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ECONOMICS OF NIGERIA AND WEST AFRICA POPULATION GROWTH: PANEL ARDL APPROACH FOR WEST AFRICA

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ABSTRACT

The puzzle for the relationship between population growth and economic growth is yet to be concluded and this has generated three school of thought in this area. The first states that population growth relates positively with economic growth, the second states that population growth relates negatively with economic growth and lastly the third states that there is a neutral relationship between population growth and economic growth. This debate necessitated this study to determine the relationship between population growth and economic growth in West Africa and also Nigeria specifically. This study employs the Panel ARDL estimation technique using data which ranges from 1990-2015 for 13 West Africa countries for West Africa and the ordinary least square estimation technique for Nigeria using time series data that ranges from 1981-2015. The Pairwise Dumitrescu Hurlin Panel Causality Test and Granger causality test was also used to determine the direction of the link between population growth and economic growth. The result of the Panel ARDL regression reveals that there is a negative significant relationship between population growth and economic growth both in the short run and long run in West Africa while the OLS regression results shows that there is a positive insignificant relationship between population growth and economic growth in the short run but a negative significant relationship between population growth and economic growth in the long run in Nigeria at 10% significant level. The causality tests results indicated that there is a unidirectional causality link between economic growth and population growth and concluded that it is population growth that causes economic growth.

Contribution/ Originality: This Study contributes in existing literature by applying the Solow growth model and Panel ARDL technique to determine the empirical regional relationship between population growth and economic growth in West-Africa. This study is one of the very few studies who has investigated this relationship employing the panel ARDL estimation technique.

1. INTRODUCTION

1.1. Background of the Study

There have been several opinion from economists regarding how population growth affects the economic growth of a country. Some opined that as population grows, economic growth declines. This is the school of thought to which Thomas Malthus theory evolve from. According to Malthus (1798) there is a universal tendency for the population of a country, unless checked by dwindling food supplies, to grow at geometric rate, doubling every 30 to 40 years. Malthus (1798) pointed out that population tends to grow geometrically, whereas food supplies grow only arithmetically. According to Malthusian model, the causal relationship between population growth and economic growth is bidirectional. On one direction, increasing population hinders economic growth while on the other direction economic growth increases population by bolstering early marriage, increasing birth rate and decreasing death rate. Some also opined that as population grows, economic growth also increases while the third school of thought is that population growth does not affect economic growth. While some economist believes that Population growth is the major driver of economic growth, some believes that population growth combined with other factors drives economic growth. Kuznets, Lewis, Meier and other economists have shown that the growth of population has been an important factor in the growth of "developed" countries (Jhingan, 2007).

The world's population was about a billion in 1800 and rose to 2.5 billion in 1950. In the year 2007 the world's population was 6.7 billion and is projected to rise to 9.2 billion by 2050 with almost all population growth projected to occur in what are now considered less developed regions – Africa, Asia and Latin America (Martin, 2009). Nigeria is also one of the less developed region. The 1991 census figure puts Nigeria's population at about 89 million people with a growth rate of 2.82 percent and total fertility rate of 5.89 percent as revealed by Post Enumeration Survey (PES). In the 2006 National Population Census, Nigeria had a population of 140,003,542 (NBS, 2010).

Nigeria is considered to be one of the fastest growing countries in the world. Nigeria is the most populous nation in sub-Sahara Africa and the tenth most populous in the world. However, the composition of this population is mainly in the youthful category with 49% being youths below the age of 21 and a dependency ratio estimated at 89%. A large proportion of this population favors and is living in the rapidly expanding urban area, presently estimated at over 45.2% and will likely hit 55.4% mark by the year 2015 (United Nations, 2007).

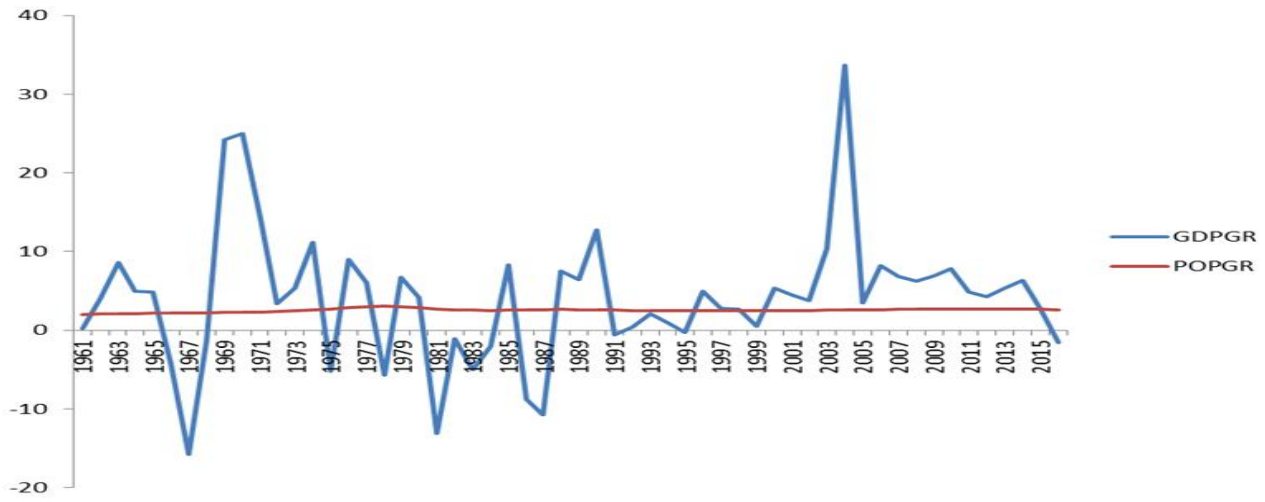


Fig-1. Nigeria Economic Growth and Population Growth

Source: Drawn by the Author With the Aid of Microsoft Excel 2007.

Closely examining Nigeria population growth rate and GDP growth rate over period 1961-2016. It would be observed that Nigeria population growth rate is almost relatively stable between these periods compared to GDP growth rate. Averagely between 1962 and 1979 GDP growth rate is greater than population growth rate. That is,

between 1961 and 1980 averagely the Nigeria economy was growing at a faster rate than population except for 1967 when Nigeria experienced a negative GDP growth rate of -15.74%. Nigeria Civil war which kick started in 1967 contributed to the negative economic growth rate in this particular year. There was a spike in GDP growth rate upward in 1970 which is 25% which might be as a result of government policies aimed at promoting economic growth and development after the Nigeria civil war. After this 1970 spike in economic growth, Nigeria have since experienced economic growth rate of less than 15% until 2004 when economic growth rate rose up to 33.74%. After this 2004 pike in economic growth rate, Nigeria has been experiencing a declining economic growth rate with a relatively stable population growth rate.

1966, 1967, 1968, 1975, 1978, 1981, 1982, 1983, 1984, 1986, 1987, 1991, 1995 and 2016 were periods Nigeria experienced negative economic growth rates according to graph 1. Population growth rates during this period is greater than economic growth rates which means gross domestic product could not sustain the population during this period. This could also mean there was a decline in economic resources/Gross domestic product during this period but a positive and higher population growth rate means population was still increasing. Population increased but GDP growth rate decreased, this implies that economic resources available to satisfy the populate cannot sustain majority of the population. Unemployment would be very high, Per capita income would also experience decrease, contributions of the economic sectors declines and other aspect of Nigeria economic activity would decline sharply during this negative economic growth rate period.

1961-65, 1969-74, 1976, 1977, 1979, 1980, 1988-90, 1992-94, 1996-2015 were periods of positive economic growth rate higher than population growth rate.

