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Abstract

This study evaluated the impact of demographic structure on Nigeria's economic growth over the period between 1981 and 2016. Employing the Autoregressive Distributed Lag ARDL) framework and granger causality test, this study confirms the existence of a long-run relationship between the dependent and independent variables. The results further showed that aged population has a negative impact on economic growth while children population as well as labour force stimulates the growth of the Nigerian economy both in the short-run and long-run thereby support the existence of the demographic dividend hypothesis. On the other hand, whereas a bidirectional relationship exists between aged population and economic growth in Nigeria and a unidirectional causality runs from children population and labour force to real GDP, economic growth engenders gross fixed capital formation (investment) and school enrolment. Hence, this study concludes that aged population, children population, labour force, gross fixed capital formation and secondary school enrolment constitute important determinants of economic growth in Nigeria. Therefore, this study recommends that the Nigerian government provide incentives and platforms which will encourage old people to engage in productive activities and to continually develop human capital of the children and labour force as it would increase the effectiveness of labour and have growth-enhancing effects on the Nigerian economy.

Keywords: Demographic Structure, Demographic Dividend, ARDL, Granger Causality, Nigeria

1.0 Introduction

Every economy of the world aims to achieve the macroeconomics goals of price stability, economy growth, full employment, favourable balance of payment and improved standard of living, among others. The demographic structure of an economy plays a crucial role in the achievement of these macroeconomic goals. It can be disaggregated into dependent and independent (labour force) population. The dependent population are the population below and above the working age while the independent population are those in the labour force. Theoretically, a country with more dependent population is expected to experience slow or negative economic growth while a country with high labour force tends to record positive growth as there are more than enough hands to improve the productivity of the economy (Bloom, et al., 2000; Mason, 2001; and Bloom and Finjay, 2009). In other words, economic growth in a country is related to an increase in the share of its working-age population, a phenomenon referred to as "Demographic Dividend."

According to World Bank Data (2018), the population of Nigeria stood at approximately 45 million people in 1981 but has grew markedly by about 322 percent to approximately 190 million people in 2017. However, this positive population growth had not been optimally harnessed for economic growth and development in the country as the population upsurge appears to be more of a curse than blessing. The surge in population has increased the pressure on the few available social amenities (roads, houses, water, schools and hospitals, among others) in the country thereby leading to their dilapidation or complete destruction; crime rate and other social vices have also been on the increase especially in major cities in the country; and cost of living is on the increase while standard of living dwindles on regular basis. These make it increasingly difficult for the Nigerian government to adequately provide quality social services to her citizens as every effort to do this is being frustrated.

In a bid to effectively manage population growth in Nigeria, policy-makers came up with different population policies overtime. They include: the National Population Policy of 1988, the National Population Policy for Sustainable Development of 2004 and the National Population Policy of 2006 whose goals are to improve the standards of living and the quality of life of Nigerians; to promote the health and welfare of Nigerians; to achieve lower population growth rates; to achieve even distribution of rural-urban population; and to prevent the causes and spread of HIV/AIDS pandemics in Nigeria. There are also a number of institutions and agencies charged with the responsibility of managing Nigeria's population. They include the National Population Commission (NPC), National Planning Commission, the Federal Ministry of Health, the National Primary Health Care Development Agency (NPHCDA), the National Health Insurance Scheme (NHIS), and the National Agency for Food and Drug Administration and Control (NAFDAC), among others. Despite these legal and institutional frameworks, the population policies implemented over time seem not to have achieved the desired results.

In addition, the persistent increase in the number of children who hawk, beg and do all kinds of menial jobs for survival is worrisome. There are two likely reasons for this malady: inadequate income or increase in dependency ratio or both. Firstly, it could mean that the income of those on whom they should depend for a living is not enough to cater for them thus, they resort to fending for themselves. Secondly, it could imply that the number of the dependent population increased at a rate higher than that of the labour force. The latter indicates a change in the demographic structure of the economy which obviously has implications for economic growth. The inability of employment opportunities to match the high population growth has led to widespread poverty, high rate of unemployment, high crime rate, and has also retarded and slowed down the economy of Nigeria.

In the first three quarters of 2016, Nigeria experienced a fall in its aggregate national output and it was declared to be in recession. The recession had debilitating effects on the economy as inflation

in the country was on the high side; governments, especially state governments, were unable to pay the salaries of their workers; a general fall in the standard of living accompanied by a very high cost of living; massive emigration of citizens to other countries of the world; tremendous increase in crime rate, terrorism, kidnapping and other social vices, and massive lay-off of workers in almost every industry in the country, among others. All these might not be unconnected from the demographic structure of the country hence, it is needful to assess the relationship between Nigeria's demographic structure and her economic growth.

The literature is awash with several studies on the issues relating population growth, demographic structure and economic growth in different countries of the world: India (Prskawetz, Kogel, Sanderson and Scherbov, 2007), China (Wei and Hao, 2010; Zhang, Zhang and Zhang, 2015; and Gao and Shao, 2016), Ethiopia (Wako, 2012), developing countries (Ven and Smits, 2011; Atanda, Aminu and Alimi, 2011) and Nigeria (Tartiyus, Dauda and Peter, 2015; Eniang, 1977; Adenola and Saibu, 2017; Nwosu, Dike and Okwara, 2014; Akokuwebe and Okunola; 2015; Aidi, Emecheta and Ngwudiobu, 2016; Bloom, Canning, Fink and Finlay; 2007; and Bloom, Finlay, Humair, Mason, Olaniyan and Soyibo, 2010; among others).

However, a critical review of the related studies in Nigeria shows that most of the authors used data of the total population of Nigeria to investigate the link between population and economic growth rather than total labour force (the working population of the economy) who are directly involved in the productive activities in the economy. On the other hand, they could have disaggregated population into different demographic structure so as to check for the individual contribution of each age group to productivity to aid comparison, a gap this study seeks to fill.

