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THE EFFECT OF POPULATION DYNAMICS ON ECONOMIC GROWTH PERFORMANCE IN NIGERIA

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Abstract

This study investigated the relationship between population dynamics (measured population growth rate) and economic growth in Nigeria, while controlling for the effect of unemployment rate, and infant mortality rate. Secondary data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, World Bank World Development Indicator (WDI) and National Bureau of Statistics (NBS) Annual Abstracts were analyzed using time-series methods such as Augmented Dickey Fuller (ADF) unit root, bound co-integration, and autoregressive distributed lag (ARDL) methods. The study was able to verified that there is cointegrating relationship between population dynamics proxy and economic growth index using the bound test method. Findings from the use of the ARDL method indicated that population growth rate, unemployment rate, and infant mortality rate had insignificant impact on economic growth. The result showed that increasing levels of population growth rate and infant mortality rate are harmful to the Nigerian economy, as unemployment had positive relationship with economic growth. These results suggest that, fluctuating levels of total output in Nigeria is not due to population dynamics. On the basis of these findings, there is for government to put in place mechanism that will checkmate the growing level of population and address the soaring infant mortality rates. These can be achieved by providing quality healthcare facilities to aid safe birth and an aggressive campaign on family planning through the collaboration of the National Orientation Agency (NOA), non-profit organizations and civil society organizations (CSOs). Implement policies that will improve technological advancement and human capital development in Nigeria.

Introduction

The interest of researchers in developed and developing economies over the years has increased on population growth and economic development studies due to low quality of life, unemployment increases and Low per capita income in the developing economies mostly. Though, there has been intensive debate in the literature on the role of population growth rate and economic growth. However, population theory cannot be discuss exhaustively without reference to Thomas R. Malthus he was the first economist who drawn the attention of other scholars to the theory of population growth on how it affects economic growth, in 1798 titled "An essay on the principle of population on how it affects future improvement of economy. Thomas Malthus was worried over the rapid increase in human population whether subsistence (food supplies) could keep pace with the demand of a growing population and that over time the human population will increase above available resources needed by man in economy, though Malthus was proved wrong to an extent because he didn't consider the possible future improvement, on human Capital development and advancement in food production technology that can increase food supplies However, most developing countries are still trapped under Malthus theory of population growth and one can easily conclude that Nigeria is not excepted from the trap because Nigeria is one of the most populated countries in Africa with an estimated populated of over 140 million with annual population growth rate of 2.9% (NPC, 2006). In 2004 Nigeria adopted a policy on population for sustainable development with an end date of 2015 and the objectives of the policy was to improve quality of life, Increase per capita income but reverse was the case due to improper implementation of the policy, currently Nigeria is experiencing overpopulation. Overpopulation occur when the demand of a growing population increases above the Subsistence (food Supplies) in economy over a period of time.In other words, a continuous increase in human population over a period time without improvement on human capital development and advancement in technology to enable food production to keep pace with the demand of a growing population,it is commonly associated with unemployment, insurgency, riot, Social disorder as well as corruption, particularly in Nigeria the persistent increase in human population without improvement on food production led to shortage of modern amenities such as education and healthcare facilities (Apinoko et al 2021). In 2018 unemployment rate increased from 23.1% to 33.3% in 2020 and to 37.7% in 2022 with the prediction to rise further to 40.6% in 2023, this statistics indicates Inequity and inadequate balance when analyzing economic growth variables (gross domestic product such that one doctor per four thousand eight hundred patient While Infant mortality rate is one hundred and twelve per a thousand live birth (Nwosu et al, 2014).

This research is motivated on grounds that several efforts made by successive governments in Nigeria to curtail the rapid increase in human population through improvement in technological advancement has not yield much success. Based on these challenges hence this study set out to empirically evaluate the relationship between population dynamics and economic growth, to examine the effects of unemployment on economic growth rate, assess the effects of infant mortality growth rate in Nigeria. While the research hypotheses are specified as H_{o1}: there is no significant relationship between unemployment and economic growth rate.H_{02}: there is no significant relationship between infant mortality rate and economic growth rate in Nigeria H_{03}:there is no significant relationship between population growth rate and economic growth rate in Nigeria.