1.1.1. Demographic Transition

Demographic transition refers to the transition from high birth rate and high death rate to lower birth rate and lower death rate as a country develops from a developing status to a developed status. This theory was proposed in 1929 by American demographer Warren Thompson, who observed transitions in birth and death rates in industrialized societies for over 200 years. Most developed countries of the world have completed the demographic transition but most developing countries are still in the process of demographic transition. According to the conventional demographic transition theory, there are three main stages of demographic transition:

(1) In stage one, there is a very slow-growing population as a result of combination of high birth rates and almost equally high death rates. At this stage population growth is relatively stable and very slow because the society is constrained by limited availability of food supply, drought and disease and nonexistent of family planning and contraceptives. This stage relates to the Malthusian Population theory.

(2) This Stage is characterized by a fall in death rate which result in population growth. This fall in death rate is as a result of improvement in agricultural yield and improvement in public health to reduce mortality particularly at childhood. Improvement in yield from agricultural practices could be as a result of introduction of new technology and agricultural techniques to boost productivity in the agricultural sector. Overall, at this stage there is a fall in death rate, increase in birth rate and high fertility rate which in turn brings about population growth. Most sub-Saharan countries are at this stage of demographic transition.

(3) Stage 3 is characterized by a fall in birth rate, low death rate and low fertility rate. fall in birth rate and low fertility rate is mostly as a result of introduction of contraceptives but low death rate may be as a result of rising living standard, modernization and improvement of the health sector. Stage three is marked as a stage with population stability. Countries at this stage are at the completion stage of their demographic transition. Most developed countries of the world belong to these stage of demographic transition.

1.1.2. Nigeria Demographic Transition

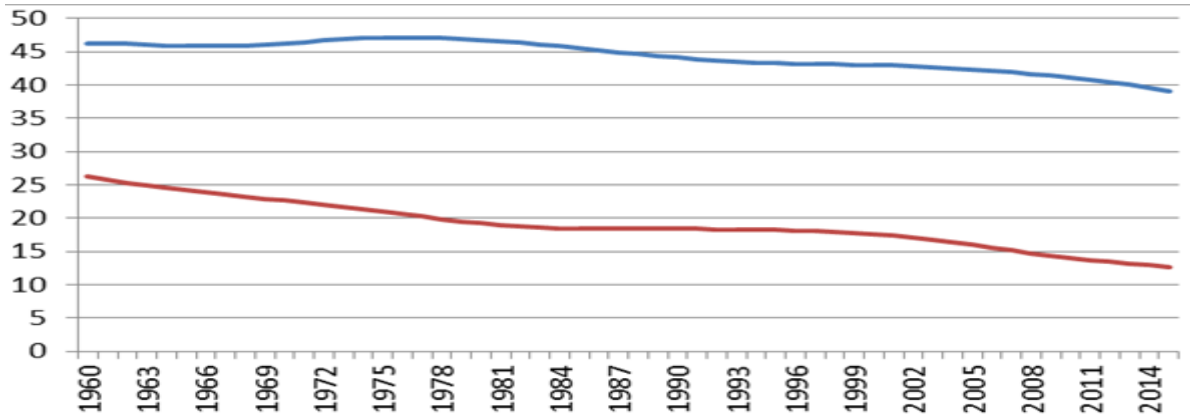


Fig-2. Nigeria Birth rate and Death rate

Source: Drawn by the Author With the Aid of Microsoft Excel 2007.

Blue line represents birth rate and Death rate represents death rate. Relation demographic transition theory to Nigeria population, According to Figure 2, It would be clearly observed that there was a sharp increase in birth rate from a relatively stable birth rate period (1960-1967) to 1968 and birth rate keeps increasing sharply until 1986/1987 when Nigeria experienced a lower birth rate again. On the other hand, between these periods (1960-1987), death rate was on a decreasing trend from 26.18 to 18.41. After these periods, that is between 1988-2016, both birth rate and death rate has been on a decreasing trend too. Fertility rate has also been decreasing over years. Fertility rate has decreased from 6.354 in 1960 to 5.587 in 2015. What this imply is that Nigeria is at verge of completing the second stage of demographic transition. This is because Nigeria is still at the stage of rapid population growth which could be mainly as a result of high fertility rate despite a decreasing fertility rate over time.

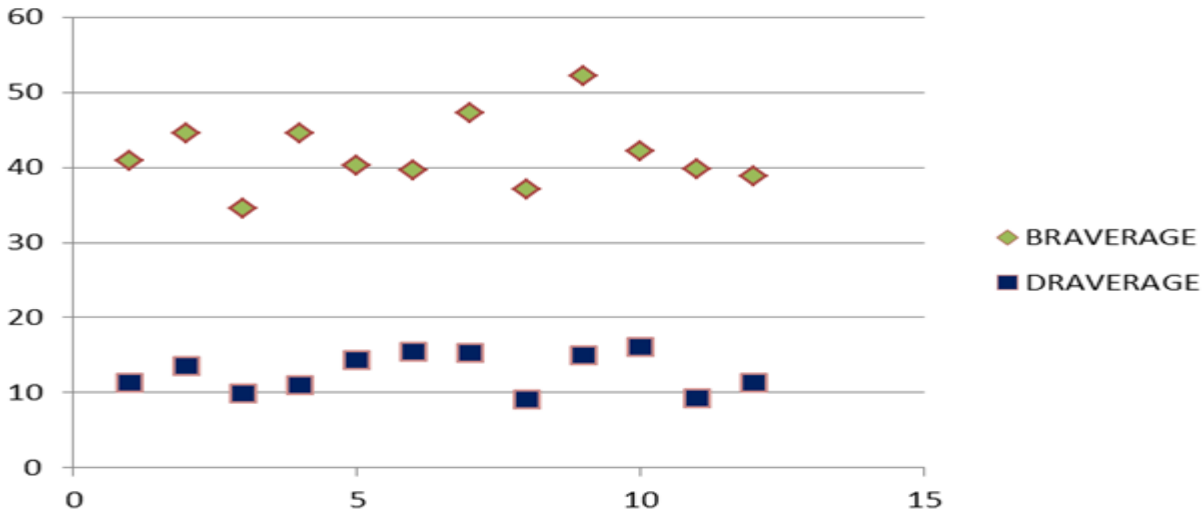


Figure-3. Average Birth and Death Rates of 12 West African Countries (1992-2016)

Source: Drawn by the Author With the Aid of Microsoft Excel 2007.

Figure 2 above shows the average birth rates and birth rates of Nigeria, Benin, Burkina-Faso, Ghana, Gambia, Guinea-Bissau, Cotedvoire, Mali, Mauritania, Niger, Senegal and Togo over year 1992-2016. From the figure, Niger has the highest average birth rate of 52.16 over year 1992-2016, Ghana has the lowest (minimum) average birth rate between 1992-2016. Amongst these twelve West African countries, Nigeria ranks 5th with an average birth rate of 42.11. This means Nigeria compared to these eleven other West Africa countries, has the 5th highest average birth rates amongst these twelve West Africa countries over year 1992-2016. Comparing average birth rate

and average death rates position of these countries reveals that, Niger that ranks as the country with the highest average birth rate ranks as the country with the fourth highest average death rate among the twelve countries. Nigeria that also ranks as the country with the fourth highest average birth rates also ranks as the country with the highest average death rate of 16.06.