The novelty of this study is its provision of a detailed and comprehensive analysis of the impact of the demographic structure of Nigeria on her economy. It also seeks to contribute its quota to the existing literature, thereby expanding the frontier of knowledge on the relationship between demographic structure and economic growth in Nigeria as it provides a basis for further research and also serve as a reference tool to other researchers who would work on related topic.

It is against this background that this study seeks to answer the following research questions: (i) Does the demographic dividend hypothesis hold in Nigeria? (ii) Is there is a long-run relationship between Nigeria's demographic structure and her economic growth? and (iii) Which age structure has the most significant impact on economic growth in Nigeria.

The rest of this paper is structured as follows: Section 2 encompasses stylized facts on demographic structure and output performance of the Nigerian economy; Section 3 contains literature review; the crux of Section 4 is methodology and empirical analysis; and Section 5 concludes the study by making policy recommendations.

2.0 Demographic Structure and Real GDP Profile in Nigeria

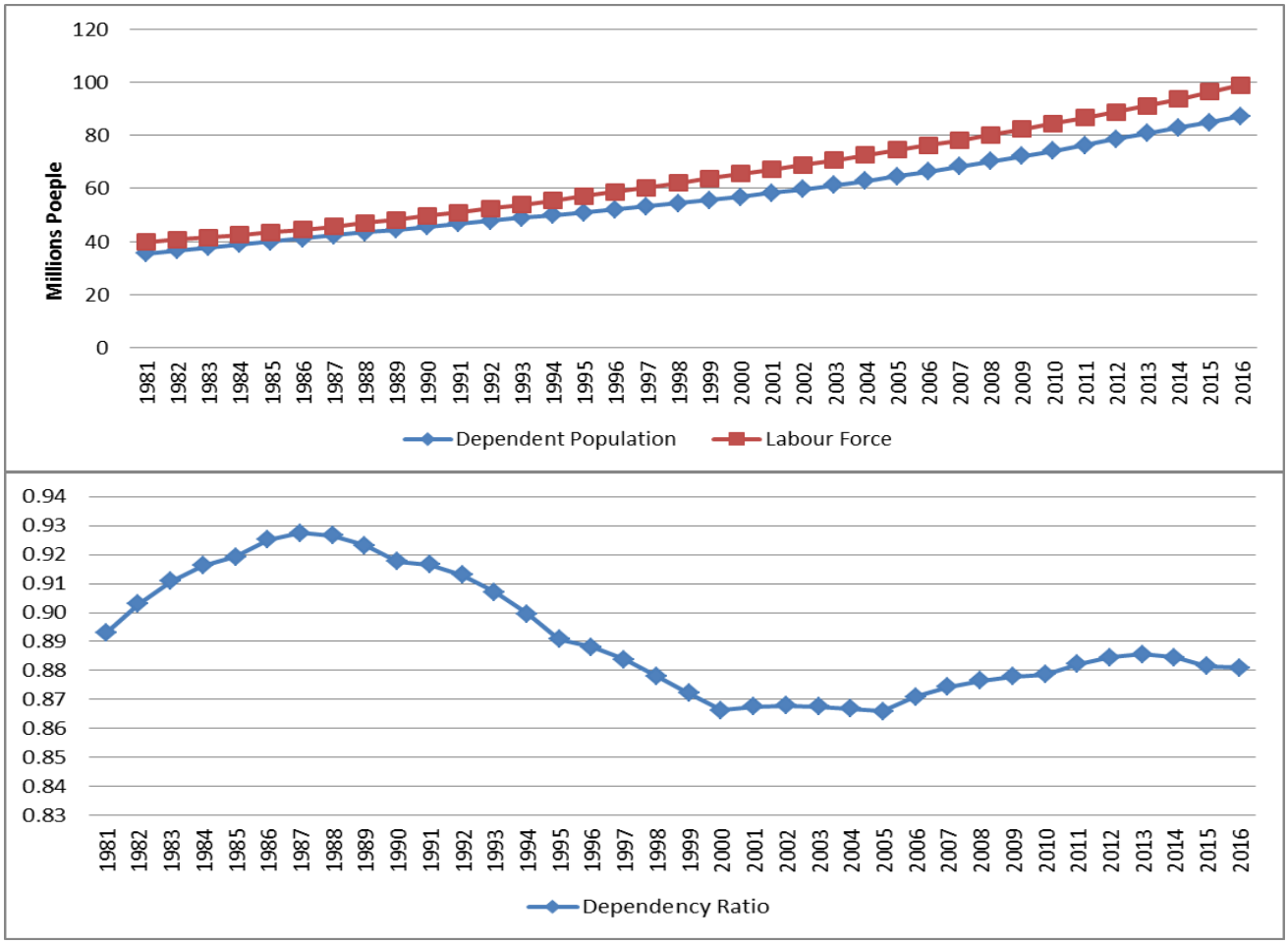
Figure 2.1 reveals that the total labour force population (15-64 years) is greater than the children population (0-14 years) and the aged (65 years and above) both individually and collectively. The sum of the children and aged population gives the dependent population which depends on the labour force for their survival. When the number of the independent population (labour force) exceeds the dependent population, it is good for the economy but when it is otherwise, it retards growth. Accordingly, Figure 2.1 shows that the independent population exceeds the dependent population throughout the period under review which is good for the economy as it puts less pressure on the productive population (labour force).

The dependency ratio is computed as the ratio of the dependent population (sum of the children and aged population) to the labour force. It is used to measure the pressure on the productive

population. If the ratio is less than one, it shows that the dependent population is less than labour force and there is no pressure on the labour force; if it is greater that than one, it indicates that the dependent population exceeds the labour force thus mounting more pressure on them; and if the ratio is one, it implies that the dependent population is equal to the labour force. Figure 2.1 shows that the dependency ratio stood above 86 per cent throughout the period under review. It reached an unprecedented height of 93 per cent in 1987, a year after the implementation of the Structural Adjustment Programme (SAP) of the World Bank and International Monetary Fund (IMF). However, it plummeted in subsequent years and was stable at about 87 per cent between 2000 and 2005 from when it began to rise steadily to 88 per cent in 2016.