SYNOPSIS OF LITERATURE ISSUES

Based on Thomas Malthus theory that was earlier stated that human population is growing geometrically while subsistence (food supply) is growing arithmetically which Malthus advise that society can only survive or avoid low quality of life if the society (people) engage in moral restraint.

However ,Thomas Malthus was proved wrong due to failure of not considering the possible future improvement in technological advancement and human capital development.

The Neoclassical growth theory,according to the model, economic growth rate is a function of capital stock growth rate, labour supply growth rate and technological progress growth rate , thus the relationship between the two variables (dependent and independent variables) can be express in production function model given as ; Q=f (L,K,T). Where Q= National output, L=Labour supply, K=Capital stock and T= Technological Progress. While the endogenous growth theory postulated that economic growth is generated internally through endogenous forces and not through exogenous forces. Also others empirical related literature were reviewed, for instance,

Efuntadeetal (2020) examined the impact of population growth rate and economic growth in Nigeria, the study spanned from 1994-2019, the variables utilized are fertility rate, mortality rate and immigration rate, the study adopted ex-post facto research design using cointegration and vector error correction model, date were obtained from central bank of Nigeria statistics bulletin and world development indicators. The study revealed that morality rate has a negative significant impact on GDP, the study recommends that government should improve on providing health care facilities so as to reduce mortality rate in Nigeria. Samuel (2021) studied the rapid population growth on economic development in Nigeria the study adopted econometrics approach, the study found that GDP, remittance, population and unemployment are negatively significant on human development index in Nigeria as such,the study recommended that government should improve on vocational training for the youths.

Alemayehu and Berhamu (2022) studied the effects of population growth on economic growth in Ethiopia from 1980-2020, the study revealed that there is positive and significant relationship between population growth and economic growth in Ethiopia within 1980-2020, also there is a long run equilibrium relationship among the variables. The study recommended that government should implement policies that would attract foreign investors.Ajit K.S. (2021) studied population growth and economic growth in developing and developed countries over the last two decades with reference to China and India. The study found that fertility decline is depends upon socio-ecconomic development.Malitta et al (2022) studied urban land expansion: the role of population and economic growth for over 300 cities, the study revealed that there is a positive correlation between population and urban land expansion but at different development stages it experience variation at countries. Anthony et al (2021)studied the effect of population growth and life expectance on economic growth using selected countries of one hundred, the variables in the study include gross fixed capital information, life expectancy, population growth and real gross domestic product. The study spanned from 2002-2017 data were obtained from world bank database, the studyadopted econometrics techniques. The study revealed that population growth, life expectancy influence economic growth negatively, study recommended that there is need to improve on economic development in the studies nations

Suluk, S. (2021) examined population growth and economic growth in Singapore from 1970-2020, the study revealed that there is a unidirectional granger causality relationship from population growth to economic growth, the study recommends that government should give priority to human capital and implement policies that will improve labour force. Akimnbode et al (2017) studied population dynamics and economic growth in Nigeria using data obtained from central bank of Nigeria statistical bulletin from 1970-2014, the study revealed unidirectional causality flowing from population growth to economic growth, the study recommended that government should improve on skill acquisition that will enhance productivity of growing labour force.David A.K (2019)evaluated

the impact of population growth on economic growth and development in Nigeria using time series data from 1960-2015, the study adopted econometrics approach, the study revealed that there is long run equilibrium relationship among the variables. The study also revealed positive and significant relationship between population growth and economic development in Nigeria. The study recommended that government should improve on health care services and human capital development through quality education. The study affirmed Onwuka 2006; Adewole 2012 and Ukpolo 2002 and Akintundeetal 2013 studies.