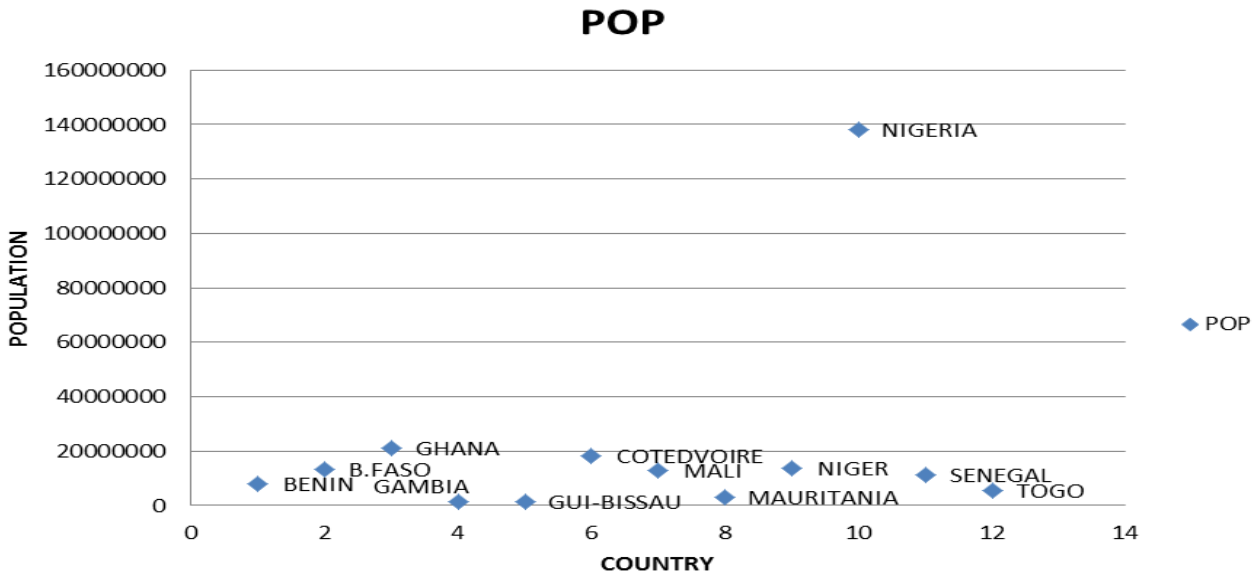


Figure-4. Average Population of Twelve West African Countries (1992-2016)

Source: Drawn by the Author With the Aid of Microsoft Excel 2007.

Comparing Nigeria population with the population of some other eleven West African countries by taking the averages of theses population between years (1992-2016). According to Figure 4, Average population of Nigeria ranks as the highest average population amongst the selected countries while Ghana and Cotedvoire ranks second and third respectively according to Figure 4. This supports the evidence of Nigeria being the first most populous country in Africa. According to Figure 4, Guinea-Bissau ranks as the least populous country amongst these West African countries by comparing their average population between 1992-2016.

1.2. Problem Statement

Series of authors has been working on this phenomenon, economic growth/development and population growth in different countries and yet a consensus has not been arrived at. This has also further generated a debate among several economist over the years which has led to economist dividing themselves into three school of thought concerning this particular research area which are pessimist school of thought, optimist school of thought and the neutralist school of thought.

The pessimist school of thought opines that an increasing population would cause a decline in economic growth. This means that there is a negative relationship between population growth and economic growth as stated by Thomas Malthus in his theory of Population. According to Ehrlich (1968) in his influential book "The Population Bomb" , in his words he stated "The battle...is over". He stated that as population keep increasing, it would get so bad that people would think to start eating the body of their deaths. What this invariably mean is that, as population grows and food production declines or remains unchanged, people would start losing battle to hunger which would cause a decline in productivity per worker and indirectly affects economic growth negatively. Paul Ehrlich work is considered an extension to Robert Thomas population theory.

The optimist school of thought can be traced back to the work of Ester Boserup. Instead of food production determining population as opined by Thomas Malthus, Ester Boserup stated that it is population that determines agricultural method. A major theme in her work that support this argument is that "necessity is the mother of invention". A reasonable explanation to this is, as population keeps growing, necessity to accommodate this

population change motivates the people to create technology that would match economic growth or even make it higher than population growth. Simply, according to the optimists there is a positive relationship between economic growth and population growth.

According to the neutralist school of thought, they believe population growth does not have any significant effect on economic growth.

From past and recent research, a consensus has not been reached. However, in order to contribute to this debate and also try to further examine the relationship that exists between population growth and economic growth in Nigeria and West Africa, this study seeks to fill the knowledge gap in that:

(1) What is the long run and short run relationship between economic growth and population growth of Nigeria and West Africa?

(2) What are the other factors that significantly affect economic growth of West-Africa and Nigeria?

(3) What is the link between population growth and economic growth, Is it unidirectional or bidirectional?

1.3 Objective

The broad objective of this study is to examine the relationship between economic growth and population growth in the Nigeria economy and West Africa as a whole.

The specific objectives of this study are:

(1) To determine the short run and long run relationship between economic growth and population growth in Nigeria economy and West Africa.

(2) To determine the other factors that significantly affect economic growth of the Nigeria economy and West Africa economy.

(3) To determine if the link between economic growth and population growth is unidirectional or bidirectional?

2. LITERATURE REVIEW

2.1. Empirical Review

Malthus (1798) believed that the world's population tends to increase at a faster rate than its food supply. It posits that population grows at a geometric rate while production capacity only grows arithmetically. Therefore, in the absence of consistent checks on population growth, Malthus made the prediction that in a short period of time, scarce resources will have to be shared among an increasing number of individuals. However, such checks that ease the pressure of population explosion do exist, and Malthus distinguished between two categories, the preventive check and the positive check. The preventive check consists of voluntary limitations on population growth. Individuals before getting married and building a family, make rational decisions based on expected income and the quality of life they anticipate to maintain in the future for themselves and their families. The positive check to population is a direct consequence of the lack of a preventive check. When society does not limit population growth voluntarily, diseases, famines and wars reduce population size and establish the necessary balance with resources.

Boserup (1965) found out that population growth is an autonomous factor, which affects agricultural productivity rather than being affected by it, as suggested by the Malthusian school. The study claimed that Malthus' assumption of diminishing returns to labor needs not hold in the long run, as higher population may lead to a more efficient division of labor as well as to improved agricultural practices (signaled by the frequency of cropping). The study concluded that soil fertility should not be viewed as fixed and given by nature, but instead can be improved by substituting the agricultural technology to a better one, which is likely to be a result of an increase in population. Primitive communities with higher population growth rates are more likely to experience economic development, provided that the necessary investment in agriculture is undertaken.

Simon (1987) investigated the long-run benefits of population growth. It discovered that in the short-run, population growth has a negative effect on living standards due to diminishing returns and the temporary burden it

poses on society whereas in the long-run, it has positive effects on living standards due to knowledge advances and economies of scale. Employing a simulation model, the study found out that in the long run (after 30 to 100 years) and when compared to constant-size population, moderate population growth improves standards of livings in developed and developing countries. Specifically, it deduced that in the long run, a growing population tends to advance knowledge, which, in turn, increases productivity and output at a higher rate than that of constant-size population. Nevertheless, a country's optimal policy regarding population growth depends on the weight given to future periods relative to the present. The more weight a country gives to future generations and the more willing a country is for the short run decline in standards of livings, the better it is for that country to pursue a policy of moderate population growth. The long-run benefits of population growth that links to economic development of poor countries are on the positive balance, contrary to conventional wisdom.

