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Review Article

Net Population Growth and Economic Growth in Nigeria: An Autoregressive Distributed Lag (ARDL) Model Approach

Bashir Umar Faruk, Ph.D[1*] and Abubakar Abdullahi (M.Sc. Student)[2]

[1]Department of Economics, Federal University Gusau, Zamfara, Nigeria
[2]Department of Economics, Umaru Musa Yar'adua University, Katsina, Nigeria

*Corresponding Author
Bashir Umar Faruk, Ph.D

Abstract: Nigeria records high population growth, which is considered to be detrimental to its growth and development over the years. This study therefore empirically examined the impact of net population growth on economic growth in Nigeria, using annual time series data covering the period of 1970 to 2017. The annual data was sourced from the World Bank Indicator (WDI) and United Nations Conference on Research and Development. The empirical results were based on Autoregressive Distributed Lag (ARDL) Co-integration analysis. The study established a negative and significant long-run co-integrating relationship between economic growth and net population growth. There is also evidence of unidirectional causality running from net population growth to economic growth in Nigeria. In line with the findings, the study recommends that government should put in place policies that would reduce fertility rate in Nigeria. Similarly the teaming Nigerian population should be harnessed to make it contributes to national development. This can be achieved through the development and implementation of appropriate educational policies that empower the citizens with the right education and skills sets. In this way, the populace will be economically productive and will meaningfully contribute to economic growth.

Keywords: Net population, economic growth, ARDL, ECM, causality, Nigeria.

1. INTRODUCTION

Precise relationship between population growth and economic growth has been a subject of long debate; as empirical evidences on the relationship between population growth and economic growth greatly differs across the globe. This is due to the fact that underlying parameters and assumptions, resources base, government policies, level of economic development, culture and of course labour force quality varies across countries (Mahmud, 2015). The relationship between population and economic growth was first noted in 1798 by Thomas Malthus. According to Malthus (1798), population if not checked will outgrow the actual available means of subsistence in no distance time. Though, the gloomy conclusions of Malthus theory of population have not turned out to be entirely true, particularly due to several unrealistic assumptions upon which the theory was based. However, the essentials of the theory cannot be completely disregarded, because the theory at least became a starting point for other famous economists including Marshal, Pigou and Keynes, who later wrote on population (Aidi *et. al.* 2016).

The world's population was about a billion in 1800 and rose to 2.5 billion in 1950. In the year 2007, the world population was estimated to be around 6.1 billion, and was projected to rise to about 9.2 billion by 2050, with almost all population growth projected to occur in the less developed regions. Between 1950 and 2000, the world population increased from 2.5 billion to 6.1 billion, however, the major shifts in population weights by continent were the result of changes in fertility and mortality, rather than large-scale migration (Martin, 2009). However, Nigeria is the most populated country in Africa, and the seventh in the world. Nigeria was rated among the fastest growing population in the world, with an average of 2.70% annual population growth rate (Gambo and idris, 2018).

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In Nigeria, population has been growing rapidly and consistently. For instance, the country's population rose from 16.06 million in 1911 to 30.42 million in 1953; it arose further to 89 million in 1991 and to over 170 million in 2014 (World Bank, 2014). Presently, world development indicators statistics has shown that Nigerian population is approximately 184 million (WDI, 2017). This huge population size does not only just make development planning difficult for the country but could also pose significant threat to economic growth in general (Aidi *et. al.* 2016). Aside the huge population size, evidence from World Bank (2014) revealed that the rate of fertility in Nigeria remained unacceptably very high. Fertility (births per woman) has been trending between 6.354 recorded in 1960 and 6.004 recorded in 2014, which is high compared to advanced countries like USA, Britain and Russia, where fertility rate on the average is less than 2.000 (World Bank, 2014). In the face of this high rate of fertility coupled with the decline rate of mortality (perhaps a resultant effect of global improvement in the overall medical/health services) a rise in the age-dependency ratio is not unexpected. In support of this, World Bank (2014) revealed that age-dependency ratio rose from 79 percent in 1960 to 83 percent in 1970, 86 percent in 2000 and about 90 percent in 2014. It is noteworthy that a rise in age-dependency ratio is tantamount to fall in the working population, which in the long-run may negatively affect productivity and economic growth (Aidi *et. al*. 2016). Kiguru, Poul, and Almadi (2013) also explained that rapid population growth tends to depress savings per capital and retards growth of physical capital per worker. Therefore, the precise relationship between population growth and economic growth has become one of the most debatable topics. However, till date no general consensus reached as regards to the nature of the relationship between population and economic growth. As a result of that empirical studies tend to produce mixed results.