Adila and Sakib (2018) studied the effect of population growth on economic growth of selected south Asian countries using time series data spanned from 1980-2015 obtained from world bankindicators, the study adopted econometric approved the study revealed that there is no long run relationship between population growth and economic growth, the study recommends that government should discover definite polices directed towards improvement on human capital development.Yizhong and lei (2002) studied population mobility and sustainable economic growth in china using panel data in 34 provinces and cities in China. The study revealed that at 5% significant in short run population growth has no significant with economic development but there is a significant relationship at long run.Oluyemi et al (2020) studied population growth and human utilization nexus in Nigeria, using expost facto research designed, the study spanned from 1990 to 2018 the study found unidirectional causality runs from employment rate to expected years of schooling in Nigeria.The study recommended that government should implement policies that would improve education quality. The study agree with Aidi et al 2016; Olabiyi 2014 studies.

Betgiluet at (2022) examined the relationship between economic growth, investment population growth and unemployment in Ethiopia. Using time service data obtained from nation bank of Ethiopia, IMF and world bank database, the study revealed that an increase in unemployment is positively correlated but opposite direction to economic growth, the study recommended that government should implement policies to address the ongoing ethnic problem and political instability in Ethiopia. Onah, V.C(2022) study the implications of population growth on the quality of life in Nigeria. The study revealed that the culture and religion of the people has rekindle the population increase in Nigeria, hence the study recommended that government should implement policies to close the lacuna between population explosion and economic growth in Nigeria.Basri B. et al (2023) studied the influence of education, poverty and population growth on economic growth in south sulawesi from 2010 to 2022, the study adopted econometrics approach, the results revealed that education has a regulative and insignificant relation with economic growth while population has a significant relationship with economic growth in south Sulawesi but there is no joint influence education, poverty and population on economic growth. The study recommended that government should implement policies to address the problem of poverty by improving on education.

Cairo, P.M. and Patrick. R (2020) studied the effect of population growth on economic growth of Tanzania using time series data spanned from 1991--2019, the study adopted Econometrics techniques for estimation of variables, the study found a cointegration relationship between population growth, inflation and Economic growth hence the study recommends that government should encourage population growth with caution by implementing policies that would become beneficiary to people.Stungwa and Saw(2021) investigated the relationship between infrastructure development and population growth in South Africa using annual panel data obtained from Nine provinces for estimation of variables, the study revealed that unemployment and Economic growth are negative and significantly related hence the study recommended that government should invest more on infrastructure to improve quality of life.

RESEARCH METHODOLOGY

This study adopted ex-post facto research designed due to nature of data utilized, time series data. According to Kalu,I.E (2013) research design is the plan of the researcher on how to collect and analyze the research data in order to achieve the study objectives. Thus, this study sought to establish the relationship between population dynamics and economic growth in Nigeria using data from 1980-2021, data were collected from central bank of Nigeria statistical bulletin, National Bureau of statistics, world bankindicator for Nigeria and other relevant journals

MODEL SPECIFICATION

The aggregate production function of the traditional Neoclassical growth model can beexpress as;

Q =f (L, K, T) ……eq. (1)

where,

Q=National output

L= Labour supply

K=Capital stock

T= Technological progress

The model of this study is drawn from the Neoclassical growth model. Therefore, our model can be express as;

RGDP =f (POP, UNEM, IMR) ……eq. (2)

$RGPD = b_0 + b_1POP + b_2UNEM + b_3IMR + \mu_t$…….. eq.(3)

Where;

RGDP=Real gross domestic product used as a proxy to economic growth

POP=Population dynamic used as proxy to population growth rate

UNEM=Unemployment rate

IMR= Infant mortality rate

μ_t = error term

b_0, b_1, b_2, b_3, = Parameters

To establish the link between the dependent and independent variables above, the researcher employed autoregressive distributed lag (ARDL) method, pre and post estimation test were conducted, such as unit root test cointegration test and diagnostic test. The unit root test was based on the Augmented Dickey-fuller method while the bound test was used to test the cointegrating relationship among the variables.

E-view version 10 statistical software was used to conduct the analysis

4. Results and Discussion

Data in this study was analyzed in line with the analytical procedure mentioned in section three.
This chapter presents the empirical results and was presented in order of precedence; *first,* we presented the descriptive statistics of yearly population dynamics (population growth rate), unemployment rate, and infant mortality rate and economic growth variables; *second*, time-series properties, *third*, empirical analysis of sensitivity of population dynamics to economic growth in Nigeria.