Mankiw *et al.* (1992) used a Cobb-Douglas economy-wide production function to investigate the impact of population growth on 'steady state' income per capita as well as on economic growth in the transition to the steady state. They revealed out that an increase in the population growth rate of 10% (e.g. 3% to 3.3%) would reduce per capita income in the steady state by 5%. If, however, one considered human capital to be an additional factor of production (which is eminently reasonable), then the negative impact of population growth is larger as population growth now forces economies to use their scarce savings to equip young people with physical and human capital. As a result, a 1% increase in population growth would decrease per capita income by 2%.

Thirlwall (1993) investigated the relationship between population growth and economic development with special reference to developing economies. The study found out that the relationship between population growth and economic development is a complex one, particularly concerning the cause and effects. Rapid population growth lowers per capita income growth in least developed countries (LDCs), yet there are many ways in which population growth may be a stimulus to progress, and there are many rational reasons why families in developing countries choose to have many children. The study concluded that complexity of the subject is compounded by the fact that, economic development is a multi-dimensional concept. The pace of economic development depends on the diversion of resources from consumption to uses that raise future output. A population with a high ratio of dependents on producers consumes more of a given output and devotes less to investments. Thus, high fertility, which produces a high level of dependency, promotes consumption at the expense of investment.

Porter (1996) employed a Solow-Swan economic growth model with exogenous saving rates to determine 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

$$Y = F(K, L), \quad (2.1)$$

Where Y is total output,

K is total physical capital,

And L is the size of the labor input

The production function exhibits positive and diminishing marginal products with respect to each input and also exhibits constant returns to scale. The economy is assumed to be a one-sector economy, where output can either be consumed or invested and capital depreciates at a constant positive rate (δ). The model further assumes that the population grows at an exogenous rate (n) which is constant over time and the 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

$$L = e^{nt}. \quad (2.2)$$

The net increase in per capita capital is:

$$\dot{k} = sf(k) - (n + \delta)k. \quad (2.3)$$

The first term on the right-hand side (RHS) is saving per capita 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:
$sf(k^*) = (n + \delta)k^*$, $y^* = f(k^*)$ and $c^* = (1 - s)f(k^*)$.

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 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 capital 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 lower standard of living per capita measured either as consumption or in growth of consumption.

Bloom and Williamson (1998) also found that demographic factors are important determinants of economic growth. Their results show that it is not overall population growth rate that drives economic performance but age distribution. The age distribution effect operates through the difference in growth rates of the working-age and the dependent population. The study found that population dynamics explain as much as 1.4% to 1.9% of the GDP per capita growth in East Asia or as much as one-third of the average East Asian miracle GDP per capita growth rate (1.9/6.1). In Southeast Asia, the estimated effect ranges from 0.9% to 1.8% of economic growth or about half (1.8/3.8) of the recorded growth in GDP per capita.

Bloom and Freeman (1988) examined the prospects for economic growth in Nigeria based on a demographic perspective. Using a cross-country growth model, their principal conclusion is that Nigeria has a substantial demographic opportunity on the horizon, though features of Nigeria's economy make capitalizing on this opportunity challenging, Nigeria does have policy options available that can allow it to harness its demographic transition into indefinite sustained growth.

Kothare (1999) studied the relationship between population growth and economic growth and concluded that India has become one of the world's fastest growing countries primarily due to its massive population growth thereby creating a positive effect on its long-run economic growth.

Aniceto and Ernesto (1999) reviewed the Philippines economy and concludes that, rapid population growth Is a critical factor of economic development, however, all or any of the country's development problems cannot be solely blamed on this factor. The prospect for catching up with its neighbors is evidently hampered by the country's rapid population growth.

Becker *et al.* (1999) developed altruistic models of inter-generational transfers where the behaviour of individuals is guided by a utility function that is increasing in own consumption and the utility achieved by one's offspring. The utility of the offspring depends, in turn, on their own consumption and the utility of their offspring. Through this inter-linking chain the current generation consumes and transfers resources to its children influenced by its concern not only for its own children but also for all future generations. An important implication of this model is that familial transfers will neutralize fiscal policy. When a government exercises expansionary fiscal policy it stimulates the economy by increasing current spending financed by issuing debt. From the perspective of intergenerational transfers, the policy is an effort to stimulate spending by transferring resources to current generations from future generations. According to this model however, the public policy is undone by altruistic households. They compensate future generations by increasing their saving and accumulating wealth, exactly offsetting the increase in public debt. This model implied that public intergenerational transfers and private intergenerational transfers are perfect substitutes. Therefore, a positive change in public transfers is matched dollar for dollar by a compensating negative change in private transfers.

Thornton (2001) conducted a research on the long-run relationship between population growth and economic development in seven Latin American countries, namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. Its findings supported the conclusion of Dawson and Tiffin (1998) i.e., "A long-run relation between population and real per capita GDP does not appear to exist; hence, population growth neither causes growth of per capita GDP nor is caused by it". (Thornton, 2001).

Bucci (2003) investigated the existence of a long-run relationship between population (size and growth) and per-capita income focusing on human and physical capital as reproducible inputs. The study found out that population growth exerts a negative effect on economic growth. However, when savings becomes endogenously determined(by individual),population growth can also have a neutral influence on economic growth. The study also extended its analysis to the case where physical and human capital can interact with each other in the production of new human capital and this interaction can either be a substitute or complimentary. When the two types of capital are substitutes for each other in the education sector, the effect of population growth on per-capita income growth is always negative whereas, the impact of population change on real per-capita income growth becomes ambiguous if physical and human capital has a complementary interaction. The resulting intuition is that, for given per-capita physical capital stock, an increase of population causes the aggregate physical capital to rise. If physical and human capital are substitutes for each other (in the sense that the larger amount of physical capital now available in the economy deters the demand and, thus, the consequent supply of human capital), the increase of population size, together with the reduction of the aggregate human capital stock, determines an unambiguous decline of the per-capita level of skills and, via this channel, a lower per-capita income growth rate. On the other hand, if physical and human capital are complementary for each other (the increase in the supply of physical capital spurs the demand and, therefore, the consequent production of new human capital), the final effect on the per-capita level of skills and, hence, on per-capita income growth of an increase in population may be either positive, or negative, or else equal to zero. Long-run per-capita income growth can be positive even without any population change; in equilibrium, both the growth rate and the level of per-capita income are independent of population size; the long-run level of per-capita income is proportional to per-capita human capital.

Oramah (2006) examined the effects of population growth in Nigeria. The study discussed the use of double time growth analysis in the explanation of the need for population control in Nigeria and the potential danger that might emanate from the continuous neglect of environmental issues presented by environmentalists and population demographers in Nigeria and the world at large. Its recommendation was based on the need for Nigeria to learn from China and other countries like Russia, Hungary etc.

Tournemaine (2007) developed a model in which technical progress, human capital, and population interact endogenously and pointed out that population growth could either have a positive or negative impact on economic development. As a result of this, the outcome would depend on the relative contribution of population and human capital to the economy.

Klasen and Lawson (2007) investigated the impact of population growth on economic growth and poverty reduction in Uganda. The paper examined the link between population and per capita economic growth, and poverty, using panel data. The study unraveled theoretical considerations and strong empirical evidence revealing that the currently high population growth puts a considerable break on per capita growth prospects in Uganda. It thereby concluded that measures to assist households with alternative ways to smooth consumption over the life-cycle would clearly assist in reducing fertility.