Against this background, this study intends to empirically examine the impact of net population growth on economic growth in Nigeria. The study is also aim at identify the direction of causality between net population growth and economic growth in Nigeria. The study of this nature is important considering the fact that for a country with such huge population size as Nigeria, it is imperative to consider population variables in any feasible economic development plan.

Following this introductory part as section one, section two deals with the theoretical review, while section three reviewed the empirical literatures. The data and estimation technique is in section four. Section five of this paper comprises of analysis and discussion of the results. Finally, section six contained the conclusion and policy recommendations based on findings from the study.

2. Theoretical Review

There are numerous views and schools of thought that explained the relationship between population growth and economic growth. According to Luigi *et. al.* (2010), these literatures can be grouped into three, depending on their evaluation of population growth and economic outcomes, namely negative effects, positive effects, and no effects. However, the early well known theory of population growth was that of Malthus (1798). According to Malthus, population growth negatively affects economic growth, because it decreases the per capita output. The main argument of his theory is that output growth cannot keep pace with population growth. To the word of Malthus, in order to keep the natural balance in the population, especially that of food and consumption, some preventive checks (fertility reduction) and positive checks (i.e mortality increase) on population growth are necessary (Malthus, 1798). Moreover, Easterlin (1967) further explained that the main assumption of the Malthus theory is that limited availability of natural resources constrains both population and economic growth.

Furthermore, according to neoclassical growth model, particularly Solow (1956), population is considered as an exogenous variable and that population growth naturally follows an arithmetical pattern instead of a geometrical pattern. Yet, Solow (1956) built his model using the population growth rate and assuming that a constant and natural population growth is independent on economic dynamics. According to Solow (1956), there are two different effects of population growth rate on output growth. These are increase in the population growth rate, which will increase the amount of labour, and thus increase both the absolute level of output and the steady state output growth rate. On the other hand, it will also reduce physical capital stock per worker; therefore, a decrease in productivity and in the steady state output per worker.

The second group of theorists, who challenged Malthusian theories from an economic point of view was Kuznets, Quandt, and Frideman (1960). According to them population growth is positively related to economic growth; it's the population growth that brings about economic growth. However, they considered three major human activities, namely; production, consumption, and saving as constituent elements that contribute to economic growth. More so, Kuznets (1976) provided additional empirical evidence on the beneficial effects of population growth, which is called a deeper analysis and critique of Malthusian theories. Similarly, Kremer (1993) empirically confirmed that, larger population was associated with higher population growth rates and faster technological improvement, which has been a consequence of population growth, and leads to an increase labour productivity, per capita income and improvement in living standards. The main focus of this school of thought has shifted from natural

and reproducible physical capital to knowledge. Therefore, production was theorized to be free from the diminishing returns to scale that characterized the previous economic analysis.

Most recently, a new school of thought argues that, a rise in population is neutral on economic growth; therefore, it may not determine economic growth. This means that, the former does not hamper with the latter (Simon, 1987). Population neutralists believed that population growth has neither a significant positive nor a significant negative impact on economic growth (Bloom and Freeman, 1986). Kelley (1988) equally revealed that population neutralism is a school of thought that believed the absence of any significant relationship between population growth and rate of economic growth.

3. Empirical Literature Review

Cranshaw, Ameen, and Cristenson (1997) examined the relationship between population dynamic and economic development using cross sectional data for 75 developing countries from 1965 to 1990. The study employed regression method of analysis. The study reveals a negative relationship between child population and economic growth. On the other hand, a positive relationship was found between adult population and economic development. Rutger and Jeroen (2011) investigated the impact of population dynamics (age-structure) on economic growth in developing countries from 1997 to 2008. The result of the study reveals a robust positive effect of working age population on GDP growth rate. Therefore, the researchers recommended the need for government to create conducive investment atmosphere, as this will provide more employment that can support the growing population. Chang, *et. al.* (2014) studied the relationship between population growth and economic growth between 1870 and 2013. The panel data of twenty one countries across the globe were used. The researchers employed bootstrap panel causality test. The findings revealed a causal link between population growth and economic growth between the countries under study, with some having unidirectional, while others have bidirectional and still there are others with no causal link between population growth and economic growth. Beside the cross countries studies, Luis and Antilla (2014) examined the influence of population dynamics on economic growth in Romania from 1990 to 2013 using ANOVA. The study revealed among other things that there is a negative relationship between population growth and economic growth during the period.