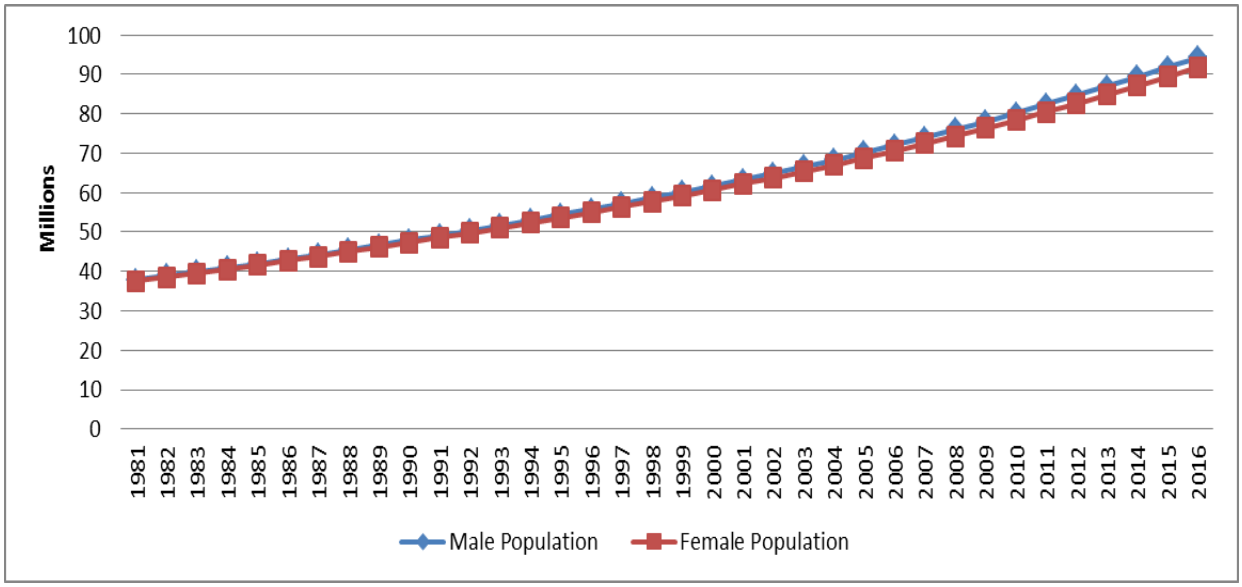
Figure 2.2 shows the trend of the total male and female population of Nigeria from 1981 to 2016. It reveals that both male and female population experienced significant increase overtime and they have a positive relationship even though it is apparent that there is arguably no significant difference between the male population and female population throughout the period under review.

Figure 2.1: Dependent and Independent Population in Nigeria (1981-2016)



Source: Author's Computation from World Development Indicator (2018)

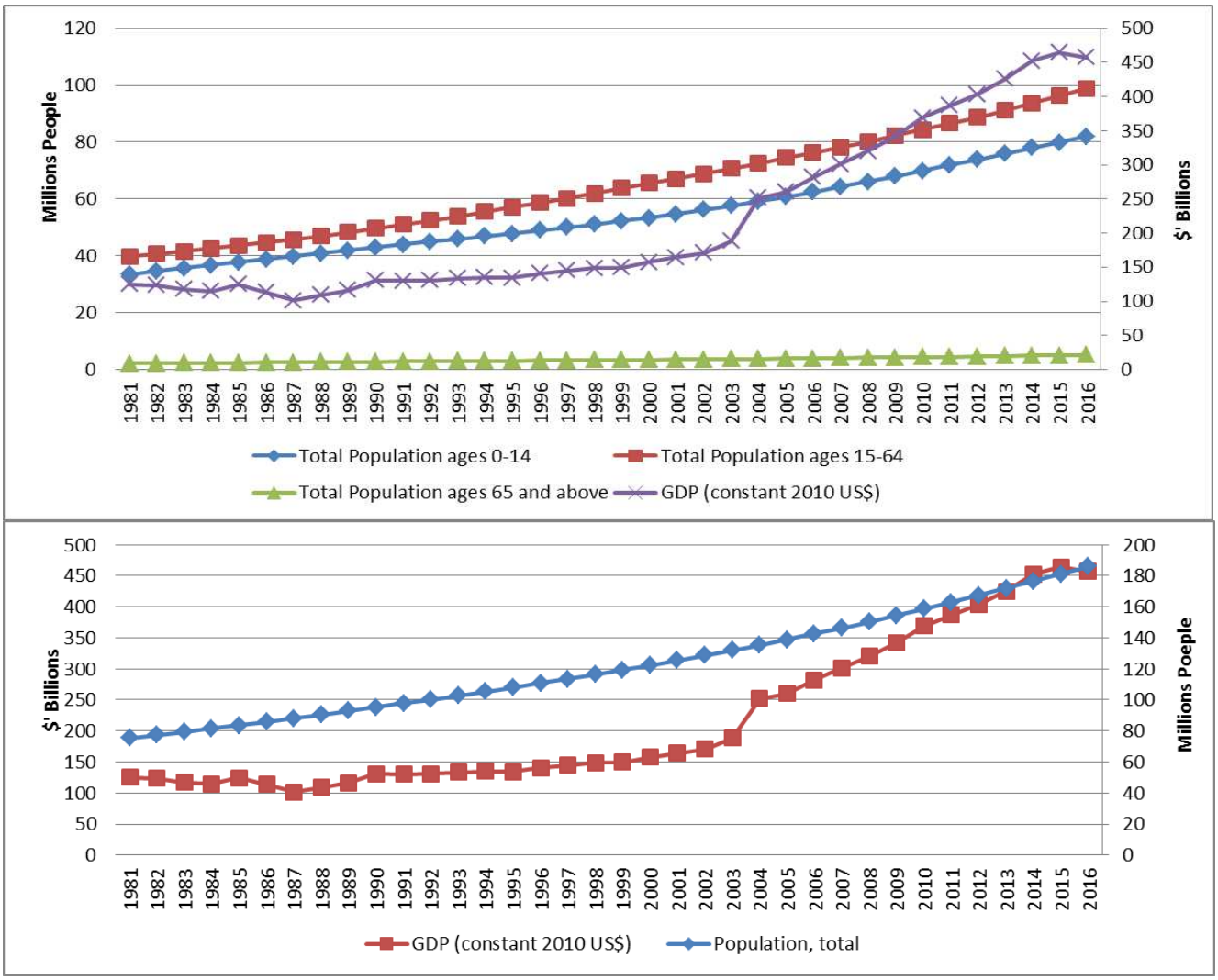
Figure 2.2: Total Male and Female Population in Nigeria (1981-2016)



