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IMPACT OF POPULATION GROWTH ON POVERTY IN NIGERIA

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Abstract
This study investigates the impact of population growth on poverty rate in Nigeria over the period: 1986 to 2021. To achieve this objective, time series data was collected mainly from National Population Commission (NPC) and National Bureau of Statistics (NBS). The data was tested for stationarity using Augmented Dickey Fuller (ADF) and Phillips Perron (PP) techniques. The results indicate the nonstationary of the variables. That is, both population growth and poverty rate time series are integrated of order one I(1). The study tested for cointegration using Johensen cointegration and the result indicates the presence of cointegration among the variables of study. Considering the integration and cointegration nature of the data, Dynamic Ordinary Least Square was estimated to avoid the possible problems of spurious regression and serial correlation. The result revealed a significant negative long-run impact of population growth on poverty in in Nigeria. Based on the empirical findings this study recommends that both government, households, private sector and nongovernmental organisations should focus in building productive population in Nigeria.

Key words: population growth, poverty rate, Dynamic Ordinary Least Square

INTRODUCTION

The existence of poverty and rapid population growth has been seen in many LDC's. These concepts have largely been accepted as being interrelated. However, their relationships have proved to be highly complex therefore addressing these problems have been difficult globally. Sustainable development practices within areas of poverty and levels of high population growth have historically been poor (UKEssays, 2018). Sub-Saharan Africa has been highlighted as one of the regions in which the relationship between high population growth rates and insufficient development to meet the needs of this larger population has been clearly evident. Nigerian population has risen steadily from an estimated 2.5 percent in 1960s to around 3.5 percent in the recent times. This suggests a population doubling in every 22 years. The relatively low mortality of less than 13 per thousand as well as increased life expectancy contributed to this trend (NPC, 2013). At independence in 1960, the population of Nigeria was estimated to be 45.21 million. The national population census of 1991 put the population at 88.99 million. By 2006, the population reached 141.41 million. Presently, the population is estimated to be 223.8 million. Also by 1965 it was found to be 50.24 million. It increased to 56.13 and 63.57 by 1970 and 1975

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respectively. In the same vein, in 1980, the population was 73.7 million; and by 1985 it also rose to 83.9 million. For the years 1990, 1995, 2000, 2005 and 2010; the populations were 95.62 million, 108.43 million, 122.88 million, 139.59 million and 159.71 million respectively. The current population of **Nigeria** is estimated to be **216.7 million** as at the first quarter of 2022, according to the latest United Nations.

Poverty indices in Nigeria (absolute poverty-defined in terms of the minimal requirements necessary to afford minimal standards of food, clothing, healthcare and shelter) as reported by National Bureau of Statistics is that 46.3% of the population lived in poverty by 1985. It fells to 42.7% in 1992 and thereafter jumped to 65.6% in 1996. By 2004 it reached 54.7%, but this increased to 60.9% (or 99,284,512 Nigerians) in 2010. It jumped to 63% by 2022. Against this background, the papers seeks to investigate the relationship between population growth and poverty in Nigeria. The paper will also explore impact of population growth on poverty in the country. The paper is structured as follows. The next section reviewed the related literatures. Section three discusses the methodology, while section four presents the empirical results and findings. The last section provides the conclusion and recommendation.

1. Empirical Review

A great deal of empirical researches have been conducted to contribute to existing literature on the impact of population growth on poverty and other related variables. Research conducted by Julian and Roy (1979) Julian (1987); Angus and Christiana (1997); John, Steven and Andrew (1998) and Rohan (1999) documented a positive correlation between Population Growth and Economic Progress and improved living conditions. Julian and Roy (1979) used a multivariate method from cross sections of LDC's for 1950-1970, and found that population size and density have an unequivocal and strong positive effect upon economic growth in those countries. Julian (1987) proved that population growth in North and South Korea, East and West Germany, and China and Taiwan enhanced and stimulated economic growth in the long run. On the other hand, a lots of studies point to the negative impact of population growth on economic growth and development. For instance Richard and Robert (1997) did an extensive analysis of cross-country data drawn from the 1980s and found that, on average, population growth dampened per capita economic growth.