Considering the age structure of Asian population, Bloom, Canning and Finlay (2010) empirically investigated the relationship between aging population and economic growth in Asia between 1960 and 2005, applying both descriptive and fixed dynamic panel regression model. The finding reveals a negative relationship between aging population and economic growth, so also a positive relationship exists between economic growth and capital stock, trade openness, and other institutional variables used in the regression model. Again, Brendan and Siokkun (2016) examined the relationship between population ageing and economic growth in Asia between 1970 and 2014, using bound testing approach of co-integration. The finding from the study revealed that, there is a negative relationship between old age dependency ratio and economic growth, while a positive long run relationship existed between youth dependency ratio and economic growth.

Kothare (1999) embarked on a research with a view to establish the relationship between population growth and economic growth in India. The study covered all provinces in India for the period of 1988 to 1998. The researcher employed the combination of descriptive and analytical statistical tools. The result of the study revealed that population growth has positive and significant impact on economic growth during the period considered. He explained further that the findings of the study are valid for both the short-run and long-run. In addition, Singh, Mittal, Sharma and Smarandache (2010) undertook a study on the determinants of population growth in Rajasthan India between 1991 and 2001. Multivariate analysis and regression analysis were employed to establish a linear relationship between population growth and crude birth rate, crude death rate, total fertility, infant mortality rate, female-male ratio, per capita expenditure among others. The findings showed that only few of the variables incorporated in the model, namely; total fertility, infant mortality, and crude death rate influence population growth during the period. In a related study, Mahmud (2015) used Johansen co-integration and vector error correction model to examine the relationship between population growth and economic growth between 1980 and 2013 in India. The study found a positive relationship between population growth and economic development. Furthermore, Susantakumar, Sethy and Harihar Sahoo (2015) undertook a study to find out the relationship between population growth and economic growth in India from 1970 to 2010, using regression analysis, granger causality and Johansen co-integration technique. The result has shown a strong positive relationship between per capita GDP and population.

Dao (2012) examined the relationship between population growth and economic growth in African countries; data were selected from forty three (43) African countries. Panel data regression analysis was used in analyzing the result. The study found that the relationship between population growth and per capita GDP is linear and negative. The findings equally showed that fertility rate has a negative impact on economic growth, similarly, old dependency ratio positively affects per capita GDP growth. Moreover,

Abda (2012) employed vector error correction model to examine the demographic changes and economic development in Ethiopia from 1950 to 2011. The result of the study revealed that there is robust and negative long run relationship between per capita income and population growth. The study further found a positive relationship between per capita income and growth of workers, with bidirectional causality in both cases.

On the studies related to Nigeria, Onwuka (2006) examined the impact of Nigerian growing population on its development between 1980 and 2006, using Ordinary Least Square estimation technique. The empirical result showed a negative relationship between population and economic growth during the period under review. In another related study, Ukpolo (2012) employed time series data on Nigeria and Cote d' Ivoire, to investigate the relationship between population growth and economic growth in Africa, using Johansen co-integration and Granger causality technique. The finding has shown that the variables are co-integrated in the long run in Nigeria, but not in Cote d'Ivoire. The study further revealed a negative long run relationship between population growth and economic growth in the long run. In Cote d'Ivoire however, the result shown that population growth causes economic growth in the short run. Similarly, Adewole (2012) investigated the effects of population on economic growth in Nigeria, using annual time series data covering the period between 1981 and 2007. The Ordinary least square regression method for analysis was used. The researcher found among other things that a strong positive relationship exists between population and economic growth. Nwosu, Dike and Okwara (2014) undertook an empirical research to examine the relationship between population growth and economic growth in Nigeria, using annual time series data from 1960 to 2008.Ordinary least square method and Granger causality test were employed. The result indicated that population growth has significant positive impact on economic growth. There is also a sustainable long run relationship between economic growth and population growth.

Using time series data, Tartiyus, Inuwa and Peter (2015) examined the impact of population growth on economic growth in Nigeria between 1980 and 2010. Descriptive statistics and regression analysis were employed. The result revealed a positive relationship between economic growth and population growth, fertility, and export growth. Aidi *et. al.* (2016) investigated the relationship between population dynamics and economic growth in Nigeria between 1970 and 2014. The data were analyzed using Ordinary Least Square estimation technique. The result showed that all the core variables of fertility, mortality and net migration are inversely related to economic growth. The finding further indicated that gross fixed capital formation and savings are strong drivers of economic growth in Nigeria. The study recommends that Nigerian government should take measures to check the alarming rate of fertility.

However, among the studies so far reviewed related to Nigeria, there are certain observed major shortcomings of time frame, control variables and inappropriate methodology among others. Therefore, this study used most recent data by extending the time frame and also incorporates new control variables of educational expenditure, gross capital formation and foreign direct investment, in order to examine the relationship between net population and economic growth in Nigeria.