Source: Author's Computation from World Development Indicator (2018)

Figure 2.3 shows the trend of real GDP and demographic structure of Nigeria from 1981 to 2016. It reveals that, like population, real GDP grew steadily throughout the period under review except for a few years, the most recent being 2016 when the Nigerian economy plunged into a recession. The trend of real GDP implies that the Nigerian economy experienced both positive and negative economic growth overtime. The upward trend which characterised the different demographic structure throughout the period under review implies an upward trend in the total population as the sum of the children population (0-14 years), labour force (15-64 years) and aged population (65 years and above) gives total population. Thus, it can arguably be said that real GDP and population has positive relationship as they both moved in the same direction for most of the period under review. This implies that population could be a one of the drivers of economic growth in Nigeria.

Figure 2.3: Trend of Real GDP and Demographic Structure of Nigeria (1981-2016)



Source: Author's Computation from World Development Indicator (2018)

3.0 Literature Review

There are several studies on the relationship between demographic structure/population and economic growth in Nigeria and other countries of the world. Most of these studies were motivated by the explosion in population witnessed in different countries of the world especially in countries like China and India. Empirical studies were carried out to examine how population change affects economic growth both in developed and developing economies. Most of the empirical findings concluded that population growth especially in labour force engenders economic growth.

In their study on the Chinese economy, Gao and Shao (2016) analysed the impact of population transition in China provinces on economic growth. The result supports the demographic dividend hypothesis. The findings of Zhang, Zhang and Zhang (2014) also support the demographic dividend hypothesis and revealed that the evolution of age structure accounts for about one-fifth of GDP per capita growth where a change in the internal demographic composition of the labour force accounts for over 50 percent. It was also found that the dynamics of age structure across provinces accounts for over one-eighth of the persistent inter-provincial income inequality. Also, Bloom, Canning, Fink and Finlay (2007) opined that increases in the proportion of the working age population can yield a demographic dividend that enhances the rate of economic growth. Song (2013) found a negative influence of young population growth on economic growth but supports the demographic

dividend hypothesis. This suggests that the favourable demographic structure accounts for the rapid growth of the Asian economies. Mason, Lee and Lee (2008) quipped that longer life, lower fertility, and population aging all raise the demand for wealth to provide for old age consumption.

Similarly, by incorporating age structure dynamics into the growth equation and applying it to China's provincial-level data, Wei and Hao (2010) examined the economic implications of demographic change in China. They found that demographic structure changes, specifically a decline in fertility rate, have helped fuel the growth of the Chinese economy. The channel through which demographic change affects income growth is primarily through its impact on steady state income levels and it is more evident in provinces where market forces operate. The result also showed a significant feedback effect between demographic behaviours (birth rates, life expectancy and marriage age) and economic growth. Furthermore, Joe, Dash and Agrawal (2015) examined the impact of changing population age structure on performance of the Chinese and Indian economy. They found that unlike China, the slow pace of decline in birth rate had adverse effects on India's savings and growth potential, together with the magnitude and timing of her first demographic dividend. They further argued that high domestic savings and investments in the demographic dividend phase are crucial in neutralizing the adverse effects of population ageing and to foster sustainable growth.

Eniang (1977) averred that rapid population growth places an economy at a disadvantage for a two major reasons. First, it retards capital formation and second, it skews the demographic structure such that there is an increase in the low skilled and unskilled labour in the labour force. Wako (2012) assessed the causal relationship between demographic factors and economic development in Ethiopia. The results revealed a negative long run relationship between per capita income and population growth and a positive relationship between the former and growth of workers with bidirectional causality in both cases. Similarly, Brunow and Hirte (2006) examined the relationship between age structure and regional economic growth and found evidence in favour of a strong positive impact of population age structure on real GDP per capita growth where the labour force below 45 years exerts the strongest positive impact. The result also supports the learning effects as it was found that a region with a relatively high share of individuals between 45 and 74 years have a relatively better performance than the average of its country whereas a high share of the young labour force have no significant impact.

Bloom, Finlay, Humair, Mason, Olaniyan and Soyibo (2010) examined the prospects for economic growth in Nigeria from a demographic change and human capital perspective. They found that Nigeria has a substantial demographic opportunity on the horizon however, she lacks policy options with which to harness her demographic transition into indefinite sustained growth and unemployment, low job productivity, and low levels of human capital are highlighted as the major roadblocks to achieving these benefits. In the same vein, Tartiyus, Dauda and Peter (2015) evaluated the impact of population growth on economic growth in Nigeria. The result revealed a positive relationship between economic growth and population, fertility and export growth and an inverse relationship between economic growth and life expectancy as well as crude death rate.

Wongboonsin and Phiromswad (2017) found that demographic structure affects economic growth differently in developed and developing economies. For developed countries, they found that an increase in the share of middle-aged workers has a positive effect on economic growth through institutions, investment and education channels. On the other hand, an increase in the share of the senior population has a negative effect on economic growth through institutions and investment channels. For developing countries, they found (but with weak evidence) that an increase in the share of young workers has a negative effect on economic growth through investment, financial market development and trade channels.