Descriptive Statistics

Table 1: Descriptive Statistics

	RGDP	POP	UNEM	IMR
Mean	20470.23	2.6286	11.3214	7.0214
Median	6804.387	2.6082	12.0500	6.7500
Maximum	80092.56	3.0637	23.9000	10.7000
Minimum	92.8812	2.4063	1.9000	3.8000
Std. Dev	25345.98	0.1390	6.9268	1.6559
Skewness	1.0016	1.1371	0.1865	0.5448
Kurtosis	2.5512	4.6192	1.5882	2.7367
Jarque-Bera	7.3760	13.6407	3.7311	2.1989
Prob.	0.0250	0.0010	0.1548	0.3330
Obs.	42	42	42	42

Source: Authors' compilation (2023)

Table 1 revealed that real gross domestic product averaged NGN20,470.23 million, fluctuating strongly between NGN92.8812 million and NGN80,092.56 million. Population growth rate during the period averaged 2.6286 percent over the period. The minimum population growth rate was 2.4063 percent, with the population in Nigeria growing to a maximum of 3.0637 percent. Unemployment in Nigeria is expected at 11.3214 percent annually and the unemployment level in Nigeria during the period rose from a minimum of 1.90 percent and peaked at 23.90 percent. During the period of investigation, infant mortality rate grew at an average of 7.0214 percent. Infant mortality rate fluctuated during the investigation period, ranging from 3.80 percent to 10.70 percent. The study observed upward trend in real gross domestic product, population growth rate, unemployment and infant mortality rate on the basis of their skewness values as they are positively skewed. In terms of normality, it was observed that unemployment and infant mortality are normally distributed, with the null hypothesis of normal distribution rejected for real GDP and population growth rate.

Table 2: Correlation Matrix

	RGDP	POP	UNEM	IMR
RGDP	1.0000			
POP	-0.1465	1.0000		
UNEM	0.8043	-0.1468	1.0000	
IMR	-0.2794	0.1891	-0.3580	1.0000

Source: Author's compilation (2023)

A multicollinearity analysis based on the pair-wise correlation method was carried out to detect if the regressors are collinear, as the presence of multicollinearity among the regressors can result in lag covariances and variances, resulting in wrong inference due to inaccurate t-statistics. Table 2 shows there is negative relationship between real GDP and population growth and real GDP and infant mortality rate. Unemployment was found to be positively related to real GDP. Regarding the regressors, the study found no evidence of collinearity, as the correlation coefficients were less than 0.80.

Unit Root

The stationarity of the series was ascertained using the augmented Dickey-Fuller (ADF) approach. Stationarity test was carried out to avoid the problem of spurious regression and in selecting the method appropriate for estimating the model. The ADF result is reported in Table 3.

Table 3: Unit Roots Result

Variable	**Augmented Dickey-Fuller (ADF)**			**I(d)**
	Level	1st Diff	5% Critical Value	
$lnRGDP_t$	-1.3042	-5.2777***	-2.9350	I(1)
POP_t	-3.1956**	-	-2.9571	I(0)
$UNEM_t$	-0.7484	-6.1083***	-2.9350	I(1)
IMR_t	-3.3511**	-	-2.9369	I(0)

Note: *, **, and *** denote significance at 10%, 5% and 1%, respectively
Source: Authors' compilation (2023)

Following the conventional process of unit root testing, the study found that there is unit root in the level form of real GDP and unemployment series. The level ADF statistics for real GDP and unemployment was found to be higher than their 5% critical values. With unit root present in the level series of real GDP and unemployment, the study carried out first differencing, further subjecting the first differenced series to unit root testing. The series (real GDP and unemployment) were found to be first difference stationary. In contrast, the test revealed stationary condition for population growth rate and infant mortality rate, in their level form. Summarily, the series reflect stationary attributes of I(0) and I(1), hence, the use of bound cointegration approach and the ARDL method.

Cointegration Test

Based off the unit root test, from which the analysis revealed stationarity properties of I(0) and I(1), the bound test was used to test for cointegration and the result presented in Table 4.

