



Population Growth, Literacy and Life Expectancy in Nigeria

Jebbin Maclean Felix

Department of Economics
Faculty of Social Science
Ignatius Ajuru University of Education, Nigeria

Kevin Ikeokwu Onyenze

Department of Economics
Faculty of Social Science
Ignatius Ajuru University of Education, Nigeria

Abstract

It is postulated that increase in population exerts a higher burden on the environment leading to environmental degradation, poverty and decline in life expectancy. This study examines the mediating effect of literacy on population growth-life expectancy nexus in Nigeria. The study adopts an econometrics technique (Toda-Yamamoto) in analysing the data and these data are time series data spanning from 1981-2018. The study revealed that Life expectancy reacted positively to the movement in population's growth rate and tertiary institution enrolment rate. This result justified the importance of higher education in mediating in the population-life expectancy nexus in Nigeria. Worthy of note is the fact that the most expected impact on Life expectancy comes from the most active population (age 15-64) and the knowledge acquired in tertiary institutions of learning, a proxy for literacy. This study therefore concludes that literacy has a mediating effect on population growth-life expectancy nexus. Thus, the study recommends that higher institutions should be tuition free and that government should allocate 25% of the annual budget to education as to increase the knowledge base of the population.

Keywords: Population, Growth, Literacy, Life Expectancy, Nigeria.

Reference to this paper should be made as follows:

Felix, M. J., & Onyenze, K. I. (2020). Population growth, literacy and life expectancy in Nigeria. *International Journal of Scientific Research in Education*, 13(4), 695-711.

Copyright © 2020 IJSRE

INTRODUCTION

The trajectory of world population increase is in affinity with the proposition of Rev. Thomas Malthus (1766-1834) population theory in which it was stated that population grows in geometrical progression while food production grows in arithmetic progression, given rise to population trap. Population trap implies that the marginal product of land will not, in the long run, be able to keep pace with the growth in population if nothing substantial is done to

ameliorate the situation. The lacuna created in the Malthus proposition affirms the importance of literacy (education or knowledge) as a veritable instrument in improving the land yield and reduce environmental degradation associated with the geometric increase in population. The improvement in knowledge to a great extent will improve the life expectancy of the people given the fact that they now have adequate knowledge or skills and information needed to live a happy and prosperous life which is the fulcrum of improvement in life expectancy.

The world population growth rate has been fluctuating over time from 1960 till date. In 1961, the world population growth rate was 1.4% accounting for 3.073 billion people on earth and average life expectancy of 75.38 years. In 1971, the world population grew by 2.15% accounting for about 3.684 billion people and an average life expectancy of 68.88 years. In 1980, the world population growth falls to 1.7% accounting for 4.434 billion people and an average life expectancy rates of 62.84 years. In 1990, the population growth rate was still at 1.7% but accounted for 5.281 billion people and the average life expectancy rate of 65.43 years. In the year 2000, the population growth rate of the world falls to 1.3% accounting for 6.115 billion people and an average life expectancy rate of 67.55 years.

In 2010, the world population growth declined further to 1.2% accounting for 6.923 billion people and an average life expectancy rate of 70.56%. While the population growth rate as of 2018 is estimated at 1.1% accounting for 7.594 billion people and an average life expectancy rate of 72.38 years (World Bank Report, 2018). Similarly, the total literacy rate which is the ability of people to read, write and use numerical has been on the increase from 1960 till 2018. The rate according to World Bank Group (2018) has been on the rise. In 1960, 1980, 2010, 2011, 2015, 2016, 2017, 2018, the literacy rate has been 42%, 86.3%, 83%, 86%, 86.3%, 86%, 91%, 86.3 respectively. It has been projected that the world population will increase to about 8.1 billion by the year 2050 and that a major percentage of that increase is expected to come from Africa countries, Asia, Latin America (Todaro & Smith, 2015).

A rising population in terms of its composition and size, has far-reaching implication for citizens' quality of life. However, the impact of population on life expectancy depends not only on the absolute size but also on its quality and composition (United Nations, 2017). Developing countries of Africa such as Ghana, South Africa, Benin, Nigeria has witnessed an increase in their population growth over time. The South Africa population growth rate, for instance, has been hovering around 2.3% to 2.7% for the period investigated, Ghana has remained within the horizon of 1.8% to 3.1%, Benin oscillates around 1.3% to 3%, Niger fluctuates 2% to 3.8% while Nigeria has remained within 1.9% to 2.7 (World Bank Group, 2018).

Nigeria population has been increasing within the period under investigation. In 1960, the population growth rate of Nigeria was 1.97% accounting for about 45,138,458 million people while the life expectancy rate stood at 36.98% years. In 1970, the population growth rate of Nigeria stood at 2.28% accounting for 55,982,144 million people while the life expectancy increased to 40.97 years. Also, in 1980, 1990, 2010, and 2018, the population of Nigeria grew at 2.84% accounting for 73,423,633 million people, while the life expectancy is 45.33 years. In 1990, the population of Nigeria grew at 2.5% accounting for 122,283,800 million people while the life expectancy is 46.26 years. In 2010 the population growth rate was 2.67% accounting for 158,503,197 million people while life expectancy rate rose to 50.89 years and finally, in 2018 Nigeria population grew at 2.58% resulting to a cumulative population of 195,874,740 (World Bank, 2018). The foregoing population figure suggests that the existing social infrastructure may not be enough to meet the population needs, given this scenario there is every tendency that life expectancy may be affected adversely.