Angus and Christiana (1997); by using panel data and survey from cross section of household from Taiwan, Thailand, Britain and United States, concluded that population growth exert large effects on national saving within the individuals countries, encouraged national investment and thereby economic growth. John *et al* (1998) investigated the overall link between population increase and economic growth of the real income of the poor from 69 developing countries and realized that real income of the poor tends to grow faster in countries that have a lower level of initial income and in countries with a well-trained and productive population. In

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addition, Rohan (1999) explored the effects of India's population growth on its economic growth, and came to the conclusion that India has advanced as a result of its population growth. Bilal (2008) employed cointegration approach and investigated the relationship between population and economic growth in the CAEs over the post-Soviet era during the period between 1989 and 2007 and discovered the existence of long-run relationship between population and real per capita income and hence aggregate economic growth. Minh (2012) Assembled data on world development indicators of 43 developing countries, applied the least-squares estimation technique in a multivariate linear regression and realized that the growth rate of per capita GDP is linearly dependent on population growth. Dewaram (2012) with the aid of Granger Causality and Cointegration tests, found a sustainable long run relationship (steady-state path) between economic growth and population growth of India. More so, Gideon *et al* (2013) estimated annual time series data for the period 1963 to 2009 of Kenya using vector auto regression technique, established the fact that population growth and economic growths are positively correlated and that an increase in population will impact positively on economic growth in the country.

Sarbapriya and Ishita (2011) & Khalid; Iqtidar; Muhammad and Mehboob (2011) explored the links between population growth, poverty, pollution and environment. They found a stable long-run relationship between population growth, poverty and pollution exist in Pakistan. Akinwande, Salaudeen and Olorunfemi (2012) examined the factors that influence rapid population growth in developing countries between 1980 and 2010. High fertility was found to be the leading causes of population growth in developing countries and youth dependency ratio was a great threat to economic growth in developing countries. In addition, Lant (1994) used a cross national regressions models from nine (9) low-population growth countries and 10 high-population growth countries and concluded that population growth is not a robustly significant correlate of per capita output growth.

Hassen (2012) Applied time series data over the period 1950 to 2011 with vector error correction model (VECM) to assess the causal relationship between population and economic development in Ethiopia. The study thus found robust and negative long run relationship between per capita income and population growth. Allen (1988) and Sinnathurai (2013) modeled the link between population pressures, saving and investment and economic growth in the Third World with the aid of Multivariate Regression Models. The results indicated population pressure retard savings and investment and thus impact on growth adversely. Abdullah; Ghulam and Asad (2015) drew evidence from Bangladesh: 1980 to 2005 and examined the impact of population growth on economic growth. The tool of analysis was Multiple Linear Regression Model (MLRS). The result confirms that economic growth and population are negatively correlated and that an increase in population will have a

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negative impact on the economic growth of Bangladesh.

Sher *et al* (2013) employed ARDL co-integration methods and investigated an empirical relationship between population growth and economic growth in Pakistan between 1975 and 2008. The authors discovered a positive impact of population growth on economic growth under the period of review. Klaudia *et al* (2015) modeled time series data (1990-2014) of Albania and analyzed the demographic effects on economic growth of the country with the analysis of variance and regression analysis. The results indicated that population growth and economic growths are both positively correlated and that an increase in population will impact positively on the economic growth in the country. Dullah, Rozilee, Mori and Jaratin (2011) found non-existence of a long-run relationship between the economic growth and the population growth and lack of causal relationship between economic growth and population growth in Malaysia. Mohammad (2009) taking a Multivariate analyses from 1981 to 2005 data from the Pakistan Economic Survey; examined empirically the relationship between population growth and economic development in Pakistan. He concludes that rapid population growth is a real problem in Pakistan because it contributes to lower investment growth and diminishes the savings rate and thus foreign investment and export; therefore have only a small impact on Pakistan's economic growth.

There are few specific studies on Nigeria. Thus, Nwosu, *et al* (2014) determined the effect of population growth on economic growth in Nigeria. The authors tested the long run relationship between population growth and economic growth with the aid of Augmented Dickey-Fuller (ADF) stationarity test combined with Granger Causality and Cointegration tests and found a positive relationship between the two variables. Aidi, Emecheta, Chisom and Ikenna (2016) investigated the relationship between population dynamics and economic growth in Nigeria using time series data spanning from 1970 to 2014. The result of their study revealed that all the core variables (i.e. fertility, mortality and net-migration) are inversely related to economic growth. Faloye and Bakare (2015) examined the impact of economic growth on poverty reduction in Nigeria using ordinary least squared (OLS). They found that economic growth has impact in reducing poverty in Nigeria. Tanimu and Saifullah (2014) used bound testing approach to cointegration and Granger causality test and determined the relationship between poverty, inequality and economic growth in Nigeria and found unidirectional causal relationship running from real GDP to poverty. The authors also found bidirectional causal relationship existed between literacy and poverty. Ngozi and Oluwasola (2011) investigated empirically the effect of population growth on savings in Nigeria using time series data from 1980 to 2007; and applied error correction model. The study discovered that rapid population growth have a negative effect on incomes and savings; thereby significantly slowing economic growth in Nigeria. In another study; Mark