Aidi, Emecheta and Ngwudiobu (2016) found that fertility rate, mortality rate and net-migration are inversely related to economic growth in Nigeria. Similarly, Nwosu, Dike and Okwara (2014) found that population growth has a significant impact on economic growth; and there is a unidirectional causality running from population growth to economic growth. Akokuwebe and Okunola (2015) argued that demographic dividend can be harnessed for the development of especially rural areas in transitional countries like Nigeria. Adenola and Saibu (2017) examined the relationship between demographic change and economic growth in Nigeria. They found that population has a positive but insignificant relationship with Nigeria's economic growth.

4.0 Methodology and Empirical Analysis

4.1 Methodology

Since this study makes use of time series secondary data, preliminary tests of stationarity such as unit root test was conducted on each variable in the model. The unit root test would be carried out using Augmented Dickey Fuller (ADF) and Phillips Perron (PP) methods to determine the level of stationarity of the variables so as to guard against spurious regression. The Autoregressive Distributed Lag (ARDL) Bounds test approach to cointegration would be conducted to determine the existence of long-run relationship between the dependent and explanatory variables. The choice of the ARDL Bounds test approach to cointegration is premised on the fact that it accommodates series that are stationary at levels [I(0)], first difference [I(1)] or both [I(0) and I(1)].
Thereafter, I would proceed to the estimation of the dynamic (short-run and long run) relationships between the dependent and explanatory variables of the ARDL models and further investigate the impacts of demographic structure on economic growth in Nigeria. Then, diagnostic test would be carried out to check for the robustness of the model and see that the models do not violate any of the assumptions of the Classical Linear Regression Model (CLRM). The Granger Causality test would also be run to check the direction of causality of the macroeconomic variables in the model. Data for this study are sourced from World Development Indicator, 2018 edition, for the period between 1981 and 2016.

4.2 Model Specification

This study analyses the impact of demographic structure on economic growth in Nigeria for the period between 1981 and 2016. For the purpose of a comprehensive analysis and to investigate the contribution of age group to economic growth, demographic structure (labour) will be disaggregated into: labour force (15-64 years) and dependent population [children population (0-14 years) and the aged population (65 years and above)]. Furthermore, gross fixed capital formation (GFCF) will be used as a proxy for capital while secondary school enrolment (SSE) will be used to proxy technology. Based on the foregoing and the theoretical framework employed in this study, the mathematical model for this study can be presented as:

$$RGDP = f(GFCF, CPOP, LABF, APOP, SSE) \quad -- \quad -- \quad -- \quad -- \quad -- \quad (4.1)$$

To aid interpretation of the results in proportionate terms using elasticities, the variables are expressed in natural logarithm. Thus, the econometric models can be specified as follows:

$$LRGDP_t = \alpha_0 + \alpha_1 LGFCF_t + \alpha_2 LCPOP_t + \alpha_3 LLABF_t + \alpha_4 LAPOP_t + \alpha_2 LSSE_t + \varepsilon_t \quad -- \quad (4.2)$$

Where:
LRGDP = Log of Real Gross Domestic Product (Proxy for Economic Growth)
LGFCF = Log of Gross Fixed Capital Formation (Proxy for Capital)
LCPOP = Log of Children Population
LLABF = Log of Labour Force
LAPOP = Log of Aged Population

LSSE = Log of Secondary School Enrolment (Proxy for Technology)
ε_t = Disturbance Term

The ARDL representation of equation (4.2) is specified as:

$$\Delta LRGDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta LRGDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta LGFCF_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta LCPOP_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta LLABF_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta LAPOP_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta LSSE_{t-i} + \beta_2 RGDP_t + \beta_3 LGFCF_t + \beta_4 LCPOP_t + \beta_5 LABF_t + \beta_6 LAPOP_t + \beta_7 LSSE_t + \varepsilon_t \quad \text{-- (4.3)}$$

Where Δ denotes the first difference operator, α_0 is the drift component, and ε_t is the error term

4.3 Preliminary Analysis

4.3.1 Descriptive Statistics

Table 4.2 presents the descriptive characteristics of the macroeconomic variables used in this study. The average value of log of real GDP, log of aged population, log of children population, log of labour force, log of gross fixed capital formation and log of secondary school enrolment are 25.97, 15.02, 17.77, 17.95, 23.96, 3.41 respectively. This suggests that labour force dominates the population of Nigeria as it is greater that both the aged and children population indicating that the dependency ratio in Nigeria is less than 1 thus, economic growth will be engendered. Furthermore, the skewness, kurtosis and probability values of the Jarque-Bera statistic show that all the macroeconomic variables incorporated in this study are normally distributed. Also, the standard deviation of each variable is very low.

Table 4.2: Descriptive Statistics

	LRGDP	LAPOP	LCPOP	LLABF	LGFCF	LSSE
Mean	25.97	15.02	17.77	17.95	23.96	3.41
Median	25.73	15.03	17.76	17.96	23.65	3.30
Maximum	26.86	15.45	18.22	18.41	24.98	4.03
Minimum	25.34	14.57	17.33	17.50	23.21	2.84
Std. Dev.	0.51	0.25	0.26	0.28	0.60	0.27
Skewness	0.59	-0.06	0.06	-0.01	0.53	0.57
Kurtosis	1.76	1.94	1.89	1.76	1.69	2.62
Jarque-Bera	4.41	1.71	1.87	2.29	4.26	2.14
Probability	0.11	0.43	0.39	0.32	0.12	0.34
Sum	934.95	540.66	639.83	646.20	862.72	122.89
Sum Sq. Dev.	9.02	2.25	2.40	2.70	12.51	2.63
Observations	36	36	36	36	36	36

Where LRDGP =log of real GDP, LAPOP=log of aged population, LCPOP=log of children population, LLBAF=log of labour force, LGFCF=log of gross fixed capital formation and LSSE=log of secondary school enrolment
Source: Author's Computation from Eviews9

4.3.2 Unit Root Test

Routinely, the time-series properties of macroeconomic variables need to be ascertained when carrying out time-series analysis so as to guard against obtaining spurious results. The appropriate test for checking these time-series properties is unit root test. It tests the null hypothesis of the presence of unit root as against the alternative hypothesis of the absence of unit root. The decision rule is that the null hypothesis will be rejected and be alternative hypothesis accepted should the computed t-statistic be greater than the test critical values in absolute terms or the probability value be less than 0.1; it will be accepted and be alternative hypothesis rejected should the computed t-

statistic be less than the test critical values in absolute terms or its probability value be greater than 0.1 or 10 per cent significance level.