Previous scholars (Klasen & Lawson, 2007; Onwuka, 2006; Nwosu et al., 2014; Adewole, 2012) have examined the effect of population growth on economic growth, while scholars such as Hussain (2002) and Kalediene and Petrauskiene (2000) examined the effect

of population growth on life expectancy. Thus, a gap exists in the literature and to fill the gap in literature, this study examines the effect of population growth and literacy on life expectancy in Nigeria using a non-granger causality test developed by Toda-Yamamoto in 1995. Other parts of this research are organized as: Part two discusses the literature reviewed. Part three discusses the variables and highlights the methods of the analysis. Part four gives the empirical results and the discussion of the findings while the last sections proffer policy recommendations and concluded the study.

CONCEPTUAL CLARIFICATIONS

Population Growth Rate

The term population growth rate means the annual average increase in population of people living in geographical location. The values are estimated using demographic models based on several kinds of demographic parameters: a country's population size, age and sex distribution, levels of internal and international migration, fertility and mortality rates by age and sex groups, and growth rates of urban and rural populations. Population growth in Nigeria has been hovering within 1.4%, 2.1%, 1.7%, 1.7%, 1.3%, 1.2% and 1.1% within the years 1961, 1971, 1980, 1990, 2000, 2010 & 2018 respectively. The cardinal reason behind the upsurge in the population may be due to the absence of functional population policy in Nigeria. The 1988 population policy that allows Nigerians to have not more than 4 children has been obsolete and no longer operational in present Nigeria which could be the reason behind the present increase in the nation's population. In the Course of this study, population growth rate will be disaggregated to population within age bracket 0-14, 15-64 and 64 and above.

Literacy

The concept of literacy means the ability of a person to read and write as well as the use of numeracy. The United Nations Development Programme has in severally classified literacy as the mean years of schooling in any country or the total number of literate persons in a given age group expressed as a percentage of the total population in that age group. The adult literacy rate measures literacy among persons aged 25 years and above while the youth literacy rate measures literacy among persons' age 15 to 24 years (World Bank Report, 2018). Given the fact that literacy improves reading, writing and the ability to use numeracy among people of a particular age, it became relevant to associate literacy to improvement in knowledge (innovation) which has the potential to inculcate new skills and ways of getting things done in the society. It should also be known that improvement in fertility and fall in mortality rate (child mortality or infant mortality) is a product of improvement in education (literacy rate).

Meaning that literacy rate plays a critical role in population growth. Increase in literacy rate is expected to increase population growth rate/volume given the fact that the number of death will fall while childbirth will rise. The literacy rate increase has the propensity to improve the quality of the environment through knowledge-based innovation that minimizes damage, conserve the environment as well as the revolution in environmental degradation. Literacy is an important development indicator in the sense that it promotes and improves the capacity of people while dealing with environmental and developmental issues. Literacy enhances skills and stimulates the hidden quality of human in preserving her environment toward a sustainable development path. In the course of this empirical examination, literacy rate will be proxies with secondary school enrolment rate and tertiary school enrolment rate respectively. The justification for the selection of these two indices is

based on the poor level of education in primary schools which has proven inadequate to meet the expectation of being responsible.

Life Expectancy Rate

Life Expectancy Rate is a demographic indicator defined by the United Nations Human Development Report as “the number of years a people would live if prevailing patterns of life is equal to all. This was what motivates Low et al. (2008) to analyse the relationship between life expectancy and reproduction by stratifying country-level data into development status using a composite indicator the Human Development Index (HDI). Health is measured by life expectancy at birth; knowledge is measured by a combination of the adult literacy rate (%) and the combined gross primary, secondary, and tertiary school enrolment ratios; and standard of living is measured by Gross Domestic Product per capita (Purchasing Power Parity US\$). Analyses of the relationships among population, literacy and life expectancy by HDI are unable to take into account the composite indicator’s direct relationship with life expectancy and literacy. The health factor used in this research will help us ascertain the impact of population and literacy rate on the life expectancy of an average Nigeria. The extant literature related to the concept under investigation has it that increase in population growth will exalt negative impact on the environment which to many instances will reduce the life expectancy of Nigerians through the effect of poverty and economic misery. Also, the parameter of literacy rate proxy with secondary school enrolment rate and tertiary school enrolment rates are expected to improve life expectancy rate through an increase in the knowledge base of the people, especially from the tertiary school.

THEORETICAL LITERATURE

Endogenous Growth Theory

Economist Paul Romer developed a theory of economic growth with “endogenous” technological change that is, it can depend on population growth and capital accumulation which was developed as a reaction to omissions and deficiencies in the Solow-Swan neoclassical growth model. Endogenous growth theory maintains that economic growth is primarily the result of internal forces, rather than external ones. It argues that improvements in productivity can be tied directly to faster innovation and more investments in human capital from governments and private sector institutions. Lucas (1986) states that investment on education will lead to the production of human capital which is the critical determinant in the growth process. This theory made great distinction between the internal effect of education where the personal life of the individual will be improved and the external effect of education which has to do with the spill over effect of an educated person in his or her environment. That it is the investment in human capital not physical capital that has spill over effect that increase technological know-how.

The Lucas equation is algebraically expressed as thus:

$$Y_i = A(K_i) \cdot (H_i) \cdot H^e$$

Where A is the technical coefficient, K_i and H_i are the inputs of physical and human capital used by the firm to produce goods Y_i . The parameter H is the economy average level of human capital while the parameter e represents the strength of external influence from human capital. Given that each firm in Lucas model faces constant return to scale, while there is increasing return to the economy. Meaning that it is not the accumulated knowledge and

experience of other firms that increase productivity but the average level of skills and knowledge in the economy. In the context of this research, the acquisition of knowledge is seen as a private good with externality. Literacy rate has been represented by the increase in Knowledge (H) while population will enter the equation as Human capital stock. The intuition behind this theory is that increase in Human and Physical capital will stimulate economic growth. Increase in Economic growth will only be sustained with healthy population over a longer period.