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(1987) adopted mathematical modelling & regression analysis and examined relationships among population growth, human capital formation and economic development in Nigeria. The conclusion arrived was that, large families and hence high population growth impede human capital formation and consequently retard economic growth. What is clearly missing from the literature is the study that investigated effect of population growth on poverty in Nigeria. Hence, the study filled the research gap by investigating the effect of population growth on poverty in Nigeria by using dynamic ordinary least squares (DOLS). Adeosun and Popogbe (2020) examined the effect of population growth on human resource utilization in Nigeria. Babatunde and Awotepu (2020) employed granger causality test and determined the direction of causality between population growth and unemployment. Oluwaseyi, Olukayode, Awoyemi and Adesola (2019) employed Johansen cointegration for and Ganger causality and examined unemployment, poverty and economic growth in Nigeria. David (2019) used residual-based cointegration and causality analysis and examined population growth and real output in Nigeria. Chinonye (2021) examined the relationship between poverty, income inequality and economic growth in Nigeria. Kuhe (2019) examined the causality between population growth and economic growth and development but did not take into account poverty rate in the model. David (2019) examined relationship between population growth and economic growth and development in Nigeria.

2. Methodology

2.1. Model Specification

Based on the theoretical and empirical linkage between population growth and to this regard, the functional form of the relationship can be modelled as follows:

$$POV_R_t = \alpha + \beta POP_GR_t + \mu_t \quad \text{----------} \quad (1)$$

Where:

α_0 = represent constant parameter

POP_GR = is the growth rate of population;

POV_GR = represent rate of poverty

Thus the Dynamic Ordinary Least Square (DOLS) for estimating the impact of population growth poverty is specified as:

$$POV_R_t = \alpha + \lambda POP_GR_t + \sum_{i=1}^{p=6} \beta\, POP_GR_{t+j} + \sum_{i=1}^{q=6} \gamma\, POP_GR_{t-k} + \mu_{1t} \quad \text{----------} \quad (2)$$

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Where POV_R represents the poverty and POP_GR is the population growth rate. The constants α, and λ represent the parameter and the coefficient of the independent variable respectively. While β and γ indicates the respective coefficients of lags and leads included in the model. Similarly, *p* and *q* represents the maximum lags and leads used in estimating the model.

3.2. Type and Sources of Data

This study employed secondary type of data. Precisely, annual time series data on the variables of study: Population growth and poverty were collected from national population commission (NPC), and National Bureau of Statistics (NBS) respectively. The data covered period span 1986 to 2021. In addendum, some data were extracted from World Bank (WB) & United Nations Population Fund (UNFPA). Relevant information were also drawn of journal articles, working papers and textbooks.

3.3. Definition and Measurement of Variables

The dependent variable, Poverty rate was measured by Poverty head count ratio based on $1.95 bench mark which gained empirical popularity and employed by the World Bank. On the other hand, the explanatory variable, Population POP_GR was measured as the percentage increase in Nigerian population. This was defined as the annual change in population over a unit time or the increase in the number of people over a given period as adopted by empirical studies including Nwosu, Dike and Okware (2014).

3.4. Method of Data Analysis

The main technique of data analysis is Dynamic Ordinary Least Square (DOLS) as specified in equation (2). The model was developed by Stock and Watson (1993) as an advancement over the traditional OLS to take care non-stationarity and cointegration among the variables of study. The model also take of econometric problems of serial correlation and endogeneity by incorporating lags and leads in the model. However, the data was first subjected to integration test Nelson and Plosser (1982) argued that most of the macroeconomics time series are non-stationary, hence Augmented Dickey Fuller (ADF), Phillips Perron (PP) stationarity techniques were employed for stationarity analysis. Johensen cointegration was also conducted to determine the presence of cointegration between the variables of study. To evaluate the statistical adequacy of the model, post estimation diagnostic tests were also performed.

3.5. Estimation Procedure

The data estimation was performed in the following stages;

3.5.1. Unit Root Test

The Ordinary Least Square (OLS) procedure requires that variables of study to be stationary otherwise the result could be spurious and hence misleading. The presence of no stationary variable (s) therefore necessitates the use of alternative procedure as best proposed by Stock and Watson (1993) in form of Dynamic Ordinary Least Square (DOLS). This study employed Augmented Dicky - Fuller (ADF) and Phillips-Perron unit root tests as methods for stationarity verification.

