International Journal of Development and Sustainability
ISSN: 2186-8662 – www.isdsnet.com/ijds
Volume 6 Number 12 (2017): Pages 1955-1965
ISDS Article ID: IJDS17101102

Does population change matter for long run economic growth in Nigeria?

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Abstract

The paper examined the relationship between demographic change and economic growth in Nigeria. While evidence in the literature tilted to the negative effect of population on economic growth in many of the emerging economies, there are some dissenting voices that argue that population and more specifically demographic change may not be central to the state of development of developing economy like Nigeria. This paper therefore subjects this contradicting position to econometric analysis. Based on time series data and using fully modified ordinary least square estimation technique, the paper showed that among the several macroeconomic variables that may affect economic growth in Nigeria population changes is missing. Indeed it is insignificant and interestingly positive in contract to the negative implication postulated by the earlier studies. Instead macroeconomic stability (inflation and exchange rate and fixed capital formation were observed to be strong drivers of economic growth in Nigeria. Therefore the paper concludes that population growth to ensure sustainable ling run growth the economic productive capacity must be expanded and enabling macroeconomic stability should be ensure and maintained consistently overtime

Keywords: Demographic Change; Population Structure; Economic Growth

Cite this article as: Adenola, F. and Saibu, O.M. (2017), "Does population change matter for long run economic growth in Nigeria?", *International Journal of Development and Sustainability*, Vol. 6 No. 12, pp. X-X.

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1. Introduction

The importance of population demographics in the development of any economy is as old as economics itself. However, the study of demography and economic growth has been long streamlined towards population matters on size and growth. Existing literature have often ignored the significance of age structure and demography transition as a driver in economic development. Prskawetz et al (2007), stated that despite various studies carried out using cross-country data, there has failed to be any significant effect between population growth and economic growth which is in contrast with the neoclassical view which states that population growth is negatively related to economic growth due to shrinking of capital.

Moreover, there are still unending arguments in the theoretical aspect to ascertain the role of population growth has on economic growth. The numerous literatures that exist have failed to establish a significant relationship between population growth and the economic growth rate. (Kelly, 1988; Temple, 1999). The reason earlier studies did not arrive at a cogent conclusion is as a result of the negligence of researchers of other important factors or composition of population dynamics.

According to Ven and Smits (2011), the changes in demography composition varies among nations of the world because of the changing age structure in the population. Also their study pointed out the recognition of the significance of age structure on economic growth in the studies carried out in the latter eighties and nineties. It has been affirmed that a falling ratio of children to youth gives rise to various opportunities to be explored for economic growth and it in turn reduces the dependency ratio and expansion of the labour force.

Also, the resultant effect of a per capita change in the number of working-age (15-64 years) population is on the output per capita in accounting terms, there is a translation from output per worker in the economy to output per capita in the economy (Kelley and Schmidt, 2005). However, despite the important role that age structure plays in the process of economic growth, the majority of the empirical work has focused exclusively on the population growth rate and economic growth. The working age population (ages 15 to 64) is the active populace and they contribute immensely to the GDP of any country, therefore, understanding the structure and paying rapt attention to the changes in the structure can play an important role in decision-making and planning of the economy and paying no attention to it, can cause many problems. To this end, this paper will focus majorly on the working age population that contributes to economic growth. While in Nigeria, the study carried out by Aidi et al (2016) revealed that all the core variables of population dynamics used in their time series data are inversely related with economic growth which is in line with the neoclassical view on the relationship that exist between population growth and economic growth.

The remainder of this paper is organized as follows. Section two introduces the empirical literature review. Section three outlines the theoretical framework and methodology adopted. Section four illustrates the data, provides summary of the analysis and results of findings on population structure and economic growth in Nigeria. Section five presents the policy implications and conclusion.

2. Literature review

Studies abound that establishes that population structure enhances economic growth. For instance, in the article of Wei and Hao (2010) Demographic structure and economic growth with Evidence from China examined the economic influence of demographic change in the Chinese setting. The growth equation used by the authors incorporated age structure dynamics and which was duly applied to China's provincial-level data in a period that spanned from 1989 to 2004. It was revealed in their work that changes in demographic structure among which the contribution in the fertility level in order to lower youth dependency, have helped spur economic growth in China since 1989. The outcome of demographic change on income growth works principally through its outcome on regular state income levels and the effect of age structure is more prominent in provinces that have vast exposure to market forces. In their work also they found that the employed variables of demographic behaviors (birth rates, marriage age and life expectancy) had a significant feedback effect on economic growth.