Malthusian Population Theory

Rev. Thomas Malthus (1788-1834) an English scholar in his essay on the principle of population in the year 1798 postulated that given the normal situation, the human can breed in prodigious rate (Weil, 2013). He further opined that what limits human population from increasing is the limited quantity of available resource such as "land". meaning that a smaller population will mean a better life for the people and higher population will lead to poverty, misery and that poverty will, in turn, limit the population growth in the long-run. Basing his position on the concept of diminishing return, Rev. Thomas Malthus has also projected that people should engage in moral restraint or limits the number of births through two methods such as positive check and preventive checking.

The positive check doctrine according to Malthus involves starvation, war and disease that has the potency to reduce the size of the population most cruelly while preventive checking involves the application of modern birth control mechanism such as abortion, the use of condom and contraceptive of all forms taken to reduce the chance of pregnancy. But Malthus never anticipated that the impact of technological innovation may have an impact on the population growth in the long run. All his emphasis has been that increase in population will put more pressure on the available lands thereby leading to poverty. This on its own has made many scholars call or classify his theory as the low-level equilibrium population trap or the Malthusian population trap (Todaro & Smith, 2015).

Given the above, the population theory by Rev. Thomas Malthus has been greatly criticized based on the following:

- The model put forward by Malthus never considered the impact of technological changes in halting the effect of rigid population growth; and
- The Malthusian population trap believed that there is a positive relationship between population growth and the national income but the modern study has reviewed that there is no positive correlation between population growth and national income rather it does with the environment.

Solow-Swan Model

A Solow-Swan economic growth model with exogenous saving rate shows the relationship between population growth and economic growth. The model assumed that both the saving rate and the consumption rate are given. Assuming, a household owns the input and manages the technology.

The production technology is assumed to take the form

$$Y = f(K, L), \text{-----} (1)$$

Where Y is total output,

K is total physical capital,

And L is the size of the labour input

The production function exhibits positive and diminishing marginal products concerning each input and also exhibits constant returns to scale. The economy is assumed to be a one-sector economy, where output can be either consumed or invested and capital depreciates at a constant positive rate (δ). The growth rate of population is exogenous. The model further assumes that this growth rate is a constant (n) and that labour supply per person is given. Normalizing the population size at time zero and the work intensity to one yield the following is the labour input

$$L = en \text{ -----(2)}$$

The net increase in per capita capital is:

$$k = sf(k) - (n + \delta)k \text{ -----(3)}$$

The first term on the right-hand side (RHS) is saving out of output per capita and the second term is the effective depreciation per capita. Defining a steady state as a situation in which the quantities, such as capital, population, and output, grow at constant rates. In the Solow-Swan model, a steady-state exists if the net increase in per capita is equal to zero. Denoting steady-state values with an asterisk the steady-state values are given by:

$$sf(k^*) = (n + \delta)k^*, y^* = f(k^*) \text{ and } c^* = (1 - s)f(k^*) \text{ ----- (4)}$$

Since the per capita values are constant in steady-state, the levels of total output, total consumption, and total capital must grow at the same rate, which is the same as that of population growth (n). An increase in the rate of population growth in a steady state does not affect the growth rate of the per capita variables, since these rates are equal to zero in steady-state. However, an increase in fertility does lead to a decrease in the level of population per capita and therefore to a decrease in output and consumption per capita. This is the capital dilution effect. An increase in the population growth rate leads to a decline in the growth rate of the per capita variables. For model with exogenous saving rates, higher population growth leads to a lower standard of living per capita measured either as consumption or in the growth of consumption.

Empirical Literature

Istaiteyeh (2017) investigate the impact of socio-economic determinants (including per capita GDP, public spending on health, urban population, and secondary school enrolment) on life expectancy in Jordan. The study covers the period from 1990 to 2014 and employed Vector Auto-Regression technique (VAR). The empirical findings indicate that unemployment and secondary school enrolment explains longevity in Nigeria.

Ilori et al. (2017) examine empirical evidence of the specific impact of public health expenditure on life expectancy in Nigeria using time series data spanning between 1981 and 2014. Their study employs bounds testing co-integration and Autoregressive Distributed Lag (ARDL) procedures to determine the relationship between public spending on health and life expectancy in Nigeria. The results indicate that School Enrolment and carbon-dioxide emission significantly and directly influenced life expectancy in Nigeria, while School Enrolment was found to be insignificant in both short and long runs contrary to economic theory.

Popoola (2018) empirically investigates the effects of population growth on average life expectancy in Nigeria taking into account the explicit role of healthy citizens in economic development as well as other control variables not considered in prior studies. Predicted on country-specific regression and Granger Causality test using time series data between 1986 and 2015, the findings reveal that rising population growth have positive and insignificantly impacts life expectancy, but 1% decrease in fertility rate and population of 65-and-above dependency ratio could positively stimulate an improvement in longevity by 5.84, and 81.5 respectively in Nigeria. Furthermore, the granger causality test shows that population growth could granger cause low life expectancy in Nigeria at least at 10% level of significance. The findings, therefore, make a case for strengthening efforts towards reducing both fertility rate and age 65 and above dependency ratio with priority given to the welfare of ages 65 and above population in Nigeria.