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3.5.2. Augmented Dickey-Fuller Unit Root Test

The Augmented Dickey-Fuller (ADF) is specified as follows:

$$\Delta Y_t = \alpha Y_{t-1} + X_t\delta + \beta_1\Delta Y_{t-1} + \beta_2\Delta Y_{t-2} + ... + \beta_p\Delta Y_{t-p} + \varepsilon_t \quad ----------(3)$$

The Augmented Dickey Fuller is based on t-distribution statistic for hypothesis testing. The null hypothesis is for the presence of unit root which can be rejected or otherwise by comparing the calculated t-static with critical value at a given level of statistical significance.

3.5.3. Phillips-Perron Unit Root Test

Phillips and Perron (PP) is an alternative procedure credited to Phillips and Perron (1988) based on nonparametric method. It can specified as:

$$\lambda_\alpha = t_\alpha\left(\frac{\gamma_0}{f_0}\right)^{\frac{1}{2}} - \frac{T(f_0-\gamma_0)(\delta\ell(\hat{\alpha}))}{2f_0^{\frac{1}{2}}\delta} \quad ----------(4)$$

The null hypothesis for PP test is also for non stationarity. A variable is said to be stationary if the null hypothesis of null hypothesis is rejected by comparing the computed test statistic with critical value at a given significance level.

3.5.4. Cointegration Test

Johansen (1988) developed a cointegration technique to measures the long-run co-movement of the variables using trace statistic and maximum Eigen values where the variables of study are nonstationary. The maximum Eigen value is specified as:

$$LR(r_0, r_0+1) = -TIn(1-\lambda_{ro+1}) \quad ----------(5)$$

Where LR(r_o, r_o +1) represent the likelihood ratio test statistic for testing the null hypothesis that rank Π= 0 versus the alternative that rank Π= 1. And the Π s the vector matrix, λ indicates the estimated values of characteristic roots. The trace statistic can also be specified as:

$$\text{LR (r0, n)} = LR(r_o, n) = -T\sum_{i=ro+1}^{n} In(1-\lambda_i) \quad ----------(6)$$

Where the Where LR(r_o, n) indicates the likelihood ratio test statistic for testing the null hypothesis that rank Π= 0 against the alternative hypothesis that rank Π ≤ n and that Π represent the vector of matrix while *n* is the maximum cointegrating equations. *T* represent the number of observations in the model. λ_i is the estimated values of the characteristic roots based on the assumption that the series are I(1) process.

4. Empirical Results and Findings

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In order to empirically determine the impact of population growth on the level of poverty in Nigeria, time series data on poverty rate and population growth rate were subjected to econometric analysis in this section. The results were analysed and policy recommendations were made.

4.1. Stationarity Test Results

Augmented Dickey Fuller (ADF) and Phillips (PP) tests were conducted to determine the stationarity of the variables of study. The results are presented in table 1.

Table 1: Augmented Dickey Fuller (ADF) Test Result

Variables	ADF Stat. at level	ADF Stat. at First Difference	Order of integration
POV_GR	-2.222323	-2.290355	I(0)
POP_GR	-2.750145	-5.096184	I(1)
Phillips-Perron Test Result			
Variables	PP Stat. at Level	PP Stat. at First Difference	Order of integration
POV_GR	-1.495388	-4.679066	I(1)
POP_GR	-2.822471	-6.525398	I(1)

Source: Authors' Computation (2022) using Eviews 9

The Augmented Dickey Fuller (ADF) test results from table 4.1 indicated that both POV_GR and POP_GR variables were not stationary at level which necessitates retesting the variables at first difference. The variables were stationary at first difference which indicated that the variables are integrated of order one I(1). To verify the validity of the ADF result, Phillips Perron test was conducted and the result confirmed that both the POV_GR and POP_GR non-stationary at level but stationary at first difference.

4.2. Cointegration Test

Cointegration using Johensen procedure with two lags as indicated by both Akaike Information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). The result is summarized in table 2

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Table 2: Johansen Cointegration Result

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.403629	19.77861	15.49471	0.0106
At most 1	0.062774	2.204250	3.841466	0.1376
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.403629	17.57436	14.26460	0.0145
At most 1	0.062774	2.204250	3.841466	0.1376

Source: Authors' Computation (2022) using Eviews 9

The Johensen cointegration result in table 2 indicated the presence of one cointegrating equation. This is because both the trace statistic and the Max-Eigen Statistic indicated the rejection of the null hypothesis of no cointegration (None), but the null hypothesis which indicates presence of cointegration (At most 1) cannot be rejected. This is evident in that both the trace statistic (2.204250) and Maximum Eigen Value statistic (2.204250) are less than their respective critical values (3.841466 and 3.841466) and their respective probability values are less than 0.05.