Safdari et al (2011), tested the effect of age population structure on economic growth in Iran using the vector autoregressive model (VAR), they found that the employed variables of gross domestic investment, government consumption expenditure, trade, age group 15 to 64 years had positive effect on economic growth while on the other hand, the employed variables of age group 0 to 14 years, age group 65 to top and inflation had a negative effect on economic growth.

Ven and Smits (2011) applied a multilevel convergence growth model in analyzing the demographic window of opportunity: age structure and sub-national economic growth in developing countries; they took into consideration 367 districts of 39 developing countries from all regions of the developing world to analyze the changes in economic growth. The empirical results revealed a strong positive effect of both the share of the working age population and of the growth rate of this share.

In the same light, Prettner and Trimborn (2012) using a R&D-based growth model, the authors analyzed the effect of continuing demographic change on medium run and long run economic growth. The results showed that, in the medium run the technological progress and economic growth moves swiftly in response to demographic change but moves at a slower rate in the long run. Numerical findings revealed that during the time period in which technological progress and economic growth moves swiftly than without demographic change can be a very long period.

Atanda et al. (2012), carried out a comparative trend review of population growth determinants between developing countries(Bangladesh, Ethiopia, Indonesia, Mexico and Nigeria) and developed countries(Germany and United States of America), the trend analysis showed that fertility rate, crude death rate, birth rate, mortality rate, and life expectancy are the major determinants of rapid population growth rate while youth dependency ratio of young people below the age 15 has also been attributed as one of the major causes of population growth and growth threat in developing countries. Nevertheless, the analysis showed that apart from just Mexico from the Upper Middle Income group, developed economies (United States of America and Germany) with large population size had a higher real economic well-being as measured by the Real GNI per capita, compared with selected developing economies in the world. The study suggests the need for a population control framework and provision of important and enhancing

infrastructures for the rapid growing population size in developing countries in order to promote the welfare of the citizenry.

In order to find a nexus between population structure changes and economic growth, Dao (2012) examined the economic effects of the demographic transition in developing countries. The author used the Least-squares estimation technique in a multivariate linear regression with a sample of forty-three developing economies, the result showed that per capita GDP growth is linearly dependent on population growth and dependency ratio. The author also tested for the nonlinear effect of population growth on economic growth and noted that the introduction of interaction terms between population growth, dependency and population growth ratio yields better statistical results.

Song (2013) examined the effects of demographic changes on economic growth in thirteen Asian countries during the period from 1965 to 2009 using OLS regressions which was ran using pooled data. In the author's results, the total population and the young population had negative growth impact on the economic growth of the selected Asian countries. While the working population and the ratio of the working population had positive impact on economic growth in the selected Asian countries in the study. These findings confirm that the occurrence of positive demographic changes had a great influence on the fast rising Asian economy.

In the work of researchers; Crespo Cuaresma, Lutz and Sanderson (2013) the dynamic panel GMM methods was used in analyzing age structure, education and economic growth in 105 countries, In the paper, the authors firstly revealed the reason for explicitly addressing changes in age structure and then reassess the empirical evidence on the relationship among economic growth, changes in age structure and education. From the global panel of countries used, the authors found that once the effect of human capital dynamics is controlled for there is no evidence that changes in age structure affect labor productivity. The results presented suggest that the advancement in human capital development is to be given rapt consideration as it is key in enhancing productivity and income growth.

Also, in the collective work of Nagarajan, Teixeira and Silva (2013) the Impact of population ageing on economic growth to uncover the potential gaps in literature, they employed bibliometric techniques based on 144 articles that centralized on ageing and economic growth which were gathered from Scopus, they found out that the impact of ageing on economic growth does not rest on the mechanism analyzed but rather changes according to the empirical methodology used. They also stated that a large majority of the empirical studies found a negative effect of ageing on economic growth although in some rare cases, evidence points to the positive or neutral effects of ageing on economic growth, the positive instance may be attributed to inefficiency in the social and institutional framework in the countries. They also found out that developing countries have few empirical studies on ageing and economic growth while there is no one on the least developed countries. This is a bothering situation as the ageing populace is also an essential issue for the less developed countries.