Ratna and Sari (2016) examine empirically the relationship between the health budget, human capital and population growth in Indonesia by using both quantitative and qualitative analysis. Their quantitative results from regression technique support the theory that there is significant no relationship between life expectancy and population growth, while their qualitative analysis is used to describe the role of formal and informal institutions, including financial institutions in reducing birth rates to improve human capital.

Adewole (2012) investigated the effect of population on economic growth in Nigeria using annual time series data for the period 1981-2007. The study adopted the OLS regression approach. Variables included in the model are real gross domestic product (RGDP), population and per capita income (PCI). The results indicate that a strong positive relationship existed between population and economic growth during the period considered.

Klasen and Lawson (2007) investigated the link between population, per capita growth and poverty in Uganda. The study employed both cross-sectional data and panel data. The results of the estimates show that population growth has a positive impact on overall economic growth. But the coefficient is always smaller than 1, suggesting that additional people have a less than proportionate influence on economic growth. In the cross-section specification, the impact is generally larger than in the panel specifications.

Gilbert et al. (2018) examined the relationship between Literacy and life expectancy in. leaning on the fact that Literacy is linked to life expectancy through a range of socio-economic factors. People with poor literacy skills are more likely to be unemployed, have low incomes and poor health behaviours, which in turn can be linked to lower life expectancy. The descriptive analysis concludes that People with poor literacy skills earn 12% less than those with good literacy skills. Low incomes are associated with higher mortality; the World Health Organization found that children born into low-income families live 17 years shorter than children born into high-income families (62 years' vs 79 years). Furthermore, it was revealed that literacy is linked to life expectancy through health and that those with low levels of literacy are more likely to have poor health, low health literacy and engage in harmful health behaviours, which in turn puts them at a higher risk of living a shorter life given that 43% of working-age adults in England don't have the literacy skills they need to understand and make use of everyday health information (known as 'health literacy'). Low health literacy is associated with a 75% increased risk of dying earlier than people who have high literacy levels.

Hansen and Lonstrup (2013) indicate that increase in longevity decreased per capita GDP growth and rising population growth. These findings are robust to the inclusion of initial life expectancy and initial GDP per capita.

Currais (2000) take into account the extent to which fertility and mortality affect the population growth rate. His findings indicate that mortality depends on health expenditure and fertility rate, and that household often takes into account the welfare and resources of

their current and future that concerns the population growth rate. In sum, most of the empirical studies conducted especially in developed and developing countries including Nigeria with emphasis on public health spending, per capita GDP, rural-urban inequality in income, and unemployment on life expectancy. However, these studies failed to appropriately account for the impact of population growth on longevity and the effect of fertility rate and age 65 and above dependency ratio. Hence, this study will bridge the gap in the empirical literature by investigating the long-run relationship between population growth, literacy and life expectancy in Nigeria.

Hussain (2002) investigated the determinants of life expectancy by using the cross-sectional data of 91 developing countries of the world, with the help of multiple OLS. He used fertility rate, per capita GNP, adult literacy rate and per capita calorie intake; he studied this relationship both in linear as well as log linear model.

Kalediene and Petrauskiene (2000) investigated that urbanization is one of the important indicators of life expectancy for both developed and developing nations. They claimed that the population of urban areas has better medical cares, better education opportunities and improved socio-economic infrastructure which have positive impact on the health.

METHODS

The emphasis here is placed on the method applied in this study, the source of data, techniques used, model specification, the definition of variables and method of data analysis.

Source of Data

Data spanning from 1981-2018 sourced from the Central Bank of Nigeria (CBN), world Bank Report (world development indicator 2018), United Nation World Population Prospects and The Internet.

Population Growth Rate 0-14	1981-2018
Population Growth Rate 15-64	1981-2018
Population Growth Rate 64 and Above	1981-2018
Secondary School Enrolment Rate (A Proxy for Literacy)	1981-2018
Tertiary School Enrolment Rate (A Proxy for Literacy)	1981-2018
Total Life Expectancy in Nigeria	1981-2018

Techniques

The work is descriptive and analytical as it makes use of the secondary data covering 1981 to 2018. The descriptive tool in this article involves only descriptive statistic while the empirical tool of analysis is the Toda and Yamamoto (1995) non granger causality test based on augmented VAR equation of the form $K + D_{max}$ after a critical review of ADF and KPSS unit root test to ascertain maximum order of integration K . The justification for this technique is based on the fact that the variables were integrated of order zero $I(0)$, order one $I(1)$ and order two $I(2)$, and gain the Granger causality test is based on F-statistic that follow a standard normal distribution which means that when variables are integrated the Granger causality test become fragile and may not be able to generate robust result. The Augmented dickey fuller (ADF) and Kwiatkowski-Phillip-Schmidt Shin (KPSS) unit root test are used to verify the stationarity of the time-series data used in the study.

Model Specification

The Given the nature of the time series data, the model specification for the empirical investigations of the mediating effect of literacy on population growth-life expectancy nexus is built on the modified version of the Toda Yamamoto (1995) composite equation to captured the objective of the study. However, we modelled a linear interaction of Life expectancy as a function of a disaggregated population grouping and literacy index proxied by Secondary School Enrolment and Tertiary School Enrolment respectively. The justification for disaggregating the literacy variable into secondary school and tertiary enrolment is that at the primary school level no specialized skill is acquired.