Furuoka (2009) employed the ARDL bounds test proposed by Pesaran *et al.* (2001) to analyze a long-run relationship between population growth and economic development in Thailand. The findings of this study indicate the existence of a long-run equilibrium relationship between population growth and economic development in Thailand. Also, it showed the existence of a unidirectional causality from population growth to economic development in Thailand. This means that population growth in Thailand has a positive impact on the country's

economic performance. These findings support the population-driven economic growth hypothesis which states that population growth promotes economic development.

Furuoka and Munir (2011) in a joint study found a bilateral causality between population and economic development in an island-state of Singapore. This highlights a dynamic nature of the population-development relationship in the country I. e. Singapore's population growth did contribute to the nation's economic development, which in return stimulated population expansion in the country.

Gideon *et al.* (2013) used Vector Auto Regression model and found that the relationship between population growth and economic growth of Kenya is positive which means an increase in population will have positive effects on the economic growth in the country. Hence, the study concluded that the country's population growth promotes economic growth.

Adediran (2012) investigated the effect of population on economic development in Nigeria from 1981-2007 based on a quantitative assessment. The study used trend analysis spanning from 1981 to 2007. The study adopted ordinary least square estimation technique to analyze the effects of population on economic growth and revealed that population growth has positive and significant impact on economics sustainability proxy as Real Gross Domestic Product (RGDP) and Per Capita Income (PCI). The study concluded that population growth has brought about a vast increase in food requirement.

Dao (2012) carried out a research on population and economic growth in 43 developing countries. The study applied the least-squares estimation technique in a multivariate linear regression. Based on data from the World Bank, it was revealed that the growth rate of per capita GDP is linearly dependent upon population growth, both the young and old dependency ratios and mortality rate. It concluded that the effect of population growth on per capita GDP growth is linear and negative.

Adediran (2012) used ordinary least square method of analysis in examining the relationship between population growth and economic growth of Nigeria. The study discovered that population growth has positive and significant impact on real GDP.

Thuku *et al.* (2013) examined the impact of population change on economic growth in Kenya. The study employed Vector Auto Regression estimation technique and used annual time series data for the period 1963 to 2009. The results indicated the existence of a positive correlation between population growth and economic growths. This implies that an increase in population will impact positively on economic growth in the country. The study concluded that population growth is not responsible for the woes including, famines that besiege the nation, it's rather traceable to inadequacy in government policies.

Tsangyao *et al.* (2014) using bootstrap panel causality test proposed by Kónya (2006) which account for both dependency and heterogeneity across countries, to test the causal link between population growth and economic growth in 21 countries over the period of 1870-2013. With regards to the direction of population growth-economic growth nexus, the study found one-way Granger causality running from population growth to economic growth for Finland, France, Portugal, and Sweden, one-way Granger causality running from economic growth to population growth for Canada, Germany, Japan, Norway and Switzerland, and no causal relationship between population growth and economic growth is found in Belgium, Brazil, Denmark, Netherlands, New Zealand, Spain, Sri Lanka, the UK, the USA and Uruguay. The study also found bidirectional Granger causality between population growth and economic growth in both Austria and Italy. These results suggest that for these two countries the population growth and economic growth both are endogenous, indicating that they mutually influence each other. In other words, while population growth influence economic growth through increase in the labour force, large market and economy of scale, on the other hand economic growth influence population growth through increase in fertility rate, healthcare delivery, decrease mortality rate and improve life expectancy. Their mutual reinforcement has important implications for the conduct of economic or population policies in both Austria and Italy.

3. RESEARCH METHODOLOGY

3.1 Theoretical Framework

3.1.1 Solow Growth Model

$Q = f(K, L)$

$Q...Output$, K...capital, L...Labour

$F_k, F_l > 0, F_{kk}, F_{ll} < 0$

assume linear independence that is constant returns to scale

$\frac{Q}{L} = f(\frac{K}{L}, \frac{L}{L})$

where k = $\frac{K}{L}$, $\frac{Q}{L}$ = Average Productivity of Labour

$Q = Lf(\frac{K}{L}, 1)$

$$\psi(k) = f(\frac{K}{L}, 1) = f(k, 1)$$

$Q = L\psi(k)$

$\psi'(k) = f_k > 0$

$f_{kk} < 0$

$$\text{Re}call : k = \frac{K}{L}$$

applying product rule of differentiation to evaluate, k

$$\frac{dk}{dK} = \frac{L(1) - K(0)}{L^2} = \frac{L}{L^2} = \frac{1}{L}$$

$$f_{kk} = \frac{\partial \psi(k)}{\partial K} = \frac{\partial \psi(k)}{\partial k} \times \frac{\partial k}{\partial K}$$

$$\psi''(k) = \frac{\partial \psi(k)}{\partial k}$$

$$f_{kk} = \psi''(k) \times \frac{1}{L} < 0$$

$Assume : Savings(S) = Investment(I)$

$S = I = sQ$

$\Delta K = I = sQ$

$$\dot{K} = sQ(\equiv \frac{dK}{dt})$$

$$\dot{L} = \frac{dL}{dt} = \lambda L$$

s...savings growth rate, λ...labour force growth rate

$$\frac{\dot{L}}{L} = \frac{dL/dt}{L} = \lambda(\lambda > 0)$$

$$\text{Re}call: Q = L\psi(k)$$

$$\dot{K} = sQ$$

$$\dot{K} = sL\psi(k)$$

$$\text{Re}call: k = \frac{K}{L}, K = kL$$

*d*ifferentiate K with respect to t using product rule

$$\frac{dK}{dt} = \dot{K} = \dot{k}\,L + k\,\dot{L}$$

$$\text{Re}call: \dot{L} = \lambda L$$

$$\dot{K} = L(\dot{k} + \lambda k)$$

$$\text{Re}call: \dot{K} = sL\psi(k)$$

$$sL\psi(k) = L(\dot{k} + \lambda k)$$

*e*lim*inate* L, from both sides

$$s\psi(k) = \dot{k} + \lambda k$$

$$\dot{k} = s\psi(k) - \lambda k$$

Relating this to a simple cobb-douglas function

$$Q = f(K, AL)$$

$$Q = K^{\alpha}(AL)^{1-\alpha}$$

Transform into per capita form

$$\frac{Q}{L} = \frac{K^{\alpha}(AL)^{1-\alpha}}{L}$$

$$\frac{Q}{L} = \frac{K^{\alpha}.A^{1-\alpha}.L^{1-\alpha}}{L}$$

$$\frac{Q}{L} = \frac{K^{\alpha}.A^{1-\alpha}.L.L^{-\alpha}}{L}, q = \frac{Q}{L}$$