Thuku, Paul and Almadi (2013) examined impact of population change on economic growth in Kenya, they had three theories which looked at population as a stimulant for economic growth, population as a repellant for economic growth and population as a neutral factor in economic growth. In the result they

obtained from the use of Vector Auto Regression estimation technique it was observed that population growth and economic growth exhibits a positive relationship which implies that an increase in population will positively spur economic growth in Kenya.

Zhang, Zhang and Zhang (2014) in their paper examined the economic implications of demographic age structure in the context of regional development in China. In order to extend the development accounting framework, the authors incorporated age structure which was duly applied in the use of a panel data set of 28 Chinese provinces. Their outcome states that changes in age structure, as reflected by shifts in both the size and internal demographic composition of the working-age population, are significantly correlated with provincial economic growth rates.

3. Research method and material

Several theoretical models have been developed to analysis the relationship between demographic factors and growth process. Malthus (1798) developed an exponential relationship between food supply and population growth in a traditional economy. The main argument of Malthus is that living standards would remain at a subsistence level in the long run (Malthus, 1963) but argued that all life forms, including humans, have a tendency to exponential population growth when resources are sufficient but that actual growth is constrained by resources available at their disposal.

The classical growth theory of Solow (1956) and Swan (1956) pioneer the second stage of the theoretical development a relationship between population and economic output. Solow and Swan model directly incorporated population as a key determinant of growth and argued that unless saving surpassed population growth and depreciation of human and material capital economic growth may stunted and economic growth could only rise if the productivity of a provided stock of capital rises because of technological progress. A major disadvantage of this theory is that the mechanism for growth which is technology is exogenous; thereby preventing models from explaining the most significant factors that determine the rate of growth and due to this, the rate of economic growth cannot be affected by policy.

The deficiency in the classical growth model led to the endogenous growth model where the assumption of exogenous it of population and technical progress were relaxed. According to the endogenous growth model, population and technical progress are dependent on economic conditions and can be determined by choice made by the agent of the economy (Romer 1986). A major advantage of endogenous growth model is its decomposition of capital into human and physical capital. Such dichotomy allows for direct incorporation of population growth as a determinant of human capital and hence an endogenous variable in growth process (Barro, Mankiw and Sala-i-martim 1995)

Given the assumptions and the theoretical postulation of the endogenous growth theorists the impact of population structure on economic growth in Nigeria is examined by specifying a growth model that directly incorporates population as a key factor in growth process. The model also in line with other extant studies (like Bloom et al., 2007) to incorporate some economic condition policy variables to accommodate the action

of government and other growth fundamental in the empirical relationship between population growth and economic growth in Nigeria.

$$RGDP = A + \gamma_1 K + \gamma_2 POP + \gamma_3 EXR + \gamma_4 INF \quad (1)$$

where = Output measured with Real Gross Domestic Product in Nigeria, A = Technological progress, K = capital formation, EXR = Exchange rate, POP = Population, INF = Inflation

Transforming this model into log linear form in other to ensure remove the consequences of different unit of measurement and also solve the problem of heteroskedasticity and multi-collinearity in the model (Gujarati 2009). More importantly to ensure the coefficients of the independent variables are interpreted as elasticity. Thus equation 1 becomes in estimable form yields:

$$LOGRGDP = LOGA + \gamma_1 LOGK + \gamma_2 LOGPOP + \gamma_3 LOGEXR + \gamma_4 LOGINF \quad (2)$$

where**:** γ_1 to γ_4 = various slope coefficient, LOG represent natural log of the variables. All the variable remains as defined above. Equation 2 above can be transform into an econometric model by including the stochastic disturbance term that is used to capture all other variables that explain economic growth. Thus including the error term, equation 2 becomes;

$$LOGRGDP = LOGA + \gamma_1 LOGK + \gamma_2 LOGPOP + \gamma_3 LOGEXR + \gamma_4 LOGINF + \varepsilon \quad (3)$$

All variables remain as defined above, $\varepsilon_{it} \approx iidN(0,\sigma)$. Equation 3 above is used to examine the impact of population structure on economic growth in Nigeria. The a-priori expectation of the model is that γ_1, to $\gamma_3 > 0$; while $\gamma_4 < 0$.