Toda-Yamamoto (1995) Model

$$\begin{bmatrix} LER_t \\ POG1_t \\ POG2_t \\ POG3_t \\ SSER_t \\ TSER_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} LER_{t-1} \\ POG1_{t-1} \\ POG2_{t-1} \\ POG3_{t-1} \\ SSER_{t-1} \\ TSER_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} LER_{t-2} \\ POG1_{t-2} \\ POG2_{t-2} \\ POG3_{t-2} \\ SSER_{t-2} \\ TSER_{t-2} \end{bmatrix} + A_3 \begin{bmatrix} LER_{t-3} \\ POG1_{t-3} \\ POG2_{t-3} \\ POG3_{t-3} \\ SSER_{t-3} \\ TSER_{t-3} \end{bmatrix} \\
 + A_4 \begin{bmatrix} LER_{t-4} \\ POG1_{t-4} \\ POG2_{t-4} \\ POG3_{t-4} \\ SSER_{t-4} \\ TSER_{t-4} \end{bmatrix} + A_5 \begin{bmatrix} LER_{t-5} \\ POG1_{t-5} \\ POG2_{t-5} \\ POG3_{t-5} \\ SSER_{t-5} \\ TSER_{t-5} \end{bmatrix} + A_6 \begin{bmatrix} LER_{t-6} \\ POG1_{t-6} \\ POG2_{t-6} \\ POG3_{t-6} \\ SSER_{t-6} \\ TSER_{t-6} \end{bmatrix} + \begin{bmatrix} \varepsilon LER_t \\ \varepsilon POG1_t \\ \varepsilon POG2_t \\ \varepsilon POG3_t \\ \varepsilon SSER_t \\ \varepsilon TSER_t \end{bmatrix} \quad (2)$$

Where $A_1 \dots A_6$ are 6X6 matrices of the coefficient, A_0 is the identity matrix and ε s are the disturbance terms which are assumed to have zero mean and constant variance. To test the hypothesis that POG1, POG2 and POG3 does not granger cause LER, $A_2 = A_3 = A_4 = 0$ against the alternative hypothesis that the null is not true, $A_2 \neq A_3 \neq A_4 \neq 0$. Also, that SSER and TSER does not granger cause LER in Nigeria, we use the following hypothesis $A_5 = A_6 = 0$ against the alternative that the null is not true. Also to capture the second objective of these study, the null hypothesis $A_5 \neq A_6 = 0$ against the alternative that the null is not true was also tested from one output.

Table1: *Apriori*

Parameters	α_1	α_2	α_3	α_4	α_5
Expectation	-	-	-	+	+

Where:

LER = Life expectancy rate
 POG1 = Population Growth Rate (0-14)
 POG2 = Population Growth Rate (15-64)
 POG3 = Population Growth Rate (64 and above)
 SSER = Secondary School Enrolment Rate
 TSER = Tertiary School Enrolment Rate
 a^s are the parameter estimate of the variables.

Variables

Population Growth Rate Aged (0-14): refers to the percentage of growth in the yearly population of people within the age bracket 0-14 in Nigeria. This proportion of the population constitutes the dependent fraction of the population and in most cases are the highest in terms of figures. The values are estimated using demographic models based on several kinds of demographic parameters: a country's population size, age and sex distribution, levels of internal and international migration, fertility and mortality rates by age and sex groups, and growth rates of urban and rural populations. Information collected through recent population censuses and surveys is used to calculate or estimate these parameters.

Population Growth Rate Aged (15-64): means the proportion of the active population which constitute the labour force of any country. The population of people men and women within the age bracket of 15 and above in many cases are the engine block for economic growth and development with very high vulnerability and proximity to life-threatening incident especially in their place of work. Also, the values are estimated using demographic models based on several kinds of demographic parameters: a country's population size, age and sex distribution, levels of internal and international migration, fertility and mortality rates by age and sex groups, and growth rates of urban and rural populations. Information collected through recent population censuses and surveys is used to calculate or estimate these parameters.

Population Growth Rate Aged (64 and above): refers to the percentage growth in the yearly population of people within the age bracket 64 and above in Nigeria. These also form part of the dependent population and most vulnerable to illness and death. The values are estimated using demographic models based on several kinds of demographic parameters: a country's population size, age and sex distribution, levels of internal and international migration, fertility and mortality rates by age and sex groups, and growth rates of urban and rural populations. Information collected through recent population censuses and surveys is used to calculate or estimate these parameters.

Secondary School Enrolment rate: This constitutes the percentage increase in the number of people in secondary education in Nigeria on Annual bases. It is the ratio of total enrolment, regardless of sex, to the total population of Nigeria.

Tertiary School Enrolment Rate: is the percentage of total enrolment regardless of age in post-secondary institutions to the population of the people.

Life Expectancy (LER)

Life expectancy rate means the numbers of years' people are expected to live on earth. It is a measure of life span. The quality of the environment is one cardinal indicator of the life expectancy at any given time followed by the literacy rate. The life expectancy of people living in a polluted environment is different from the life expectancy of people living in an environment that is not highly polluted. In the same manner, improvement in literacy rate has proven to be responsible for the increase in the expected life span of the people through improvement in medicine, technological innovation, etc.

DATA ANALYSIS

Descriptive Statistic

The basic tool of descriptive analysis used in this research work is the descriptive statistic. Below is the output which gives robust details on the mean, median, maximum and minimum, skewness, kurtosis, Jacque-Bera, etc explains the character of the series under investigation.