Table 4: Bound Test Result

Estimated Model		**F-statistics**
$F_{RGDP}(rgdp/pop, unem, imr)$ K = 3		9.066370***
Critical Value	I(0)	I(1)
1%	3.65	4.66
5%	2.79	3.67
2.5%	3.15	4.08
10%	2.37	3.2

Note: No level relationship is the null hypothesis; *K* is what informs on the regressors used; *, ** and *** informs on 10%, 5% and 1% significance, respectively.
Source: Author's computation (2023)

The null hypothesis tested is that there is no long run relationship among the series. Table 4 revealed that, the computed F-statistics of 9.066370 is greater than 3.67, which is the critical value for the I(1) series at 5% level. On the basis of this result, the study strongly rejected the null hypothesis of no cointegrating relationship. Hence, the alternative of cointegrating relationship among the series is accepted. This suggest long run equilibrium relationship exist between population dynamics variables and economic growth. With cointegration established, the study employed the ARDL method in estimating the static and dynamic models.

Long- and Short-Run Parameters

With cointegration confirmed, the model of population dynamics and economic growth was estimated using the ARDL method to obtain the long- and short-run parameters. This is presented in Table 5.

Table 5: ARDL Long and Short Run Results

Dependent Variable: $lnRGDP_t$				
Panel I: Long Run Results				
Variable	***Coefficient***	***Std. Error***	***t − Stats***	***Prob.***
POP_t	-2.0281	5.8276	-0.3480	0.7307
$UNEM_t$	0.0190	0.1135	0.1680	0.8679
IMR_t	-1.9035*	0.9770	-1.9482	0.0627
C	29.7433	19.3922	1.5337	0.1376
Panel II: Short Run Results				
Variable	***Coefficient***	***Std. Error***	***t − Stats***	***Prob.***
$D(POP_t)$	0.3483	0.7256	0.4799	0.6354
$D(POP_{t-1})$	0.3252	0.4112	0.7909	0.4364
$D(POP_{t-2})$	0.9926**	0.4808	2.0643	0.0495
$D(POP_{t-3})$	1.1227**	0.4654	2.4120	0.0235
$D(IMR_t)$	-0.0639***	0.0194	-3.2790	0.0031
$D(IMR_{t-1})$	0.0369	0.0228	1.6161	0.1186
$D(IMR_{t-2})$	0.0731***	0.0216	3.3845	0.0024
$D(IMR_{t-3})$	0.0414**	0.0181	2.2892	0.0308
ECM_{t-1}	-0.0756***	0.0104	-7.2515	0.0000
R^2 = 0.4697		Adjusted R^2 = 0.3235		

Note: *, ** and *** denote significance at 10%, 5% and 1% level.
Source: Author's computation (2023)

Presented in Table 5 are information on the parameter estimates, their probability values, and coefficient of determination, among others. Table 5 contains the estimates of the long-run parameters, presented in Panel I, and those of the short-run parameters, which are summarized in Panel II. From Panel I, the result shows a coefficient of -2.0281 and a probability value of 0.7307 for population growth. These parameters indicates that population growth has negative impact on economic growth in the long run. By this result, one percentage point increase in population growth rate result in 2.0281 percent decrease in economic growth. More so, the probability value of 0.7307 for population growth rate indicate that, the reduction in economic growth resulting from rising population growth rate is

insignificant. This finding failed to corroborate the results of Onwuka (2006) and Adewole (2012), who found significant relationship between population growth and economic growth. In the long run, one percentage point increase in unemployment rate is associated with 0.0190 percent increase in economic growth. The probability value of 0.8679 estimated for unemployment indicate that, the stimulating effect which unemployment has on economic growth in the long run is insignificant. This by implication means that, changes in unemployment have zero effect on economic growth in the long run. Changes in infant mortality rate had marginal effect of -1.9035 percent on economic growth. The negative marginal effect suggests that rising infant mortality rate is detrimental to the growth of the Nigerian economy. One percentage point increase in infant mortality rate leads to about 1.9035 percent reduction in total output. This negative impact on economic growth exhibited by changes in infant mortality rate is only significant at 10% level.