$$\frac{Q}{L} = \frac{K^{\alpha}}{L^{\alpha}}.A^{1-\alpha}$$

$$k^{\alpha} = \frac{K^{\alpha}}{L^{\alpha}}$$

$$q = A^{1-\alpha}k^{\alpha}$$

Recall: $\dot{k} = s\psi(k) - \lambda k$, at steady state, $\dot{k} = 0$

$$s\psi(k) - \lambda k = 0$$

$$s\psi(k) = \lambda k,\ sq = \lambda k$$

$$s(A^{1-\alpha}k^{\alpha}) = \lambda k$$

$$\frac{s(A^{1-\alpha}k^{\alpha})}{k^{\alpha}} = \frac{\lambda k}{k^{\alpha}}$$

$$s(A^{1-\alpha}) = \lambda k^{1-\alpha}$$

$$\frac{s}{\lambda}(A^{1-\alpha}) = k^{1-\alpha}$$

$$k = (\frac{s}{\lambda}(A^{1-\alpha}))^{\frac{1}{1-\alpha}}$$

$$k = (\frac{s}{\lambda})^{\frac{1}{1-\alpha}}A$$

Recall: $y = A^{1-\alpha}k^{\alpha}$, substitute k equation in y,

$$y = A^{1-\alpha}((\frac{s}{\lambda})^{\frac{1}{1-\alpha}}A)^{\alpha}$$

$$y = A^{1-\alpha}(\frac{s}{\lambda})^{\frac{\alpha}{1-\alpha}}A^{\alpha}$$

$$y = A^{1-\alpha+\alpha}(\frac{s}{\lambda})^{\frac{\alpha}{1-\alpha}}$$

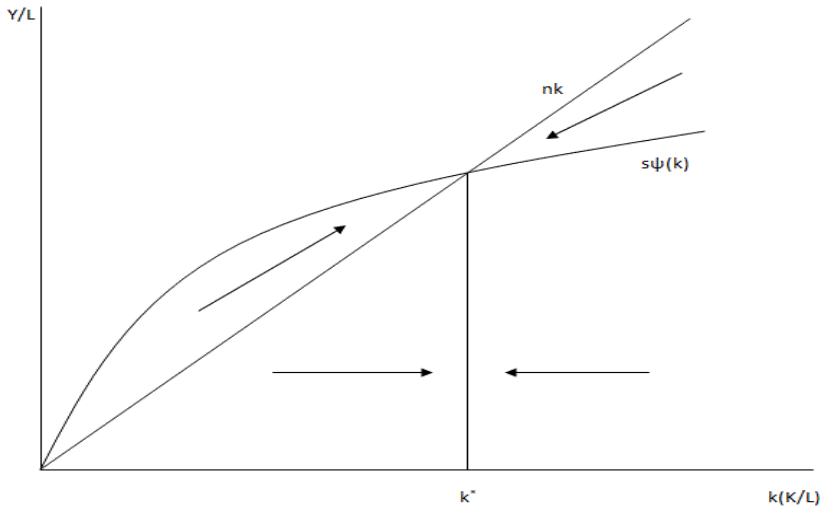
$y = A(\frac{s}{\lambda})^{\frac{\alpha}{1-\alpha}} \rightarrow$ solow growth model equation

This equation relates GDP per capita positively with savings rate and negatively with labour force growth rate/population growth rate. This implies that there is a negative relationship between economic growth and population growth rate.

taking natural logarithm of both sides

$$\ln y = \ln A + \frac{\alpha}{1-\alpha}\ln(s) - \frac{\alpha}{1-\alpha}\ln(\lambda)$$

3.1.2. Solow Growth Model Equilibrium



k^* represents capital per worker at steady state. At steady state, even if k is higher or lower than k^*, the economy would still return to k^* because at this point k^* is at stable equilibrium. From the diagram, to the left of k^* where $k^* > k$, at this point, $s\psi(k) > nk$ and at a non-stable (dynamic) equilibrium , $k^* > 0$. As a result of the stable state of the economy being assumed, the economy would grow towards equilibrium which would increase capital per worker k, to a stable state of capital per worker, k^* .The economy would eventually approach equilibrium state. Also to the right of k^*, $k > k^*$, $s\psi(k) > nk$ and $dK/dt < 0$. To economy would shrink backward to restore the economy back to equilibrium and this would lead to decrease in capital per worker to shrink backward to k^* .

3.2. Methodology

3.2.1. Data

All the data used for this study is sourced from the world bank data base. Data is collected for thirteen West African countries which are Benin, Burkina-Faso, Gambia, Guinea, Guinea-Bissau, Cotedvoire, Mali, Mauritania, Niger, Nigeria, Sierra-Leone, Senegal and Togo for years 1992-2015. Data used for Nigeria specific data analysis is also sourced from world bank data base which ranges from 1981-2015.

3.2.2. Analytical Technique

In order to avoid a spurious regression using a time-series data, statistical properties of the series has to be examined. First step in examining the statistical properties of panel data(used in this study), is to identify the order of integration of the variables to be used by testing if the variables are stationary or not. That is by testing for unit root. If the variables are stationary at level(I(0)) or first difference(I(1)), the Second step is to determine if there is presence of cointegration amongst the variable.

For the panel data analysis, Levin, Lin & Chu t, ADF - Fisher Chi-square and PP - Fisher Chi-square panel unit root tests are used to determine the stationarity of the variables. Pedroni Residual Cointegration test is adopted to test for cointegration. Causality between Gross Domestic Product and Population growth rate is tested using Pairwise Granger causality test. Panel Autoregressive Distributed Lag model estimation technique is used to estimate and examine the short run and long run equation.

For the Nigeria specific time series data analysis, Phillip Perron test would be used to test for unit root while the Johansen cointegration test would be used to test for cointegration among the variables. Ordinary least square estimation technique is used to estimate the long run and error correction model equation for Nigeria.

3.3. Model Specification

Based on Solow Growth Model developed in 1956 which earned Robert Solow a Nobel laureate in 1987, this study would examine the relationship between economic growth and population growth. This model is also considered an extension to Harrod-Domar model developed in 1946. This study adopts this Solow model to examine the relationship between economic growth and population growth.

Based on the adopted model, the model can be specified as:

$Y = f(K , L)$

$$\ln y = \ln A + \frac{\alpha}{1-\alpha}\ln(s) - \frac{\alpha}{1-\alpha}\ln(\lambda)$$

According to Solow growth model, there is a positive relationship between economic growth and saving rate/capital and a negative relationship between economic growth and population growth rate. Gross domestic product(GDP(y)) is proxy to Economic growth, Gross fixed capital formation is proxy to capital(K) while Labor force as a percentage of total population and Population growth rate is proxy to Labor.

$Y = \alpha + \beta_1(K) - \beta_2(L)$

$GDP = \alpha + \beta_1(GFCF) - \beta_2(LF) - \beta_3(PGR)$

$\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 < 0$

GDP---Gross Domestic Product

GFCF--Gross Fixed Capital Formation which is proxy to Capital(K).

LF------Labor Force as a percentage of total population which is proxy to Labor(L).

PGR----Population growth rate which is also adopted as a proxy to Labor(L).

Specifying the equation econometrically:

For Panel data analysis:

$GDP_{it} = \alpha + \beta_1 GFCF_{it} - \beta_2 LF_{it} - \beta_3 PGR_{it} + \varepsilon_t$

ε_t....error term

For Nigeria specific time series data analysis:

$GDP_{it} = \alpha + \beta_1 GFCF_t - \beta_3 PGR_t + \varepsilon_t$

4. RESULTS AND DISCUSSION

4.1. Pre-Estimation Analysis

4.1.1. Descriptive Statistics

1.0. Descriptive Statistics for Panel Data

Table-1. Descriptive Statistics Result For Panel data(1991-2015)

STATISTIC	GDP	LBR	POPR	CAP
Mean	1.70E+10	36.78537	2.795660	2.48E+09
Median	8.28E+09	36.41□29	2.860571	9.20E+08
Maximum	5.28E+10	38.56062	2.955034	8.79E+09
Minimum	3.56E+09	35.87268	2.569687	5.17E+08
Std. Dev.	1.58E+10	0.835453	0.126321	2.69E+09
Skewness	1.088248	0.807226	-0.636871	1.214730
Kurtosis	2.650679	2.332863	1.867769	2.818184
Jarque-Bera	68.43322	42.97564	40.90314	83.58933
Probability	0.000000	0.000000	0.000000	0.000000

Source: computed by the author

Table 1 contains Panel data descriptive statistics which the data is extracted from thirteen countries with a time of 1990-2015 for each countries. All these total to 338 observations for each variable from all the 13 countries.