Table 2: Descriptive Statistic Result

	LER	POG1	POG3	SSER	TSER	OG2	
Mean	48.08763	44.28968	2.816697	32.47842	8.057105	52.89362	
Median	46.19700	44.14742	2.816986	32.07000	7.840000	53.06699	
Maximum	53.95000	45.23741	2.900177	48.14000	14.79000	53.58621	
Minimum	45.63700	43.60432	2.735548	17.01000	2.310000	51.87711	
Std. Dev.	2.829996	0.520601	0.058789	7.755802	3.651903	0.561203	
Skewness	0.902429	0.486533	0.005941	0.282338	0.046471	-0.515209	
Kurtosis	2.232437	1.906523	1.381865	2.302921	1.826652	1.853785	
Jarque-Bera	6.090559	3.392372	4.145963	1.274232	2.193523	3.761320	
Probability	0.047583	0.183382	0.125810	0.528815	0.333951	0.152489	
Sum	1827.330	1683.008	107.0345	1234.180	306.1700	2009.958	
Sum Sq. Dev.	296.3284	10.02793	0.127876	0.161512	2225.641	493.4466	11.65312
Observations	38	38	38	38	38	38	38

Table 2 illustrates the descriptive statistic estimate that explains the descriptive analysis in the investigations of the impact of population growth rate and literacy rate on life expectancy in Nigeria using time series data spanning from 1981 to 2019. The result revealed that the mean value which is the average of the distributions for LER, POG1, POG3, SSER, TSER and POG2 are 48.08763; 44.28968; 2.816697; 32.47842; 8.057105 and 52.89362 while median which measures the centre of the distribution less sensitive to the outlier relative to the mean are: 46.19700; 44.14742; 2.816986; 32.07000; 7.840000 and 53.06699. The maximum and minimum value in the distribution includes 53.95000; 45.23741; 2.900177; 48.14000; 14.79000; 53.58621 and 45.63700; 43.60432; 2.735548; 17.01000; 2.310000; and 51.87711 respectively while the skewness result reveals that POG2 has long-left tails given the fact that it was skewed to the negative side while other has long right tails given their positive signs. Kurtosis which measures the peakedness of the distribution reveals all the series exhibit flat trajectory (plytokurtic) relative to normal. The Jacque-Bera statistic and its probability values reveal that all the series has normal distributions except the Life Expectancy series with probability value less than 5% threshold. The final position of the descriptive statistics is that the model is well fitted and the residual of the series in the model are normally distributed.

Empirical Analysis

Table 3: Unit Root Testing (ADF) Result

Variables	T-Stat	Critical	1 st Difference		2 ND Dif		Order
			T-Stat.	Critical	T-Stat	C-Value	
LER	-3.655213	-2.921175	-	-	-	-	I(0)
SSER	-1.16364	-2.943427	-5.868584	2.945842	-	-	I(1)
TSER	0.034524	-2.943427	-6.980927	2.945842	-	-	I(1)
POG1	1.794978	-2.960411	-5.632209	-2.960411	-	-	I(1)
POG2	-2.006384	-2.960411	-1.719496	-2.960411	-5.242522	-2.960411	I(2)
POG3	0.848543	-2.960411	-4.388953	-2.960411	-	-	I(1)

Table 4: Unit Root Testing (KPSS) Result

Variables	T-Stat	Critical	1 st Difference		2 ND Dif		Order
			T-Stat.	Critical	T.stat	c.value	
LER	0.896094	0.463000	0.156967	0.463000	-	-	I(1)
SSER	0.731187	0.463000	0.076143	0.463000	-	-	I(1)
TSER	0.775220	0.463000	0.560776	0.463000	0.260776	0.463000	I(2)
POG1	0.431197	0.463000	0.404615	0.463000	-	-	I(1)
POG2	0.404615	0.463000	0.537485	0.463000	0.237485	0.463000	I(2)
POG3	0.518302	0.463000	0.284556	0.463000	-	-	I(1)

In line with conventional procedure, a stationarity test was performed with Augmented Dickey-Fuller (ADF) test and a confirmatory with Kwiatkowski-Phillip-Schmidt Shin (KPSS). KPSS is a mirror opposite of ADF and brought into this analysis to confirm the maximum order of the integration of the series investigated. Mirror opposite in these context means that lower T-statistic than the critical values means stationarity. The unit root test indicates that the series has a different order of integrations I(1), I(2) and I(0) which suggests a complicated situation. The non-stationary series in the model were made stationary after first and second differences in line with the proposition of Box Jenkins (1987). A non-stationary series will be made stationary after first differencing. Thus, the need to apply a modified non-granger causality test developed by Toda and Yamamoto (1995). Toda and Yamamoto (1995) test is a bi-directional causality procedure that allows us determines the causality of series in the model. Toda Yamamoto (1995) is a none granger causality test based on augmented VAR in the form of $K + D_{max}$ which generate asymptotic VAR statistic in the form of the chi-square distribution. A close look at the Unit Root test for ADF and KPSS shows that the highest or maximum order of integration 2 plus lag length 3=5.

Table 5: Lag Selection Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-201.3095	NA	0.002964	11.20592	11.46715	11.29801
1	66.65418	434.5357	1.09e-08	-1.332659	0.495951*	-0.687988
2	117.9289	66.51853	5.61e-09	-2.158318	1.237671	-0.961073
3	186.2543	66.47882*	1.55e-09*	-3.905640*	1.057729	-2.155820*

The table illustrates the lag selection outcome needed for the estimation of Today Yamamoto (1995) non-granger causality test in views. A close look at the result shows that the chosen information criterion according to Akaike Information Criterion is lag length 3. * indicates lag order selected by the criterion. Learning on the position of Akaike information criterion,

the modified non-granger causality test was estimated with the e-views 10, statistical packed at presented below. The chosen lag length will enter into the Toda Yamamoto (1995) non-granger causality equation as K.