4. Data and Estimation Technique

Annual time series data cover the period from 1970 to 2017 was used. The data were sourced from world development indicators (WDI, 2018) and United Nations Conference on Trade and Development (UNCTAD). Data on the growth rate of real Gross Domestic Product (GDP) as the dependent variable, net population growth was measured by the difference between birth rates and death rates in Nigeria; education expenditure represents the total government expenditure in primary, secondary and tertiary education. The gross fixed capital measured the total capital stock, while, foreign direct investment (FDI) is measured by FDI stock. However, education expenditure was put among the control variable, because it is part of human capital believed to plays a significant role in boosting economic growth. Fixed capital formation was incorporated among the control variable, because it serves as an important ingredient for production, thus, may enhance economic growth. Foreign direct investment also play an important role in achieving economic growth, as explained by Yaseen (2014) that the transfer of external resources is one of the most important instruments that gives support to an economy, through increase the investment level of the country, and consequently, adjust the structure of the economy. Therefore the relationship between the variables of interest can be depicted in the following model:

$$GDP_t=\beta_0 + \beta_1 LNPG_t + \beta_2 LGED_t + \beta_3 LGGFC_t + \beta_4 LGFDI_t + \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

GDP= Growth Rate of Real Gross Domestic Product
NPG= Net Population Growth
LGED= Log of Education Expenditure
LGGFC= Log of Gross Fixed Capital
LGFDI= Log of Foreign Direct Investment

β_1,β_2,β_3 and β_4= Coefficients
βo= Intercept
μ_t= Random Error Term

Accordingly, the ARDL model used in this study was derived from Lucas (1988) and Romer (1986) type of endogenous growth model. Therefore, is specified as:

$$\Delta(GDP)_t = \alpha_0 + \alpha_1 GDP_{t-1} + \alpha_2 \ln(NPG)_{t-1} + \alpha_3 \ln(ED)_{t-1} + \alpha_4 \ln(GFC)_{t-1}$$
$$+ \alpha_5 \ln(FDI)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta(GDP)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(NPG)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln(ED)_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta \ln(GFC)_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_5 \Delta \ln(FD)I_{t-i} + \mu_t \quad \text{.....(2)}$$

In order to get the short-run coefficients of the variables, an error correction model (ECM) is estimated. The ARDL specification of the ECM is represented below:

$$\Delta(GDP)_t = \alpha_0 + \sum_{i=1}^{p} \beta_1 \Delta(GDP)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(NPG)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln(ED)_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta \ln(GFC)_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_5 \Delta \ln(FDI)_{tI-i} + \delta ECT_{t-1} + \mu_t \quad \text{.....(3)}$$

5. ANALYSIS AND DISCUSSION OF RESULTS

5.1 Unit Root Test Result

To ascertain the unit root (or stationarity) property of the series, so as to avoid obtaining a spurious results, this study employs Augmented Dicker-Fuller (ADF) and Philips-Perron (PP) stationarity tests. The results of the various stationarity tests are contained in Table 1 below:

Table 1: Results of ADF and PP Unit Root Tests

Variables	ADF				PP			
	Intercept		Intercept and Trend		Intercept		Intercept and Trend	
	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.	Level	1st Diff.
LGDP	0.569	-5.764***	-0.821	-5.973	0.302	-5.850***	-1.045	-5.981
LED	-1.622	-3.610***	-1.914	-3.586	-1.174-	-7.353***	-1.359	-7.282
IFDI	-0.606	-12.901***	-2.516	-12.744	-1.287	-	-4.111**	-12.744
LGFC	-2.282	-4.209***	-2.339	-4.162	-1.547	-4.205***	-1.536	-4.157
LNPG	-0.995	-2.667	-6.286***	-0.830	-2.864	-2.161	-	-1.843

Source: Authors' computation using E-views 9.0.

*** and ** indicate statistical significance at 1% and 5% respectively. L denotes logarithm. Lag length are selected based on AIC.

The Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests are conducted. Table 1 above revealed that LGDP, LED, LFDI and LGFC have unit root at their levels, which means they are not stationary. It is only the net population growth (NPG) found to have no unit root at level, and hence, is stationary at level, i.e it is integrated of order zero[I(0)]. After taking the first difference, the unit root in the remaining variables disappeared and they became stationary, therefore, they are integrated of order one[I(1)].Thus, the mixed order of integration of the variables above provides a strong justification for the application of the ARDL method in this study. Upon verifying the stationary status of the variables, the co-integration test is then conducted using the bounds testing approach.

5.2 Results of ARDL co-integration test

The results of co-integration test of the model involving net population growth is presented in Table 2 below. It shows that the calculated F-statistic (6.211) is greater than the upper critical bounds value at 1%. This implies that there is long run equilibrium relationship between the log of GDP, log of NPG and other control variables (Gross fixed capital, human capital and foreign direct investment).