In the short run, Panel II revealed that population growth rate significantly stimulates economic growth, but only after two and three years. The marginal effect resulting from increase in population growth rate after two and three years are 0.9926 percent and 1.1227 percent respectively. The short run analysis revealed negative contemporaneous effect of infant mortality rate on economic growth, as one percentage point increase in infant mortality is associated with 0.0639 percent reduction in economic output. Interestingly, rising level of infant mortality enhances economic growth by 0.0731 percent and 0.0414 percent, but in the second and third period lag. The error correction coefficient of -0.0756 is testament to cointegrating relationship among population dynamics variables and economic growth, as the coefficient is negative and significant, attesting to the reverting tendency of the model. The coefficient suggests that, about 7.56 percent of short run deviation from long run equilibrium level of economic growth is corrected every year.

With regression model increasing used for prediction/forecast, there is need to ensure that the classical linear regression assumptions hold. These assumptions include serial independence, homoscedasticity of the errors, stability of the parameters and specification error. To this end, diagnostic test was conducted on the estimated ARDL model (1, 4, 0, 4) and the result presented in Table 6 revealed that the parameters estimated are consistent and efficient. This is based on the results of the Breusch-Godfrey LM, ARCH, Ramsey RESET tests and stability test using cumulative sum (CUSUM) and CUSUM of Squares plot. For the Breusch-Godfrey LM, ARCH, and Ramsey RESET tests, the study failed to reject the null hypotheses as the probability values of the Chi-square statistics for the Breusch-Godfrey LM, ARCH, and Ramsey RESET tests are greater than 0.05. The conclusion from this is that, the ARDL model (1, 4, 0, 4) does not have serial correlation problem, the variance of the errors is constant, the functional representation of the model is not misspecified. From the CUSUM and CUSUM of Squares plot of Figure 1 and 2, the parameters are adjudged to be stable over the period of investigation.

Table 6: Diagnostic Test Results

Tests	CLRM Problem	χ^2 Value	χ^2 Prob.	Decision
Breusch-Godfrey LM	Serial Correlation	1.1207	0.5710	Serial independence
ARCH	Heteroscedasticity	0.8477	0.3572	Constant Variance
Ramsey RESET	Specification error	1.5497	0.2252	Correctly specified
CUSUM	Stability	-	-	Stable Model
CUSUM of Squares	Stability	-	-	Stable Model

Note: CLRM stands for classical linear regression model
Source: Authors' compilation (2023)