3.1. Data measurement and sources

Real GDP is the monetary value of goods and services in the country using 1990 as the base year. The assumption is that growth in the domestic country gross domestic product implies that the economy is doing well and vice versa. Real GDP is obtained from World development indicator (WDI) 2016. Gross fixed capital formation which was previously referred to as formerly gross domestic fixed investment; the gross fixed capital formation data are denominated in the US dollars. According to world bank, Gross fixed capital formation consists of any advancement made on a land (drainages, boreholes, parking lots, and so on); included also are plant, machinery, and equipment purchases; and road construction, railway construction, also included are learning institutions both formal and informal, offices, hospitals, private residential dwellings, and commercial and industrial buildings. The System of National Accounts 1993 regarded net acquisitions of valuables as a part of capital formation. The data is sourced from World development Indicator, 2016. Population is working population which is the proportion of the population ages 15-64 that is economically active: all people who supply labor for the production of goods and services during a specified period, the variable is obtained from WDI 2016. Inflation rate is the percentage change in general price level using 2005 as the base year. It is measured in percentage and the data is obtained from World Development Indicator (2016).

3.2. Estimation technique

This study employed the fully modified ordinary least squares (OLS) technique as its method of analysis. This method was chosen because it takes into consideration the non-stationarity and time series attributes of the variables employed in the study, it also allows for proper evaluation of the relationship of certain variables on another variable in the model. The evaluation principle used in the study are the economic principle, statistical test and econometric test which allows for the examination of the sign, size and significance of the parameter estimates in the model, the economic principle evaluates the sign and size of the parameters while the statistical test provides the statistical significance of various parameters and variables in a model by using the t-test, f-test and R^2. Finally, the econometric test is used and it tests for the problem of serial autocorrelation and multi-colinerity among the variables and the stochastic error term in a time series analysis. In determining the relationship among the variables, the multiple regression analysis is used in this study as it ascertains the relationship between the dependent variable and the explanatory variables.

4. Results and interpretation

The variables for this study are gross domestic product used for economic growth which is the dependent variable also exchange rate, inflation, gross fixed capital formation and working population which are the independent variables. The study covered the period spanning from 1994 to 2016.

Table 1. Descriptive analysis

	GDP	LFP	EXR	INF	GFCF
Mean	40.83870	55.96087	116.3512	16.72275	4.701739
Median	39.15000	56.00000	100.0000	11.57798	4.850000
Maximum	69.78000	57.30000	272.3437	72.83550	9.790000
Minimum	20.17000	54.70000	69.86901	5.382224	1.000000
Std. Dev.	18.09793	0.734685	53.88618	16.22769	3.387341
Skewness	0.284819	0.170217	1.720692	2.576655	0.216502
Kurtosis	1.564942	2.182925	5.027840	8.664303	1.328595
Jarque-Bera	2.284550	0.750861	15.29046	56.19756	2.856876
Probability	0.319092	0.686994	0.000478	0.000000	0.239683

Source: Author's computation

The descriptive statistics in Table 1 above shows that gross domestic product has a mean value of 40.84 during the period under study. The variables showed a minimum and maximum value of 20.17 and 69.78 and a standard deviation of 18.09 from the mean. Similarly, labor force population (ages 15 to 64) has an average value of 55.96 during the period under review. The variable shows a standard deviation of 0.73 as well as a lower and higher value of 54.7 and 57.3 respectively. From the standard deviation value, it can be deduced that LFP is volatile. Exchange rate in Nigeria increased on the average by 116.35 during the period under study. The variable reveals a minimum of 69.90 and a maximum of 272.34 and also a standard deviation of 53.89. During the period under review, inflation showed an average value of 16.72 with a trough of 5.38 and

a peak of 72.8. Gross fixed capital formation in Nigeria grew by 4.70 on the average within the period 1994 and 2016. The variable has a standard deviation of 3.39 as well as minimum and maximum value of 1.00 and 9.79. The probability value of the Jarque-Bera Statistics indicates that apart from inflation and exchange rate, the other variables are normally distributed.

Table 2. Correlation matrix

	GDP	LFP	EXR	INF	GFCF
GDP	1.000000	-0.325474	-0.213145	-0.403918	0.958381
LFP	-0.325474	1.000000	0.616310	0.531946	-0.280940
EXR	-0.213145	0.616310	1.000000	0.145168	-0.187944
INF	-0.403918	0.531946	0.145168	1.000000	-0.346543
GFCF	0.958381	-0.280940	-0.187944	-0.346543	1.000000

Source: Author's computation

As a preliminary step to estimating the model, correlation analysis was conducted on the variables to determine if they can all be included in the model. Hence, the table above shows the correlation among the variables used in the model. From the results shown in the table, there is absence of multicollinearity problem in the specified regression model.