Table 2: Bounds test result.

Test statistics	Value	K
F- Statistics	6.211***	4
Significance	Lower(bound)	Upper(bound)
10%	2.00	3.090
5%	2.560	2.88
1%	3.290	4.370

Source: Researchers' computation using EVIEW 9.0.

*** denotes statistical significance at 1%.

Note: Lag length is automatically selected based on AIC

Having established the presence of long-run relationship among the variables involved, the next step is to undertake diagnostic tests, and then estimate the long run coefficients and their short-run dynamics.

5.3 Result of Diagnostic Tests

In order to check for the reliability of the estimated model, some diagnostic tests were conducted. To achieve this task, the Breusch-Godfrey, serial correlation LM test, Breusch- Pegan hetroscedasticity test, Jarque-Bera normality test and Ramsey RESET (functional form) test are conducted.

Table 3: **Result of Diagnostic Tests**

Test	LM version	F-statistic
Normality (Jarque -Bera Test Statistics)	JQ= 18.527 [0.0000]	Not applicable
Serial Correlation (Breusch - Godfrey LM Test)	CHSQ= 3.665[0.056]	F=1.963 [0.177]
Heteroscedasticity (Breusch – pagan – Godfrey)	CHSQ= 21.586[0.305]	F= 1.229 [0.322]
Specification Error (Ramsey RESET Test)	t= 0.219[0.829]	F=0.048 [0.829]

Source: Researcher's computation using EVIEWS 9.1.

P-values are in parenthesis

From the table above, the serial correlation test using Breusch-Godfrey has shown that, the LM version is insignificant, indicating that the series are not serially correlated at 5% level. The test therefore proved that the error terms are independents, which means that the error term in one period does not depend on the error term in another period. Therefore, we accept the null hypothesis of no serial correlation and conclude that there is no autocorrelation among the error terms. The Jarque-Bera test statistics shows that the series are not normally distributed at 1% probability level. This means rejection of null hypothesis of normally distributed series and accept the alternative, which stated that, the series are not normally distributed. However, according to Arshed cited in Umar (2018), if the sample is higher than 30, then one can ignore the normality issue as per central limit theorem. The Breusch – pagan – Godfrey heteroskedasticity test result has shown high p-value indicating that, it is statistically insignificant. This suggests that we accept the null hypothesis and conclude that the residuals have a constant variance (Homoskedastic).

5.4 Stability Test Result

In order to ascertain the stability of the parameters, the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares recursive residuals (CUSUMQ) tests were conducted. If the plot of CUSUMQ breaks in the lower/upper bounds, the parameters may said to be unstable. However, the blue lines have not cross the reds, which means that there is no recursive residual in terms of mean in the CUSUM, and in terms of variance in the figure 2 (CUSUMSQ). Furthermore, the plots in Figure 1 and Figure 2 below falls within the boundaries, because it's clear to see that the (CUSUM) and (CUSUMQ) plots does not fall either of the 5% critical lines. This shows that none of the variable used is sensitive to structural break and the estimated parameters of the models used in this study are stable for the period under study.