This study employs the Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) unit root tests to check the order of integration of the macroeconomic variables of this study and the results are presented in Table 4.3. The results of Augmented Dickey-Fuller (ADF) show that all the variables are stationary at first difference [I(1)] except log of children population that is stationary at level [I(0)]. Similarly, the Phillips-Perron results show only log of gross fixed capital formation is stationary at level [I(0)] while all other variables are stationary at first difference [I(1)].

The unit root results show that the macroeconomic variables employed in this study are a combination of I(0) and I(1) series or are integrated of different orders. This condition makes the ARDL Bounds test approach to cointegration appropriate for investigating the long-run relationship among these variable.

Table 4.3: Unit Root Test Results

	Augmented Dickey Fuller (ADF)			**Phillips-Perron (PP)**		
	Level	**First Difference**	**I(d)**	**Level**	**First Difference**	**I(d)**
LAPOP	-2.82b	-3.59b**	I(1)	-2.49b	-3.61a**	I(1)
LCPOP	-19.36b*	-	I(0)	-1.43b	-3.46b**	I(1)
LGFCF	-2.09b	-3.26a**	I(1)	-3.68b**	-	I(0)
LLABF	-1.71b	-5.01a*	I(1)	-2.70b	-3.02a**	I(1)
LRGDP	-2.28b	-4.66b*	I(1)	-2.70b	-3.02a**	I(1)
LSSE	-2.20b	-6.28b*	I(1)	-2.42b	-6.42a*	I(1)

Source: Author's Computation from Eviews9

Note: *, ** and *** represent statistical significance at 1%, 5% and 10% level respectively; 'a' denotes model with constant and 'b' is for model with trend and constant and trend. I(0) and I(1) indicate stationarity at level and first difference respectively.

4.3.3 ARDL Bounds Test Approach to Cointegration

Following the unit root tests results, cointegration test is carried out using the ARDL Bounds Test approach. This is because this techniques accommodates the series that are integrated of different orders [(I(0) and I(1)] unlike the Engle-granger and Johansen Cointegration test which accommodate only series that are stationary at first difference [I(1)]. It tests the null hypothesis of "no long-run relationship" where the decision rule is that the null hypothesis be rejected should the value of the computed F-statistic exceed the upper bound and not rejected should it fall below the lower bound. However, the Bounds test will be inconclusive should the computed F-statistic fall between the lower and upper bound.

Accordingly, Table 4.4 presents the result of the ARDL Bounds test and revealed that the result is adjudged inconclusive because the computed F-statistic (3.76) falls between the lower bound and the upper bound critical value at 5 percent level of significance. This implies that the long run relationship among the variables (dependent and independent) is unascertained. Hence, it is needful to proceed to estimating the short-run and long-run ARDL model.

Table 4.4: ARDL Bounds Test Result

Significance Level	Critical Value		Computed F-Statistics
	Lower (I0) Bound	Upper (I0) Bound	
1%	3.41	4.68	3.76
5%	2.62	3.79	
10%	2.26	3.35	

The Bounds critical values for k=5are obtained from Narayan (2005) case III for 40 observations.
Source: Author's Computation from Eviews9

4.4 Presentation and Interpretation of the Result

4.4.1 Analysis of the Short-Run ARDL Model Results

Table 4.5 present the results of the estimated short-run ARDL model. Firstly, the coefficient of the error correction term follows a priori expectation as it is negative, less than one in absolute value and statistically significant at 1 per cent significance level. This suggests that there is actually a long run relationship among the variables in the model as against the Bounds test result that adjudged it inconclusive thus, the error correction term confirms the existence of a long-run relationship among the variables. The error correction term shows the speed of adjustment of the dependent variable from a short-run disequilibrium in the previous period to its long-run equilibrium in the current period. Accordingly, the coefficient of the error correction term (-0.85) suggests that the speed of adjustment from a short-run deviation such as population explosion is quite fast as about 85 percent of the disequilibrium in real GDP resulting from the shock in the previous period will converge to the long-run equilibrium in the current period.

In addition, the coefficient of the first period lag of log of real GDP and its associated probability value show that the expectations about real GDP growth in Nigeria is adaptive in nature because the previous value of real GDP constitutes an important determinant of its present value. Furthermore, the result shows that aged population is inversely related to economic growth in Nigeria such that an increase in aged population by 1 percent will, on the average, slow down the economic growth by about 4.32 percent. This result is plausible and is in line with a priori expectation. Economic theory classifies the aged together with children as dependants who rely on the working population for their survival. Hence, rather than increase productivity and output, they contribute to its decline. This result parallels the findings of Wei and Hao (2010), Gao and Shao (2013) and Wongboonsin and Phiromswad (2017). It also implies that aged population is one of the determinants of economic growth in Nigeria.

In addition, the result shows that children population has a positive and significant relationship with economic growth. Specifically, an increase in child population by 1 percent will, on the average, stimulate economic growth by 4.04 percent. This result is in sharp contrast with a priori expectation and with the findings of Wei and Hao (2010) and Gao and Shao (2013). However, this result depicts the true picture of Nigeria. Nigeria is a country where child abuse is prevalent and children are left to fend for themselves. Oftentimes, children of school age are found hawking and trading on highways during school hours. This could be traced to the high poverty rate and unemployment rate in the country which has made it extremely difficult for parents to provide for their wards. This result implies that the contribution of these children to productive and commercial activities in Nigeria is significant.