The average value for Gross Domestic Product data between 1990-2015 for thirteen countries was approximately 17 billion US dollar per year. The maximum value for Gross Domestic Product data was 52.8 billion US dollars while the minimum value was 3.56 billion US dollars. The deviation of the series from the mean is 15.8 billion which implies that deviation of each of the value of the series from the mean was high due to high value of the standard deviation. Measure of asymmetry of Gross Domestic Product data was 1.088248 which means that Gross Domestic Data was positively skewed and is skew to the right. From this value of skewness we can say that Gross Domestic Product data is likely to be normally distributed. Kurtosis value for Gross Domestic data is 2.650679 which shows that it is platykurtic and is relative to normal distribution. Jarque bera test statistic for Gross Domestic Product data implies that computed probability value which is 0.0000 is less than the chosen level of significance 0.05 , this means that we reject the null hypothesis which states that the series was normally distributed. Conclusively, according to jarque bera test statistic confirms that Gross Domestic Product data was not normally distributed.

The average value for Labor force as a percentage of total population(LBT) data between 1990-2015 for thirteen countries was approximately 36.79% . The maximum value for LBT was 38.56% while the minimum value was 35.87%. The deviation of the series from the mean is 0.835453. Measure of asymmetry of LBT data was 0.807226 which implies that LBT was positively skewed and is skew to the right. From this value of skewness we can say that LBT is likely to be normally distributed. Kurtosis value for LBT was 2.332863which shows that it is platykurtic and is relative to normal distribution. Jarque bera test statistic for LBT data implies that computed probability value which is 0.0000 is less than the chosen level of significance 0.05 , this means that we reject the null hypothesis which states that the series was normally distributed. Conclusively, according to jarque bera test statistic confirms that LBT was not normally distributed.

The average value for Population Growth rate(POPR) data between 1990-2015 for thirteen countries was approximately 2.795660%. The maximum value for POPR was 2.955034% while the minimum value was 2.569687%. The deviation of the series from the mean is 0.126321. Measure of asymmetry of POPR data was -0.636871 which implies that POPR was negatively skewed and is skew to the left. From this value of skewness we can say that POPR is likely to be normally distributed. Kurtosis value for POPR was 1.867769 which shows that it is platykurtic and is relative to normal distribution. Jarque bera test statistic for POPR data implies that computed probability value which is 0.0000 is less than the chosen level of significance 0.05 , this means that we reject the null hypothesis which states that the series was normally distributed. Conclusively, according to jarque bera test statistic confirms that POPR data was not normally distributed.

The average value for Gross fixed capital formation which is proxy to capital(CAP) data between 1990-2015 for thirteen countries was approximately 2.48 billion US dollars. The maximum value for CAP was approximately 8.79 billion US dollars while the minimum value was approximately 517 million US dollars. The deviation of the series from the mean was approximately 2.69 billion. Measure of asymmetry of CAP data was 1.214730 which implies that CAP was positively skewed and is skew to the right. From this value of skewness we can say that CAP is likely to be normally distributed. Kurtosis value for CAP was 2.818184 which implies that it is platykurtic and is relative to normal distribution. Jarque bera test statistic for CAP data implies that computed probability value which is 0.0000 is less than the chosen level of significance 0.05 , this means that we reject the null hypothesis which states that the series was normally distributed. Conclusively, according to jarque bera test statistic confirms that CAP data was not normally distributed.

1.1. Descriptive Statistics for Nigeria data

Table-1.1. Descriptive Statistics result for Nigeria-specific data(1981-2015)

STATISTIC	GDP	CAP	POPR
Mean	1.29E+11	1.74E+10	2.579285
Median	4.41E+10	4.14E+09	2.579037
Maximum	5.68E+11	8.57E+10	2.715063
Minimum	1.58E+10	2.02E+09	2.488183
Std. Dev.	1.66E+11	2.51E+10	0.069540
Skewness	1.578676	1.657735	0.167888
Kurtosis	3.987444	4.126839	1.679951
Jarque-Bera	15.95987	17.88225	2.705611
Probability	0.000342	0.000131	0.258514

Source: computed by the author

Table 1.1 contains the descriptive statistics for Gross Domestic Product, Capital which is proxy with gross fixed capital formation and population growth rate for Nigeria with a time frame of 1981-2015 which sum up to 35 observations.

The average value for Gross Domestic Product data between 1981-2015 for Nigeria was approximately 129 billion US dollar per year. The maximum value for Gross Domestic Product data was 568 billion US dollars while the minimum value was approximately 15.8 billion US dollars. The deviation of the series from the mean was approximately 166 billion which implies that deviation of each of the value of the series from the mean was high due to high value of the standard deviation. Measure of asymmetry of Gross Domestic Product data was 1.578676 which means that Gross Domestic Data was positively skewed and was skew to the right. From this value of skewness, we can say that Gross Domestic Product data is likely to be normally distributed. Kurtosis value for Gross Domestic Product data was 3.987444 which shows that it is Leptokurtic and is relative to normal distribution. Jarque bera test statistic for Gross Domestic Product data implies that computed probability value which is 0.000342 is less than the chosen level of significance 0.05 , this means that we reject the null hypothesis which states that the series was normally distributed. Conclusively, according to Jarque bera test statistic confirms that Gross Domestic Product data was not normally distributed.

The average value for Gross fixed capital formation which is proxy to capital(CAP) data between 1981-2015 for Nigeria countries was approximately 17.4 billion US dollars. The maximum value for CAP was approximately 85.7 billion US dollars while the minimum value was approximately 2.02 billion US dollars. The deviation of the series from the mean was approximately 25.1 billion. Measure of asymmetry of CAP data was 1.657735 which implies that CAP was positively skewed and is skew to the right. From this value of skewness we can say that CAP is likely to be normally distributed. Kurtosis value for CAP was 4.126839 which implies that it is Leptokurtic and is relative to normal distribution. Jarque bera test statistic for CAP data implies that computed probability value which is 0.000131 is less than the chosen level of significance 0.05 , this means that we reject the null hypothesis which states that the series was normally distributed. Conclusively, according to Jarque bera test statistic confirms that CAP data was not normally distributed.

The average value for Population Growth rate(POPR) data between 1981-2015 for Nigeria was approximately 2.795660%. The maximum value for POPR was 2.579285% while the minimum value was 2.488183%. The deviation of the series from the mean is 0.069540. Measure of asymmetry of POPR data was 0.167888 which implies that POPR was positively skewed and is skew to the right. From this value of skewness we can say that POPR is likely to be normally distributed. Kurtosis value for POPR was 1.679951 which shows that it is platykurtic and is relative to normal distribution. Jarque bera test statistic for POPR data implies that computed probability value which is 0.258514 is greater than the chosen level of significance 0.05 , this means that we do not reject the null hypothesis which states that the series was normally distributed. Conclusively, according to jarque bera test statistic confirms that POPR data was normally distributed.

4.1.2. Unit Root Test

H_0 There is unit root(non stationary time series)

H_1 There is no unit root(stationary time series)

Table-2. Panel Unit root test

VARIABLE	lm, Pesaran and Shin W-stat		ADF-Fisher Chi-square		PP-Fisher Chi-square	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
GDP	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
CAP	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
POPR	0.0000	0.0000	0.0000	0.0000	0.9219	0.0009
LBR	1.0000	0.0004	1.0000	0.0046	1.0000	0.0000

Source: computed by the author

Table 2.0 shows panel unit root test result. Generally according to the lm, Pesaran and Shin W-stat , ADF-Fisher Chi-square and PP-Fisher Chi-square unit root tests concludes that GDP, CAP, POPR, LBR are all

stationary at first difference. That is we reject null hypothesis(H_0) and conclude that all the variables are stationary at first difference.

