \delta_4 \ln FTR_{t-1} + \delta_5 \ln INF_{t-1} + \mu_t \quad (3) \end{aligned}$$

Where,  $\emptyset$ ,  $\varphi$ ,  $\pi$ ,  $\gamma$  and  $\rho$  represent the short run parameters and  $\delta_2$  to  $\delta_5$  represent the long run parameters. The null hypothesis of no presence of cointegration is presented as:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$$

While, the alternative hypothesis of the presence of cointegration is presented as:

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 = \delta_4 \neq \delta_5 \neq 0$$

Therefore, the hypothesis testing of the ARDL cointegration is based on value of critical Bound and the F-statistics. If the value of the F-statistics is greater than the critical value of the upper bound, then we reject the null hypothesis meaning that there is cointegration relationship among the variables. If the F-statistics value is less than the critical value of the upper bound, then we failed to reject the null hypothesis which implies that there is no cointegration. Hence, if the value of the F-statistics is between the critical value of upper and lower bound the cointegration decision is inconclusive. In such a situation we will have to rely on the lagged error correction term to investigate long run relationship. If a long run relationship exists among the variables of the study, equation (3) will be reformulated as follows:

$$\begin{aligned} \Delta \ln RGDP_t = & \alpha_0 + \sum_{i=1}^p \emptyset_i \Delta \ln RGDP_{t-i} + \sum_{i=1}^p \varphi_i \Delta \ln GCE_{t-i} + \sum_{i=1}^p \pi_i \Delta \ln PPG_{t-i} \\ & + \sum_{i=1}^p \gamma_i \Delta \ln FTR_{t-i} + \sum_{i=1}^p \rho_i \Delta \ln INF_{t-i} + \mu_t \quad (4) \end{aligned}$$

The method of ARDL approach estimates  $(P + 1)^K$ , this equation represent the number of regressions in order to get the optimum lags for each variable. Where,  $P + 1$  is the maximum number of lags to be used and  $K$  is the number of variables in the equation (Shrestha and Chowdhury, 2007). The model selection is based on the Akaike Information Criterion (AIC) that uses the smallest possible lag length and is therefore described as the parsimonious model.

However, the specification of ARDL short run dynamics is investigated using the ARDL version of ECM of the following specification:

$$\begin{aligned} \Delta \ln RGDP_t = & \alpha_0 + \sum_{i=1}^p \emptyset_i \Delta \ln RGDP_{t-i} + \sum_{i=1}^p \varphi_i \Delta \ln GCE_{t-i} + \sum_{i=1}^p \pi_i \Delta \ln PPG_{t-i} \\ & + \sum_{i=1}^p \gamma_i \Delta \ln FTR_{t-i} + \sum_{i=1}^p \rho_i \Delta \ln INF_{t-i} + \psi ECM_{t-1} + \mu_t \quad (5) \end{aligned}$$

The last term of equation (5) is the error correction term which was the results from the varied long run equilibrium relationship and  $\psi$  signifies the speed of adjustment from the short run to the long run state of equilibrium. Notwithstanding, diagnostic test will be carried out in order to check the reliability of the ARDL model. Thus, serial correlation test, heteroscedasticity test and normality test were conducted. In addition, the stability tests such as Cumulative Sum of Recursive Residuals (CUSUM) and the Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) were conducted.

#### 4. EMPIRICAL RESULTS

The empirical results of the study were presented and discussed in this section. The Pesaran *et al.* (2001) critical values were grounded on the postulation that the variables are either integrated of order I(0) or I(1). Unit root tests assure that none of the series is integrated of I (2) or higher. Therefore, the augmented Dickey Fuller (ADF) procedure (see, Dickey and Fuller (1979)) was employed to test the stationarity of the variables and the results of the test were presented in Table 1. Hence, the test for stationarity shows that variables such as; LPPG and LFRT are integrated of order zero I(0), LRGDP, LGCE and LINF are integrated of order one I(1).