The result also shows that labour force has a significant (at 10 percent significance level) positive relationship with economic growth thus confirming the existence of demographic dividend in Nigeria. Specifically, the result show that an increase in labour force by 1 percent will lead to

approximately 1.21 percent increase in economic growth. This implies that the Nigerian economy responds sharply to changes in labour force thus suggesting that labour-intensive production must be engendered for Nigeria to experience more economic growth. This result parallels economic theory and the findings of Brunow and Hirte, (2006), Wei and Hao (2010), Van and Smits (2011), Gao and Shao (2013), Song (2013), Akokuwebe and Okunola (2015), Zhang, Zhang and Zhang (2015) and Wongboonsin and Phiromswad (2017). In sum, of the three age groups in this study, aged population has the greatest influence on economic growth in Nigeria albeit negative. This could be attributed its high growth rate in relation with other age groups.

Moreover, in line with a priori expectation, the coefficient of gross fixed capital formation has a positive sign indicating a significant positive relationship with economic growth in Nigeria. Specifically, the Nigerian economy will grow by approximately 0.15 percent if gross fixed capital formation increases by 1 percent. This suggests that capital is an important driver of economic growth in Nigeria although its influence on economic growth is not as great as that of labour force. This suggests that for the Nigerian economy to experience sustainable and inclusive economic growth, there is a need to combat unemployment and create conducive environment where investment in both capital and labour will thrive. In addition, school enrolment has a significant positive relationship with economic growth such that an increase in school enrolment by 1 percent will, on the average, lead to an increase in economic growth by 0.24 percent. This result is plausible and in line with theoretical expectation. It suggests that education is an important determinant of economic growth in Nigeria thus investing in education will further stimulate the growth of the Nigerian economy.

On the other hand, the Adjusted R-Squared result (0.992) indicates that about 99 percent of the variation in the real GDP can be explained by aged population, children population, labour force, gross fixed capital formation and school enrolment. This implies that this model has a very high explanatory power and could be used for policy prescription. In the same vein, the probability value of the F-Statistic shows that aged population, children population, labour force, gross fixed capital formation and school enrolment jointly influence economic growth in Nigeria. It is noteworthy that all the explanatory variables are individually significant in influencing economic growth in Nigeria so, their joint significance is not surprising. Moreover, the value of the Durbin-Watson statistic shows the absence of autocorrelation in this model.

Table 4.5: Short-Run Estimates

Dependent Variable: LRGDP				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	0.353405	0.149593	2.362436	0.0259
D(LAPOP)	-4.326803	1.323578	-3.269020	0.0030
D(LCPOP)	4.042570	1.643113	2.460311	0.0208
D(LGFCF)	0.147738	0.046614	3.169403	0.0039
D(LLABF)	1.210393	0.673751	1.796499	0.0840
D(LSSE)	0.242220	0.115490	2.097318	0.0458
ECM(-1)	-0.853035	0.144453	-5.905293	0.0000
ECM = LRGDP - (-5.0722*LAPOP + 4.7390*LCPOP + 0.1732*LGFCF + 1.4189*LLABF + 0.2840*LSSE -12.6817)				
R-Squared = 0.9943		Adjusted R-Squared = 0.9928		
F-Statistic = 648.52 (0.0000)		Durbin-Watson Stat = 1.8795		

Source: Author's Computation from Eviews9

4.4.2 Analysis of the Estimated Long-Run Model Results

Table 4.6 presents the long-run result of the estimated ARDL model. As is the case in the short run model, a significant negative relationship exists between aged population and economic growth in Nigeria in the long run such that economic growth will plummets by approximately 5.07 percent if aged population increases by 1 percent. This shows that degree of responsiveness of economic growth in Nigeria to a change in aged population is very high. This result is plausible and in consonance with economic theory which posits that demographic dividends tend to decline as dependent population increases. Interestingly, the influence aged population has on economic growth in the long-run is greater than in the short-run.

On the other hand, the result shows that children population has a positive effect on economic growth in Nigeria in the long run. In particular, economic growth will increase by approximately 4.74 percent if children population increased by 1 percent. This finding contrast theoretical postulation but typically depicts the case of Nigeria. Similar to the coefficient of the aged population, the coefficient of children population shows that children population influences economic growth more in the long-run than the short-run.

Moreover, a significant positive relationship was found to exist between labour force and economic growth in Nigeria in the long run thus justifying the existence of demographic dividends in Nigeria. In particular, economic growth will be stimulated by about 1.41 percent should labour force increase by 1 percent. This shows the importance of labour force in engendering economic growth in Nigeria in the long-run. In other words, it suggests that labour force constitutes an important determinant of long-run economic growth in Nigeria. Interestingly, the impact of labour force on economic growth in the long-run outweighs its short-run impact.

Similarly, the coefficients of gross fixed capital formation and school enrolment are positive indicating that they have a positive relationship with economic growth in Nigeria in the long run. Specifically, an increase in gross fixed capital formation and school enrolment by 1 percent will stimulate economic growth in Nigeria by approximately 0.17 percent and 0.28 percent respectively. This result complies with theoretical expectations as well as empirical findings which posit that capital and technology (education) are important drivers of long-run economic growth.

Summarily, the long run results show that aged population, children population, labour force, gross fixed capital formation and school enrolment all influence long-run economic growth in Nigeria. In other words, aged population, children population, labour force, gross fixed capital formation and school enrolment constitute important determinants of long-run economic growth in Nigeria.