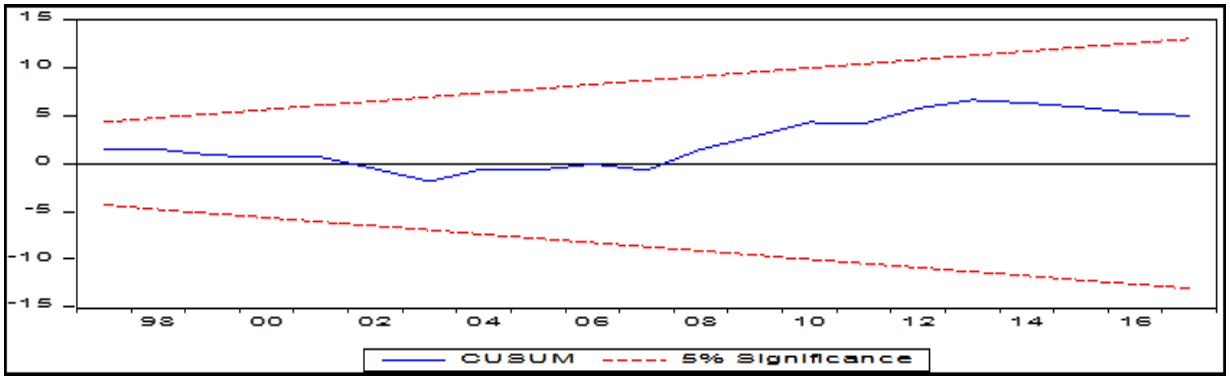

Figure 1: Cumulative sum of recursive residuals plot

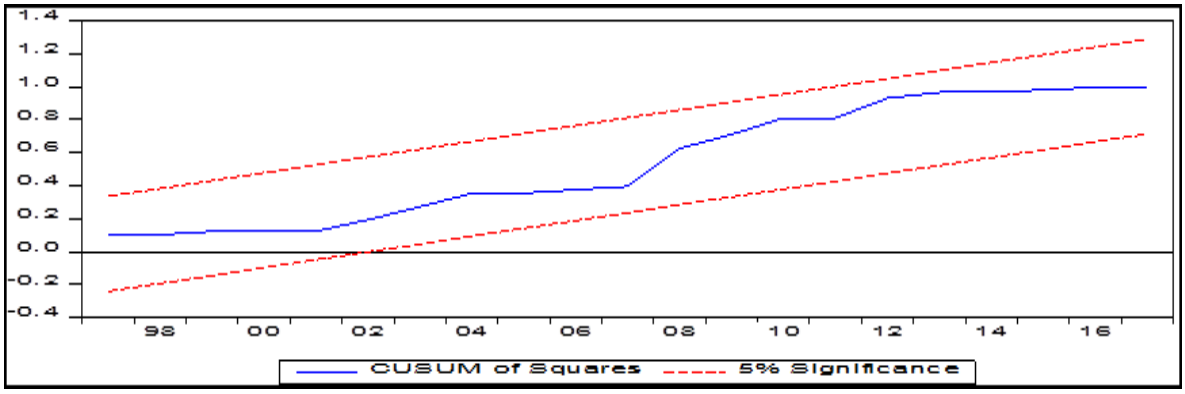

Figure 2: Cumulative sum of square recursive residuals plot

5.5 Result of the estimated long run coefficients (Dependent variable: LGDP)

In estimating the relationship between the variables, the optimal lag-lengths are (2, 4, 4, 3, 2) as automatically chosen by the Akaike Information Criterion (AIC). The result of the estimated long-run relationship is reported in Table 4 below:

Table 4: Result of long run coefficients (Dependent variable LGDP)

Variable	Coefficient	Prob
LNPG	-3.334*	0.080
LED	0.461***	0.000
LGFC	0.162**	0.050
LFDI	0.173***	0.001
C	22.315***	0.001
R^2 = 0.714 F-Stat= 2.754 (0.013) DW-Stat = 2.219		

Source: researcher's computation using EVIEWS 9.0. ***,**,and *** denote statistical significance at 1%,5% and 10% respectively.

Note: The ARDL model selected based on AIC is 2,4,4,3,2.

From the table 4 above net population growth (LNPG) has a long run negative and significant effect on economic growth in Nigeria at 10% level of significance. This implies that a 1% increase in net population growth leads to a 3.3% decrease in economic growth in the long-run. This finding is in line with the view of pessimistic school of thought propounded by Malthus and his followers. According to the theory, population is believed to have negative impact on the limited available resources. Furthermore, the finding of this research equally confirmed the findings of previous researchers such as Owuka (2006) and Adewole (2012) who also confirmed a negative relationship between population growth and economic growth in Nigeria. Other studies found a similar result include: Okpolo (2012), and Dao (2012). Therefore, the outcome of this research finding shows that high population growth negatively affect the Nigerian economic growth process.

Government educational expenditure (ED) as a proxy for human capital has a positive coefficient and significance long run relationship with economic growth in Nigeria. A 1% increase in educational expenditure (ED) by government leads to an improvement in economic growth in Nigeria by 46%. Similarly, Gross fixed capital has a positive and significant effect on economic growth in Nigeria at 1% level. This also means that a 1% increase in gross fixed capital leads to an increase Nigeria economic growth to about 16%.

In addition, foreign direct investment (FDI) has a long run positive and significant effect on GDP at 5%. Thus, 1% increases in foreign direct investment (FDI) leads to increase in economic growth by 17%. However, the positive relationship between foreign direct investment and economic growth in Nigeria signifies that foreign direct investment is beneficial to the Nigerian economy, not only by supplementing domestic investment, but also creation of employment opportunities to our teeming unemployed youth, transfer of technology from industrialized nations and also increases domestic competition and other positive externalities.

Consequently, F-statistics of 2.754 with its probability value of 0.013 signifies that even though some coefficients may not be statistically significant individually, but jointly are significant in predicting variation of GDP during the study period. The computed R^2 value of 0.714 shows that 71.4% of the total variation in the Gross Domestic Product (LGDP) is accounted for by the explanatory variables incorporated in the model. While, the remaining 28.6% of the total variation in GDP, is attributable to influence of other variables, which are not included in the regression model. Finally, the Durbin Watson (DW) statistics of 2.219 suggests no autocorrelation, based on the rule of thumb.