Table 6: Toda Yamamoto (1995) Non-Granger Causality Test Result

Dependent variable: LER

Excluded	Chi-sq	df	Prob.
POG1	9.262859	3	0.0260
POP2	12.41238	3	0.0061
POG3	6.276498	3	0.0989
SSER	0.745029	3	0.8626
TSER	6.735993	3	0.0408
All		14	---

Dependent variable: POG1

Excluded	Chi-sq	df	Prob.
LER	117.8099	3	0.0000
POP2	8.633299	3	0.0346
POG3	16.98055	3	0.0007
SSER	11.57071	3	0.0090
TSER	6.056267	3	0.1089
All	181.2276	15	0.0000

Dependent variable: POG2

Excluded	Chi-sq	df	Prob.
LER	5746.966	3	0.0000
POG1	1.893827	3	0.5947
POG3	22.65098	3	0.0000
SSER	13.13006	3	0.0044
TSER	12.05734	3	0.0072
All	10339.68	15	0.0000

Dependent variable: POG3

Excluded	Chi-sq	df	Prob.
LER	136.7954	3	0.0000
POG1	7.963544	3	0.0468
POP2	4.176100	3	0.2431
SSER	9.309532	3	0.0254
TSER	6.707803	3	0.0818
All		14	---

Dependent variable: SSER

Excluded	Chi-sq	df	Prob.
LER	4.809641	3	0.1863
POG1	4.650205	3	0.1993
POP2	2.871334	3	0.4119
POG3	3.611746	3	0.3066
TSER	2.236301	3	0.5248
All		13	---

Dependent variable: TSER

Excluded	Chi-sq	df	Prob.
LER	30.67941	3	0.0000
POG1	4.020521	3	0.2593
POP2	0.765235	3	0.8578
POG3	1.589377	3	0.6618
SSER	1.022303	3	0.7959
All		13	---

Test statistics not available for lag coefficients with restrictions.

To capture the main object of this empirical analysis, Toda Yamamoto (1995) non-granger causality test of the equation $K + D_{max}$ which generated asymptotic VAR statistic in the form of chi-square distribution was estimated. In the Life Expectancy equation, it can be inferred that:

- Increase in POG1 granger cause LER given the fact that the probability value ($0.0260 < 0.05$) less than the threshold 5%. A unit increase in POG1 within the age bracket of 0-14 will emit 9.262859 increase in Life Expectancy rate on average, ceteris paribus. There is a bidirectional causality.
- Increase in POG2 granger causes LER given the statistically significant probability value ($0.0061 < 0.05$). A unit increase in Population growth rate within the age bracket 15 to 64 will emit 12.41238 increase in life expectancy, on average ceteris paribus. This result revealed that there is a bidirectional causality moving from the population within the age bracket 15-64 toward the life expectancy and from life expectancy to POG2. Meaning that an increase in population growth of people within these age bracket will increase life expectancy in Nigeria, all things being equal, and increase in life expectancy will increase POG2 all things being equal.
- Increase in POG3 granger cause LER given the statistically significant probability value ($0.0989 < 0.10$) at a 10% level of significance. An increase in Population Growth Rate within the age bracket 64 and above will emit 6.276498 increases on Life Expectancy, on average, ceteris paribus. There is a bidirectional movement. In capturing the literacy role, it can be inferred that: The coefficients of SSER does not granger cause LER given the insignificant probability value ($0.8626 > 0.05$) above the 5% statistically significant threshold. These to many instance simply that secondary school enrolment proxy for literacy will not cause changes or variation on Life expectancy in Nigeria.

- Tertiary School Enrolment Rate granger cause life expectancy rate given the statistically significant probability value ($0.0408 < 0.05$). an increase in Tertiary Education enrolment will emit 6.735993 increase on Life Expectancy, on average *ceteris paribus*. This to many instances implies that an increase in tertiary school enrolment causes variation in life expectancy rate. It could also mean that increase in Tertiary School Enrolment does equip people with the requisite information needed to promote personal hygiene leading to an improved health status necessary for sustained health longevity.
- Finally, a close look at the six equation shows that there is a bidirectional causality with all the series in the model except the Secondary school enrolment rate (SSER). Meaning that Secondary Education does not guarantee or stimulate the needed knowledge to improve human life. The outcome of this empirical examination conformed to the reality in Nigeria. Graduate of an average secondary school in Nigeria especially the government schools are ill-educated with the basic rudiment for a sustained and healthy living. The outcome of theses empirical investigation supports the endogenous growth theory put forward by Robert Lucas. Robert Lucas in his new endogenous growth model opined that education is a kind of investment which promote economic growth and development. Economic development in this context will be seen from the Human development index perspective which in cooperates life expectancy especially in developing country like Nigeria.