Table 4.6: Long Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LAPOP	-5.072246	1.439036	-3.524753	0.0016
LCPOP	4.739044	1.759199	2.693865	0.0122
LGFCF	0.173191	0.040443	4.282360	0.0002
LLABF	1.418926	0.820574	1.729186	0.0956
LSSE	0.283951	0.127181	2.232652	0.0344
C	-12.681700	4.589753	-2.763046	0.0104

Source: Author's Computation from Eviews9

Table 4.7 presents the results diagnostic (post-estimation) tests carried out to check the appropriateness of the model for policy formulation. It is a standard practice that before the empirical results of a study can be adjudged valid for policy formulation, diagnostic tests need to be carried out to ensure that the estimated model conform to or does not violate the assumptions of the Classical Linear Regression Model (CLRM). Specifically, the diagnostic tests include: test for normality, serial correlation, heteroscedasticity and correct specification form. The null hypotheses are: the errors are normally distributed, there is no serial correlation, errors are heteroscedastic and the model is correctly specified respectively. The decision rule is that if the probability value of each test is less than 5 per cent level of significance, the null hypothesis will be rejected but accepted if more than 5 per cent significance level. Accordingly, the probability of all the diagnostic tests are more than 5 per cent hence, all the null hypotheses will be accepted. This suggests that the estimated model fulfils all the assumptions of CLRM in that the model is correctly specified and its errors are normally distributed, homoscedastic and free from serial correlation. Intuitively, this indicates that the results and findings of this study are appropriate for policy formulation and prescription.

Table 4.7: Diagnostic Tests

Jarque-Bera Normality Test	0.371288 (0.8306)
Breusch-Godfrey Serial Correlation LM Test	0.325323(0.8499)
Heteroscedasticity Test (ARCH)	2.672393(0.1021)
Ramsey RESET Test	4.080526(0.0542)

N.B: Probability values are in parenthesis
Source: Author's Computation from Eviews9

4.4.3 Analysis of the Granger Causality Test Results

Granger-causality test is carried out in this study to further establish the existence of relationship between demographic structures and economic growth in Nigeria. The Granger-causality test is designed to determine the direction of causal relationship between macroeconomic variables. There are basically three kinds of relationship outlined by this test: bidirectional, unidirectional and neutral, relationship. Bidirectional relationship exists when the two variables in question granger-causes each other; unidirectional relationship exists when the one of the two variables in question granger-causes the other; and a neutral directional relationship exists when none of the two variables in question granger-causes each other.

The Granger-causality test tests the null hypothesis of no Granger-causality between two variables. The decision rule is that if the probability value of each test is less than 10 per cent level of significance, the null hypothesis will be rejected but accepted if more than 10 per cent significance level. The Granger-causality test results are presented in Table 4.8. Accordingly, the results show that there is a bidirectional relationship between aged population and economic growth in Nigeria indicating that aged population influences economic growth and vice versa. On the other hand, children population and labour force have a unidirectional causal relationship with economic growth in Nigeria. The nature of the relationship suggests causality runs from children population and labour force to economic growth.

In addition, there is a unidirectional causal relationship running from gross fixed capital formation and school enrolment to economic growth in Nigeria. This suggests that when the Nigerian economy grows, it engenders a surge in gross fixed capital formation (investment) and school enrolment. This result is plausible in that it reveals that investment as well as education will thrive

when an economy experiences growth. In sum, these results give further credence to the results of the estimated ARDL model.

Table 4.8: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
LAPOP does not Granger Cause LRGDP	34	3.11520	0.0595
LRGDP does not Granger Cause LAPOP		7.27334	0.0028
LCPOP does not Granger Cause LRGDP	34	7.03853	0.0032
LRGDP does not Granger Cause LCPOP		0.94494	0.4003
LLABF does not Granger Cause LRGDP	34	4.71573	0.0169
LRGDP does not Granger Cause LLABF		0.55807	0.5783
LGFCF does not Granger Cause LRGDP	34	2.33080	0.1152
LRGDP does not Granger Cause LGFCF		14.7269	0.0000
LSSE does not Granger Cause LRGDP	34	1.40277	0.2621
LRGDP does not Granger Cause LSSE		6.89288	0.0036

Source: Author's Computation from Eviews9

5.0 Conclusion and Policy Recommendations

The effects of demographic structure on economic growth cannot be overemphasized thus, researchers from different parts of the world have made efforts at discovering these effects. Given the high rate of poverty and unemployment in Nigeria, it became imperative to examine the link between demographic structure and economic growth to actually see if demographic structure has a role to play in determining economic growth in Nigeria. Hence, this study was carried out to examine the effects of demographic structure on economic growth in Nigeria using the ARDL framework to estimate the specified short-run and long-run equation.

Sequel to the empirical findings of this study, this study concludes that demographic structure plays a pivotal role in the performance of the Nigerian economy. Specifically, aged population has a negative impact on economic growth while children population as well as labour force stimulates the growth of the Nigerian economy both in the short-run and long-run. However, their impacts are greater in the long-run than the short-run. It was also found that gross fixed capital formation and school enrolment are important drivers of economic growth in Nigeria. On the other hand, this study concludes that whereas a bidirectional relationship exists between aged population and economic growth in Nigeria and a unidirectional causality runs from children population and labour force to real GDP, economic growth engenders gross fixed capital formation (investment) and school enrolment. Hence, this study concludes that aged population, children population, labour force, gross fixed capital formation and secondary school enrolment constitute important determinants of economic growth in Nigeria.

The implications of these findings for the Nigerian economy are hereby discussed. First, the negative impact of aged population on economic growth suggests that the increase in the population of old people is one of the variables responsible for the slow growth of the Nigerian economy as they do not engage in productive activities any longer therefore, government can provide incentive and platforms which will encourage old people to engage in productive activities and make adequate provisions to cater for them at this stage of their lives. Second, the positive impact children population, school enrolment and labour force has on economic growth in Nigeria suggests that there is need to continually develop human capital as it would increase the effectiveness of labour which will have growth-enhancing effects on the Nigerian economy.

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