5.6 Short run dynamics and error correction mechanism

Having established long run co-integration between the variables of interest, we then proceed to examine the short run behavior of the variables in case

of long run disequilibrium and then observe the speed of adjustment towards the long run equilibrium, using Error Correction model (ECM).

The ECM measures speed of adjustment and it shows how fast the system adjusts to restore equilibrium.

Table 5: ***Result of the Estimated Short-run Relationship and Error Correction Mechanism (Dependent Variable: LGDP)***

Variable	Coefficient	Prob.
D(LGDP(-1))	0.068	0.584
D(LNPG)	-0.309	0.932
D(LNPG(-1))	-6.164	0.133
D(LNPG(-2))	106.578***	0.000
D(LNPG(-3))	-97.027***	0.000
D(LED)	0.137***	0.000
D(LED(-1))	-0.065*	0.066
D(LED(-2))	-0.126***	0.001
D(LED(-3))	-0.073*	0.012
D(LGFC)	0.034	0.417
D(LGFC(-1))	0.013	0.734
D(LGFC(-2))	-0.035	0.330
D(LFDI)	0.040**	0.042
D(LFDI(-1))	-0.005	0.804
ECM(-1)	-0.560***	0.000

Source: Researcher's computation using Eviews 9.0
***,**,* denotes statistical significance at 1%,5%,and 10% respectively.

The table above gives the short run estimate of the coefficients in the study. The result indicates a negative short run relationship between LNPG and LGDP. This means that a 1% increases in population growth leads to decrease in economic growth by 31%, equally the coefficients for LNPG at lag 2 and 3 are statistically significant at 1% level. Educational expenditure (LED) has a positive and significant relationship with economic growth in the short run. A 1% increases in educational expenditure by government leads to 14% increase in economic growth and statistically significant at 1% level. In contrast, the coefficients for LED at lags 1, 2 and 3 are found to be negative and statistically significance at 10% and 1% in the short run.

Furthermore, the short run table shows a positive and insignificance relationship between LGFC and LGDP. Increase of LGFC by 1% leads to decrease in economic growth by 3%. The lag 1 and lag 2 of LGFC have shown a positive and negative insignificant relationship between LGFC and LGDP. The relationship between foreign direct investment (LFDI) and economic growth indicates a positive and significance relationship at 5% level. Increase level of foreign direct investment by 1% will lead to 4% increases in economic growth during the study period.

Most importantly, the coefficient of error correction term (ECT) is -0.560 which is negative, less than one and statistically significance at 1% level. This means that 56% of the deviation from equilibrium would be corrected within one year period. It should be noted that, the essence of the estimation of ECM is to ascertain the speed of adjustment since the deviation from the long run equilibrium is corrected through the short run dynamics.

Table 6: Pairwise Granger Causality Test Result

Null hypothesis	F-statistics	P- values	Hypothesis Accept/Reject	Causality
LNPG does not Granger Cause LGDP LGDP does not Granger Cause LNPG	6.253 0.269	0.016 0.607	Reject Accept	Unidirectional No causality
LED does not Granger Cause LGDP LGDP does not Granger Cause LED	4.100 4.661	0.049 0.036	Reject Reject	Bidirectional
LFDI does not Granger Cause LGDP LGDP does not Granger Cause LFDI	5.233 4.584	0.027 0.038	Reject Reject	Bidirectional
LGFC does not Granger Cause LGDP LGDP does not Granger Cause LGFC	5.041 2.763	0.030 0.104	Reject Accept	Unidirectional No causality
LED does not Granger Cause LNPG LNPG does not Granger Cause LED	5.053 0.008	0.030 0.929	Reject Accept	Unidirectional No causality
LFDI does not Granger Cause LNPG LNPG does not Granger Cause LFDI	0.203 0.155	0.654 0.696	Accept Accept	No causality No causality
LGFC does not Granger Cause LNPG LNPG does not Granger Cause LGFC	13.192 1.766	0.001 0.191	Reject Accept	Unidirectional No causality
LFDI does not Granger Cause LED LED does not Granger Cause LFDI	5.970 0.021	0.019 0.885	Reject Accept	Unidirectional No causality
LGFC does not Granger Cause LED LED does not Granger Cause LGFC	7.699 0.195	0.008 0.661	Reject Accept	Unidirectional No causality
LGFC does not Granger Cause LFDI LFDI does not Granger Cause LGFC	0.161 4.519	0.691 0.039	Accept Reject	No causality Unidirectional