Table 3. Regression result

Dependent Variable: GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	40.28909	134.3587	0.299862	0.7677
EXR	-0.006549	0.028712	-0.228086	0.8222
INF	-0.008500	0.003001	-2.847514	0.0000
LFP	0.367831	2.451638	0.150035	0.8824
GFCF	4.944317	0.371550	13.30727	0.0000
R-squared	0.925179	Mean dependent var		40.83870
Adjusted R-squared	0.908552	S.D. dependent var		18.09793
S.E. of regression	5.472894	Akaike info criterion		6.427152
Sum squared resid	539.1463	Schwarz criterion		6.673999
Log likelihood	-68.91225	Hannan-Quinn criter.		6.489234
F-statistic	55.64319	Durbin-Watson stat		1.710804
Prob(F-statistic)	0.000000			

Source: Author's computation

Table 3 shows that the coefficient of determination *R*-square of 0.925179 shows that the independent variables account for about 93 percent variation in the dependent variable (GDP).The *F*-statistics of 55.64319 shows that the coefficients of all the independent variables are jointly significant at one percent (1%) level of significance and the model is adjudged to be good and relevant. The Durbin –Watson (DW) which is

1.710804 shows that there is no serial correlation in the model. The result revealed that the coefficient of exchange rate (EXR) (-0.006549) is negative and statistically insignificant (looking at the t-statistics of -0.228086 and probability of 0.8222). Also the coefficient of inflation (-0.008500) shows a negative relationship between inflation and the dependent variable, the t-statistics (-2.847514) as well as P-value (0.0000) show that the variable is statistically significant in the model. Thus, one percent increase in INF will on the average trigger approximately 0.85 percent fall in the dependent variable (GDP).

There exist a positive relationship between the Labor force participation rate (ages 15 to 64) with a coefficient of 0.367831 but the variable is statistically insignificant (looking at the t-statistics of 0.150035 and probability value of 0,8824) Also, the gross fixed capital formation shows a positive correlation between GFCF and the dependent variable(GDP) with a coefficient of 4.944317 and it is statistically significant at one percent(1%) with t statistics value of 13.30727 and a probability value of 0.0000. The constant term has a positive relationship with the dependent variable but it is statistically insignificant as probability value is 0.7677 and t-statistics value is 0.299862

5. Policy implication and conclusion

Among what can be deduced from these findings are: that the Nigerian economy has not maximized benefits stemming from the labour force participation rate (ages 15 to 64) and exchange rate; that Nigeria has not tapped into the benefits of a large population to enhance national productivity and increase labour force participation, the large population is characterized of deprived people either in one aspect or more.

From the findings, it suffices to conclude that the Nigerian government should gear efforts to ensure that the active populace are engaged in productive activities that yields economic growth. Sequel to the findings of this study, the following policies are recommended: There is a need for the government to promote both domestic and foreign investment by putting in place policies that are socially and economically friendly to investment. This will help reduce the level of unemployment in the country as more jobs will be created and this will enhance productivity in the economy. There is also the need of large investment in human capital (education, health & skills) both on the part of the government and private bodies. This will improve the quality of labour which will in turn positively exert productivity; finally, measures should be put in place to check the exchange rate as it is one of the economic drivers which can affect economic growth.

This study investigated the impact of population structure on economic growth in Nigeria using labor force participation rate(the active population ages 15 to 64) as a proxy for population structure, other variables used were inflation, exchange rate, gross fixed capital formation. It was observed that the labor force participation and exchange rate variable positively and negatively related to GDP respectively but the variables failed to be statistically significant. While inflation and gross fixed capital formation were statistically significant in the analysis.

Therefore, it suits to say that labour force participation could be a strong driver of economic growth in Nigeria if the number increases in relation to what has been maintained overtime. From the regression

results, inflation was observed to be a negative driver of economic growth; this can be explained from the point view of the monetary theorists that believes there's a negative relationship between inflation and aggregate output. The monetarist believe that when there is an increase in money supply this will lead to excess demand over excess supply of output, excess money supply increases demand and aggregate supply does not vary as it is believed the economy is operating at full employment, this will lead to increase in prices of goods. If the expansion in money supply continues, inflation will keep rising. The gross fixed capital formation is a positive driver of economic growth. This is in line with the Solow growth model which emphasizes capital formation for economic growth to take place.

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