4.3. Dynamic Ordinary Least Square Model

Considering the stationarity nature of the variables and the presentence of cointegration in the model, the standard ordinary least square technique cannot efficiently estimate the impact of population growth on poverty because the result can be spurious which will be misleading. Consequently, Dynamic Ordinary Least Square (DOLS) model which accommodates these peculiarities was adopted for empirical analysis.

Table 3: Dynamic Ordinary Least Square

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP_GR	-88.13755	16.95943	-5.196965	0.0006
C	278.5815	43.50868	6.402895	0.0001

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R^2	0.874430	-	-	-
Adjusted R^2	0.693050	-	-	-
F-statistic	4.820993	-	-	0.011755

Source Author's Computation (20220 using Eviews 9

Table 3 summarized the result of Dynamic Ordinary Least Square estimation. The coefficient of population growth (POP_GR) is statistically significant even at one percent level of significance. This result indicates that population growth significantly affect poverty rate. The negative sign shows an inverse relationship between population growth and poverty rate. Consequently, a unit change in population growth will lead to reduction in poverty rate by eighty eighth (88) units in the long-run. This can be interpreted as, as population growth doubles, poverty rate tends to reduce by eighty eighth percent (88%). The Adjusted R-squared coefficient of 0.69 shows adequate goodness of fit as about seventy percent (70%) variation in the dependent variable is explained within the estimated model. The overall significant of the model measured by F-statistic (4.820993) is also statistically significant owing to it probability (0.011755) which is less than 0.05 critical value.

4.4. Post-estimation Diagnostic

Post estimation tests were performed to verify the validity and statistical robustness of the estimated Dynamic Ordinary Least Square (DOLS). The results are presented in table 4.

Table 4: Post-estimation Diagnostics Results

Diagnostic test	Technique	Null Hypothesis	Probability (5%)
Serial Correlation Test	Breusch-Godfrey Serial Correlation LM Test	No Serial Correlation	0.4696
Heteroskedasticity Test	Breusch-Pagan-Godfrey	Constant Variance	0.8865
Normality Test	Jarque-Bera	Residuals Normally Distributed	0.7005
Specification Test	Ramsey Reset Test	Correctly Specified	0.5037

Source Author's Computation (20220

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using Eviews 9

Results in table 4 indicates that the estimated model does not suffer serial correlation, heteroskedasticity, non-normality, and specification. This is result of the failure to reject the respective null hypothesis of no serial correlation, constant variance, normal distribution and correct model specification.

s

Table 5 shows that the model free from Multicolinearity as the centered Variance Inflation Factor (VIF) is less than ten (10) critical value.

5. Discussion of Findings and policy Implications

The main objective of this study is to examine the impact of population growth on poverty rate in Nigeria over the period of 1986 to 2021. To achieve this time series data was collected for the two variables of study over the period of study. The data was first subjected to stationarity tests using Augmented Dickey Fuller (ADF) and Phillips Perron (PP) techniques. The result unanimously indicates that both the variables of study are nonstationary at level but at first difference I(1). The study further investigates the cointegration relationship using Johensen cointegration. The result confirmed the presence of cointegration between the variables of study. Consequently, traditional Ordinary Lest Square cannot efficiently estimate the model and hence Dynamic Ordinary Lest Square (DOLS) was estimated. The result shows a strong statistically significant inverse relationship between population growth and poverty rate in the long-run. One hundred percent increase in population growth can lead to reduction in poverty rate. This shows that productive population growth can go a long way in combating poverty in Nigeria. Although the findings does not support the Malthusian theory which postulated positive relationship between population growth and poverty, the result is in agreement with Sarbapriya and Ishita (2011) & Khalid; Iqtidar; Muhammad and Mehboob (2011) who established a significant long-run relationship between population growth and poverty. The model was subjected to post-estimation diagnostics and the result shows that the estimated model is statistically sound as it does not suffer from serial correlation, heteroskedasticity, or misspecification, the model was also fond be normal and free form multicolinearity.

6. Conclusion and Recommendations

Based on the empirical evidences, this study concluded that population growth strongly reduce poverty rate in Nigeria at least in the long run. Based on this inference, the following recommendations are forwarded. Firstly, that Nigerian policy makers should target human capital development. This will go a long way in combatting the level of poverty in Nigeria. Secondly, at micro level, households should also focus on children

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capacity building by ensuring children are well educated and trained across the endeavors of human life. This will help in building productive population with less poverty rate. Finally, private sector and non-governmental organisations should also increase their efforts in investing towards qualitative education in Nigeria.

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