Source: Researcher's computation using EVIEWS 9.1

From the table above, it shows that the null hypothesis of no causal relationship between net population growth and economic growth, running from net population growth to economic growth could be

rejected at 10% level, since the probability is significant at 5%. However, the null hypothesis of no causal relationship running from LGDP to net population growth could not be rejected. Thus, there is unidirectional causality between net population growth and economic growth, running from net population growth to economic growth in Nigeria. LED has a bi-directional relation with LGDP at 5% probability level; this means that both LED and LGDP granger cause each other (feedback effect). The test also captured a bidirectional relationship between LFDI and LGDP. The null hypotheses of no causal relationships in both directions are rejected at 5% level i.e., from LFDI to GDP and from GDP to LFDI. This shows that, inflow of foreign direct investment into Nigeria increases the growth of its economy and in the same way growth of Nigerian GDP attracts foreign investors into the country. The test further indicated a unidirectional relationship between gross fixed capital LGFC and LGDP. The null hypothesis of no causal relationship running from LGFC to LGDP is rejected at 5% probability level. However, the null hypothesis of no causal relationship running from LGDP to LGFC could not be rejected. Thus, there is unidirectional causality between LGFC and LGDP, running from LGFC to LGDP in Nigeria.

From the table also, it can be seen that the null hypothesis of LED does not Granger-cause LNPG could be rejected at 5% probability value. On the other hand, the null hypothesis of LNPG does not Granger-cause LED cannot be rejected, because the probability is about 0.929 which is highly insignificant. Therefore, the study concludes that there exists a unidirectional causality between LED and LNPG, running from LED to LNPG. Furthermore, the null hypothesis of no causal relationship between LGFC and LNPG, running from LGFC to LNPG could be rejected at 1% significance level. On the other hand, the null hypothesis of no causal relationship running from LNPG to LGFC could not be rejected, with the probability accounted for 0.191. Thus, there exist unidirectional causality between LGFC and LNPG, running from LGFC to LNPG. The results equally shows that LFDI granger causes LED, since the p-value is statistically significant, while LED does not granger causes LFDI, since its p-value is insignificance.

The result further illustrated that the null hypothesis of no causal relationship between LGFC and LED, running from LGFC to LED could be rejected at 1% level. So also, the null hypothesis of no causal relationship running from LED to LGFC could not be rejected, due to an insignificant probability value of 0.661. Therefore, there is unidirectional causality between LGFC and LED, running LGFC to LED in Nigeria. Lastly, a unidirectional relationship between LFDI and LGFC is also found, which show that at 5% significant level LGFC Granger causes LFDI, while LFDI does not Granger cause LGFC. Finally, the tests result above indicates the presence of no causal effect in both directions between LFDI and LNPG.

6. CONCLUSION AND POLICY RECOMMENDATIONS

The aim of this research work is to establish the empirical evidences on the relationship between net population growth and economic growth in Nigeria. However, scholars of economics are divided based on three theories namely: pessimists who believed economic growth and population growth to be negatively related, this means that if population increases, economic growth decreases. Optimists viewed economic growth and population growth to be positively related, this means that when population increases economic growth increases. Lastly, the neutralists who viewed population growth to be neutral to economic growth. Meaning there is no any relationship between economic growth and population growth. However, the present study employed an econometric model under the framework of endogenous growth model to investigate the relationship between net population and economic growth in Nigeria, using a time series data from 1970 – 2017. The result of ARDL bound tests of co-integration shows that the variables are co-integrated and are having long run relationship. In other words, the relationship between economic growth and net population growth was found to be negative and statistically significant in the long run. Result from ECM shows that in case of short run deviations from the path of equilibrium, the speed of adjustment towards long run equilibrium is about 56%, which would be corrected within one year period. Finally, the study also discovered a unidirectional causality running from net population growth to economic growth in Nigeria. In line with the findings of this research work, the following recommendations were made:

- Since the finding of this study shows a negative relationship between net population growth and economic growth. Therefore, government should re-formulate its population policies, so that fertility rate can be reduced. In line to this, family planning programmes should be encouraged across the board by the authorities, so as to curb increasing fertility rate in Nigeria.
- Government should embark on various enlightment campaign exercises, in order to educate the populace on the dangers of over population and the need to have smaller families that can be catered for.
- The teaming population of Nigeria should be harnessed to make it contributes to national development. This can be achieved through the development and implementation of appropriate educational policy that empower the citizens with the right education and skills sets. In this way, the populace will be economically productive and will meaningfully contribute to economic growth.

- Girls-child education should be encouraged in urban and rural centers, thereby promote fertility declined through sex education programmes in Nigeria.

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