CONCLUSION

The empirical investigation of the impact of population growth rate and literacy rate on life expectancy in Nigeria as estimated using annual time series data source from World bank annual report (2018) and National Bureau of Statistic (NBS, 2018), The following resolution was inferred from the estimation of Toda-Yamamoto (1995) model of granger non-causality test with the equation $k+d_{max}$ which generates asymptotic VAR statistic in the form of the chi-square distribution. In capturing objective one of their empirical analysis, it was succinctly established that there is a bidirectional causality among the dependent variable and the explanatory variables in the equation. Meaning that life expectancy cause changes in population growth rate as well as population growth rate does to life expectancy. The increase in population having positive and significant impact on life expectancy contradicts Solow swan steady-state theory in which they opined that an increase in population growth in a steady state does not affect the growth rate of the per capita variables, given that the rates are equal to zero in steady-state. The outcome of this research work contradicts the position of Ratna and Sari (2016) and Popoola (2018) who in their view believed that population does not impact life expectancy positively. In investigating the mediating effect of Literacy on Life Expectancy, it was inferred that tertiary school enrolment rate is the major determinant of Life Expectancy in Nigeria while secondary school enrolment rate plays insignificant role in molding to that extent. The outcome of this research could be the reason behind the low level of information related to personal hygiene leading to increase in avoidable death amidst higher population growth. Life expectancy is also said to have reacted to the improvement in tertiary education as a proxy for literacy. This to many instances justified the fact that tertiary education is said to be the only level of educational attainment that justified or qualified one to be known or called an educated person. This justified the reason why much attention was given to tertiary education in Nigeria. This is in line with the position of Istaileyeh (2017) and Gilbert et al. (2018).

Finally, Life expectancy in Nigeria is said to have reacted positively to the movement in populations growth rate and tertiary school enrolment rate which to many instances

justified the importance of higher education in Nigeria. It should also be known that the most expected impact on Life expectancy comes from the most active population (age 15-64), and higher institutions enrolment.

Recommendations

Given the above result the study recommends that tertiary education should be tuition free, and 25% of the annual budget should be allocated to education as to increase knowledge and improve the quality of life in Nigeria. This is because increase in knowledge will help to reduce fertility rate and by extension the population, with its attendant consequence on dependency ratio.

REFERENCES

- Adewole, O. A. (2012). The effect of population on economic development in Nigeria: A quantitative assessment. *International Journal of Physical and Social Science*, 2(5), 1-14.
- Currais, L. (2000). *Population, growth and health expenditure*. Department of Economic Analysis, Faculty of Economics, La Coruria University.
- Gilbert, L., Teravainen, A., Clark, C., & Shaw, S. (2018). Literacy and life expectancy in England are linked through the conduits of socio-economic factors and health. *An evidence review exploring the link between literacy and life expectancy in England through health and socioeconomic factors*.
- Hansen, C. W., & Lonstrup, L. (2013). The rise of life expectancy and economic growth in the 20th century. *Discussion Papers on Business and Economics*, 16(5), 234-252.
- Husain, A.R. (2002). Life expectancy in developing countries: Across-section analysis. *The Bangladesh Development Studies*, 28(1/2), 161-178.
- Ilori, I. A., Olalere, S. S., & Babatola, M. A. (2017). An Empirical analysis of public health expenditure on life expectancy: Evidence from Nigeria. *British Journal of Economics, Management and Trade*, 17(4), 1-17.
- Istaiteyeh, R. M. S. (2017). Economic and social factors in shaping Jordan's life expectancy: Empirical analysis (1990-2014). *Advances in Management and Applied Economics*, 7(5), 45-59
- Kalediene, R. & Petrauskiene, J. (2000). Regional life expectancy patterns in Lithuania. *The European Journal of Public Health*, 10(2), 101-104.
- Klasen, S. & Lawson, D. (2007). *The impact of population growth on economic growth and poverty reduction in Uganda* (No.133). Diskussionsbeiträge.
- Low, B. S., Hazel, A., Parker, N., & Welch, K. B. (2008). Influences on women's reproductive lives: Unexpected ecological underpinnings. *Cross-Cultural Research*, 42(7), 201-219.
- Lucas, R. E. (1988). On the mechanics of Economic Development. *Journal of Monetary Economics*, 22, 3-42. [http://doi.10.1016/0304-3932\(88\)90168-7](http://doi.10.1016/0304-3932(88)90168-7)
- Nwosu, C., Dike, A., O., & Okwara, K., K. (2014). The effect of population growth on economic growth in Nigeria. *The International Journal of Engineering and Sciences*, 3(11), 7-18.
- Onwuka, E. C. (2006). Another look at the impact of Nigeria's growing population on the country's development. *African Population Studies*, 21(1), 1-18.
- Popoola, O. T. (2018). Population growth and life expectancy in Nigeria: Issues and further considerations. *Humanities and Social Science Research*, 1(1), 2576-3024.

- Ratna, A. Z., & Sari, L. Z. (2016). Health budgets, human capital, and population growth: Empirical study in Indonesia. *Review of Integrative Business and Economics Research*, 5(1), 357-368.
- Romer, P. M. (1994). The Origins of Endogenous Growth. *The Journal of Economic Perspectives*, 8(1), 3-22. <http://doi:10.1257/jep.8.1.3.JSTOR2138148>
- Todaro, M. P., & Smith, S. C. (2015). *Economic Development* (12 Ed.). Pearson. Harlow.
- United Nations (2019). *World Population Prospects 2019 online edition*. United Nations, Department of Economic and Social Affairs, Population Division.
- United Nations. (2017). *World population prospects: The 2017 revision*. United Nation Department of Economics and Social Affairs.
- Weil, D. N. (2013). *Economic growth*. Pearson Education.
- World Bank (2018). *Doing Business 2018: Reforming to Create Jobs*. Washington, D.C.
- World Health Organization (WHO) (2014). *Ensuring human rights in the provision of contraceptive information and services: Guidance and recommendations*. Geneva: WHO. <http://www.who.int/reproductivehealth/publications/family-planning/human-rights-contraception>