**Table-1. Unit Root Test Results**

Variables	ADF Test At Level		ADF Test At First Difference		Order of Integration
	t-Statistic	Probability	t-Statistic	Probability	
LRGDP	-2.954021	0.9281	-2.957110	0.0001	1
LGCE	-2.954021	0.9445	-2.971853	0.0173	1
LPPG	-2.986225	0.0127	-	-	0
LINF	-2.986225	0.3321	-2.960411	0.0241	1
LFTR	-3.557759	0.0001	-	-	0

Source: Authors' computation

To determine the presence of long run relationship among the variables of the study, the Pesaran *et al.* (2001) bound test procedure was used. The bound test results were presented in Table 2. The result reveals that F-Statistics is 10.02 which is greater than the upper critical bound of 4.37 at 1% level, 3.49 at 5% level and 3.09 at 10% level. This suggests that there is long run relationship among LRGDP, LGCE, LPPG, LINF and LFTR over the period of the study, i.e. 1981 to 2014.

**Table-2. Bound Test Results**

Level of Sig.	1% sig. Level		5% sig. Level		10% sig. Level	
Critical Bound	Lower (0)	Upper (1)	Lower (0)	Upper (1)	Lower (0)	Upper (1)
Critical Value	3.29	4.37	2.56	3.49	2.2	3.09
F-Statistics = 10.02662	K = 4					

Source: Authors' computation

The next step of the ARDL approach would be to estimate the coefficients long run relationship of the variables and the associated error correction model (ECM). The results of the long run estimated coefficients are presented in Table 3. As such LGCE coefficient suggest a positive and insignificant relationship with LRGDP and the result does not confirm with a priori expectation because the central notion is that non-productive government spending lowers the growth rate but over the long run the relationship between RGDP growth rate and GCE would be positive especially if such kind of spending is channelled into productive sector. Moreover, LFTR and LRGDP is negatively related to LRGDP and the relationship is significant. This result conforms with a priori expectation because a higher fertility rate means that increased resources must be devoted to child bearing rather than to production of goods. Hence, the coefficient of LINF suggests a positive and significant relationship with LRGDP and the relationship supports the a priori expectation since a higher price paves the way for economic growth by stimulating investment. Lastly the coefficient of LPPG reveals a positive relationship with LRGDP and the relationship is strongly significant but is not in line with a priori expectation as stipulated by the neoclassical model, a higher population growth rate has a negative effect on output because investment has to be diverted to provide capital for new workers, rather than raise capital per worker.

**Table-3. Estimated Long Run Coefficients for ARDL model**

Regressor	Coefficient	Std. Error	t-Statistic	Prob.
LGCE	0.109416	0.070633	1.549091	0.1334
LFTR	-13.134373	4.499374	-2.919156	0.0072
LINF	0.636144	0.151523	4.198325	0.0003
LPPG	5.763063	1.794222	3.212013	0.0035
C	23.920421	9.795566	2.441964	0.0217

Source: Authors' computation

The results of ECT were presented in Table 4. The results reveal that government consumption expenditure, fertility rate and population growth are statistically insignificant while inflation rate are statistically significant at 1% level. Moreover, ECT coefficient is negative and strongly significant at 1%. This confirms the presence of a stable long run relationship among the variables. The ECT shows the speed of adjustment to reinstate equilibrium in the dynamic model following a disturbance. The coefficient of the ECM is  $-0.85$ , implying that a deviation from long run equilibrium is corrected by 85% after each year.

However, the diagnostic test such as Lagrange Multiplier (LM) for serial correlation, ARCH test for heteroscedasticity and normality of the residual terms are presented in Table 4 suggesting that the ARDL model passes all the diagnostic tests. This is because we found no evidence of serial correlation and heteroscedasticity. The residual terms are normally distributed and the functional term of the model appears well specified.