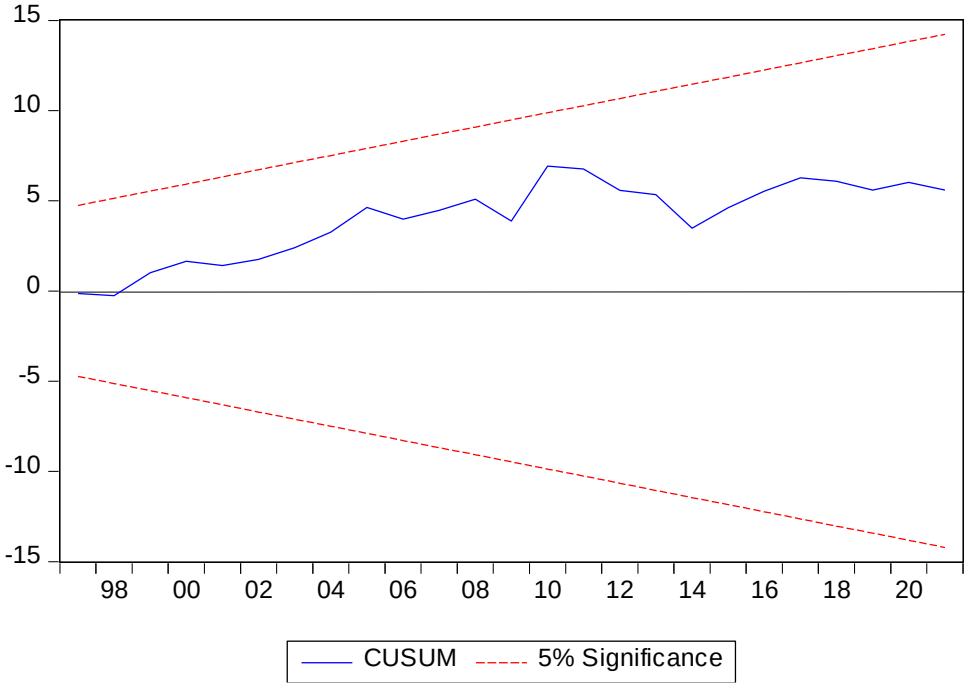

Figure 1: CUSUM Plot

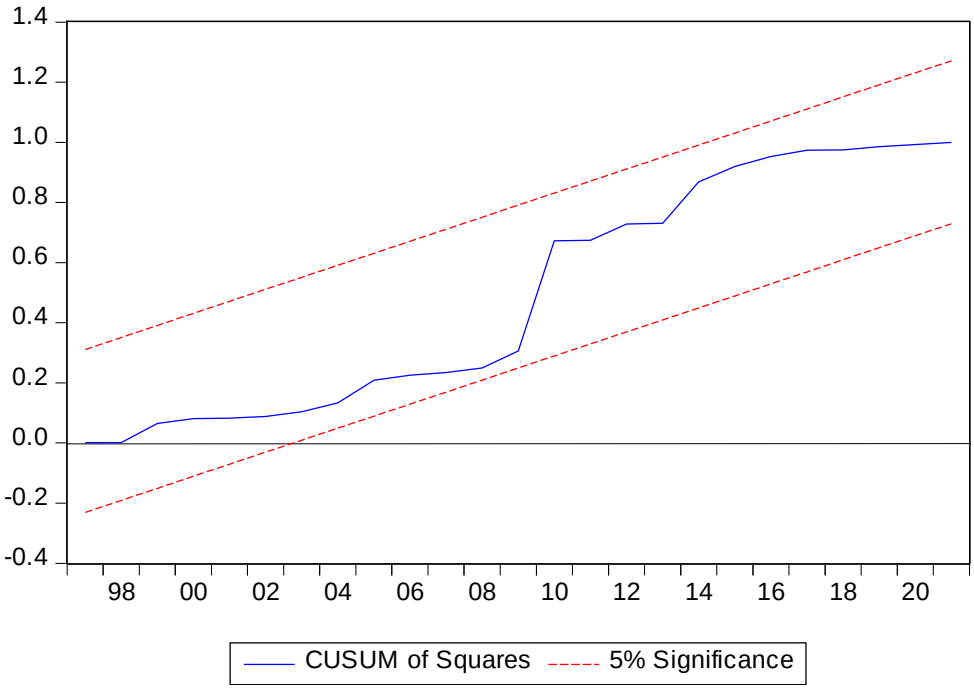

Figure 2: CUSUM of Squares Plot

5. Conclusions and Recommendation

In developing countries, unemployment, poverty and population have been on the increase and these tragic events has been a continued trend in Nigeria. Economic growth in Nigeria has been below potential, with fluctuating output level recorded as the economy slipped into recession in 2016 and 2020. With economic growth being a major macroeconomic objective, one wonders if the fluctuating level of output in Nigeria is related to her population dynamics. In this study, the nexus between

population dynamics and economic growth was examined using the autoregressive distributed lag (ARDL) method. The result showed that, while increasing population growth is harmful to the economy of Nigeria in the long run, the effect is insignificant. The implication is that, fluctuating movement in total output is not due to population dynamics. Furthermore, the study showed that unemployment and infant mortality rate are insignificant determinants of economic growth. Given the findings of this study, there is need for government to put in place mechanism that will checkmate the growing level of population and address the soaring infant mortality rates. These can be achieved by providing quality healthcare facilities to aid safe birth and an aggressive campaign on family planning through the collaboration of the National Orientation Agency (NOA), non-profit organizations and civil society organizations (CSOs).

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