Table-4. Error Correction Representation for ARDL model

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(LGCE)	0.120954	0.083638	1.446161	0.1601
D(LFTR)	-10.130824	6.401881	-1.582476	0.1256
D(LINF)	0.639265	0.189158	3.379522	0.0023
D(LPPG)	1.968293	2.020763	0.974035	0.3390
ECT(-1)	-0.849212	0.176329	-4.816064	0.0001
<b>Statistical Tests</b>		<b>Diagnostic Tests</b>		
R <sup>2</sup>	0.997035	Autocorrelation Test (DW stat)		2.100089
Adj R <sup>2</sup>	0.996351	Heteroskedasticity Test (BPG)		0.095013
AIC	-1.028526	Normality Test (JB-Stat)		0.447369
SC	-0.711085			
F-statistic	2.04765			

Source: Authors' computation

However, in order to ensure the robustness of the result as well as the stability of the parameters of the model, cumulative sum of recursive residuals (CUSUM) and the cumulative sum of square of recursive residuals (CUSUMSQ) were used to test for stability. The two test graphs were shown in Figures 1 and 2 below, concerning the parameters stability, the decision rule was based on the position of the graphs of CUSUM and CUSUMSQ.

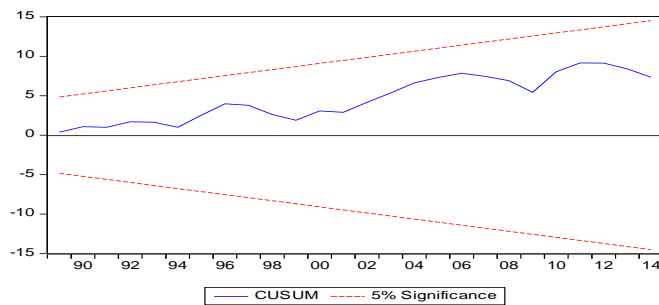


Figure-1. CUSUM of recursive residuals of the determinant of economic growth equation

Source: Authors' computation

As shown from the two figures (1 and 2), both CUSUM and CUSUMSQ plots cross the critical boundaries of 5%, therefore, based on these we could conclude that the estimated parameters for both the short run and long run of the equations used were very stable.

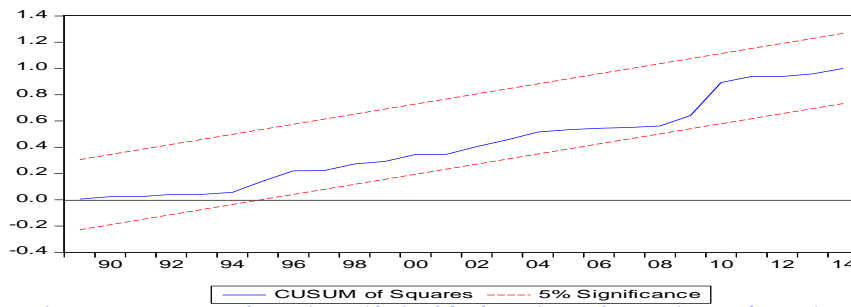


Figure-2. CUSUMS of recursive residuals of the determinant of economic growth equation

Source: Authors' computation

## 5. CONCLUSION

This research investigated the long run determinants of economic growth in Nigeria with emphasis on the effects of government consumption expenditure, fertility rate, inflation and population growth using annual data for the period 1981 to 2014. The study employed Autoregressive Distributed Lag (ARDL) approach. The study found that the relationship among the variables such as real GDP, government consumption expenditure, fertility rate, inflation rate and population growth are cointegrated. The ECT coefficient revealed that the speed of adjustment to restore equilibrium is 0.85 which suggests that there is a stable long run relationship, compared with the other variables. Fertility rate and population growth had the strongest effect on economic growth in the long run followed by inflation rate. However, in the short run all the variables with the exception of inflation rate do not have significant effect on economic growth. However, the findings of this research is that, the neoclassical exogenous model as specified in Barro (1996) is a poor fit for the Nigerian scenario. The data does not support the convergence thesis, hence, a more robust model is required that will incorporate the missing variables which will test the neoclassical postulations. Therefore, the policy implication of this finding is that, Nigerian government should give more emphasis on improving its level of technology, investing in research and development, increasing the stock of human capital, and build up its capital stock. Furthermore, as observed by Barro (1996) observed that, the long-term growth rate depends on governmental actions, such as taxation, maintenance of law and order, provision of infrastructure services, protection of intellectual property rights, and regulations of international trade, financial markets, and other aspects of the economy. The government therefore has great potential for good or ill through its influence on the long-term rate of growth.

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