According to lm, Pesaran and Shin W-stat , ADF-Fisher Chi-square and PP-Fisher Chi-square unit root tests, GDP was not stationary at level because the calculated probability value from the test statistic is greater than the chosen level of significance(5%). That is 1.0000 is greater than 0.05 hereby we do not reject the null hypothesis that there is presence of unit root at level. After differencing GDP data, it is stationary because the computed probability values from lm, Pesaran and Shin W-stat , ADF-Fisher Chi-square and PP-Fisher Chi-square unit root tests is less than the chosen level of significance(That is 0.0000 which is the computed probability value from all the tests is less than 0.05). Therefore, at first difference we reject the null hypothesis and conclude that GDP data is stationary at first difference.

CAP data is not stationary according to the lm, Pesaran and Shin W-stat , ADF-Fisher Chi-square and PP-Fisher Chi-square panel unit root tests at level because the computed probability values from the panel unit root tests is greater than the chosen level of significance(1.0000 > 0.05). This study conclude that CAP data is stationary at first difference and non-stationary at level. That is, we do not reject the null hypothesis of presence of unit root at level while we reject null hypothesis at first difference.

According to lm, Pesaran and Shin W-stat and ADF-Fisher Chi-square panel unit root tests, POPR data was stationary both at level and at first difference that is we reject the null hypothesis and conclude that there is no unit root. While according to PP-Fisher Chi-square panel unit root test, POPR data is not stationary at level because the calculated probability value from the test is greater than the chosen level of significance(0.9219 > 0.05). POPR data is stationary at first difference because calculated probability value from the test is less than the chosen level of significance(0.0000 < 0.05).

lm, Pesaran and Shin W-stat , ADF-Fisher Chi-square and PP-Fisher Chi-square panel unit root tests all conclude that LBR data is non-stationary at level while it is stationary at first difference.

Phillip Perron Test

Table-2.1. Phillip Peron Unit Test Result

UNIT ROOT TEST	LEVEL(I(0))	FIRST DIFFERENCE(I(1))
GDP	0.9878	0.0001
CAP	0.8949	0.0038
POPR	0.1923	0.0015

Source: computed by the author

Table 2.1 shows the unit root test result for the variables used for Nigeria with a time frame of 1981-2015. According to the Phillip Perron test, GDP, CAP and POPR are all stationary at first difference. That is, the null hypothesis would be rejected at first difference. They are all stationary at first difference because the computed probability value is less than the chosen level of significance(5%).

4.1.3. Cointegration Test

H_0.....No cointegration

H_1.....There is presence of cointegration

Chosen level of significance = 5%

Table-3. Pedroni Residual Cointegration Test Result

COINTEGRATION TEST	Within Dimension (Probability value)		Between Dimension (Probability value)
Panel Rho-Statistic	0.0365	Group Rho-Statistic	0.3516
Panel PP-Statistic	0.0014	Group PP-Statistic	0.0052
Panel ADF-Statistic	0.0000	Group ADF-statistic	0.0000

Source: computed by the author

Table 3.0 contains the Pedroni Cointegration test result. According to the Within dimension aspect of this cointegration tests, Panel Rho-statistic reveals that the null hypothesis is rejected because the computed probability value of this test statistic was less than the chosen level of significance(that is 0.0365 < 0.05). Likewise Panel PP-statistic also reveals that the null hypothesis is rejected because the computed probability value for this test statistic is less than the chosen level of significance(0.0014 < 0.05). Similarly, Panel ADF statistic also supports rejecting null hypothesis. In short Panel rho-statistic, Panel PP-statistic and Panel ADF-statistic reveals that there is presence of cointegration among the variables used for this study(presence of long run relationship between the variables) by rejecting the null hypothesis.

Within dimension aspect of this cointegration test implies that Group PP-statistic and Group ADF-statistic support rejecting null hypothesis because Group PP-statistic computed probability value is less than the chosen level of significance(0.0052 < 0.05) and Group ADF-statistic computed probability value is less than the chosen level of significance(0.0000 < 0.05). While only the Group Rho-statistic states that we do not reject the null hypothesis because the computed probability value from the test statistic is greater than the chosen level of significance(0.3516 > 0.05). Summarily, Group PP-statistic and Group ADF-statistic supports the evidence of the presence of cointegration while the Group Rho-statistic predicts absence of cointegration.

Conclusively, according to the six test statistic of the Pedroni Residual cointegration test highlighted in Table 3.0, five supports rejecting null hypothesis. We can conclude that, there is presence of cointegration among variables employed in this study by rejecting the null hypothesis(H_0).

Johansen cointegration Test result

Unrestricted Cointegration Rank Test (Trace)

Table-3.1. Johansen Cointegration Test Result(Trace)

Hypothesized No of cointegrating equation	Eigenvalue	Trace Statistic	0.05 Critical values	Probability value
None *	0.590745	37.38270	29.79707	0.0055
At most 1	0.211533	7.899932	15.49471	0.4761
At most 2	0.001726	0.057002	3.841466	0.8113

Source: computed by the author
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Table-3.2. Johansen Cointegration Test Result(Maximum eigenvalue)

Hypothesized No of cointegrating equation.	Eigenvalue	Max. Eigen Statistic	0.05 Critical values	Probability value
None *	0.590745	29.48276	21.13162	0.0027
At most 1	0.211533	7.842930	14.26460	0.3949
At most 2	0.001726	0.057002	3.841466	0.8113

Source: computed by the author
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

According to the result of Johansen cointegration test in both table 3.1 and table 3.2, there is an evidence of the presence of cointegration. Table 3.1 shows the Unrestricted Cointegration Rank Test (Trace) while table 3.2 shows Unrestricted Cointegration Rank Test (Maximum Eigenvalue) generated from the Johansen cointegration test. Both the Trace and Maximum Eigenvalue test indicates one cointegrating equations at 0.05(5%) level. This denotes the rejection of the null hypothesis and conclude that there is presence of cointegration among the variables used for the Nigeria data analysis. According to the Unrestricted Cointegration Rank Test (Trace), the null hypothesis is rejected because the probability value of the number of cointegrating equation is less than 0.05(5%) level(0.0055 < 0.05) but the other probability values under at most 1 and at most 2 are greater than 0.05(0.4761 > 0.05, 0.8113 > 0.05) hence it indicates the presence of one cointegrating equation. While according to Unrestricted Cointegration Rank Test (Maximum Eigenvalue), the null hypothesis is also rejected because the probability value of the number of cointegrating equation is less than 0.05(5%) level(0.0027 < 0.05) but the other probability values under at most 1 and at most 2 are greater than 0.05(0.3949 > 0.05, 0.8113 > 0.05) hence it indicates the presence of one cointegrating equation.

4.2. Estimation and Interpretation of Result

4.2.1. For West Africa

4.2.1a. GDP Panel ARDL Model (4, 4 , 4 , 4)

Table-4. GDP Panel ARDL Model(4 , 4 , 4 , 4) Result

Variables	Coefficient	Standard Error	T-statistic	Prob value
LONG RUN EQUATION				
LBR	-0.473045	0.151885	-3.114501	0.0023
CAP	0.692283	0.071993	9.616013	0.0000
PGR	-0.194405	0.092679	-2.097616	0.0381
SHORT RUN EQUATION				
ECT	-0.714937	0.004501	-158.8503	0.0000
DLOG(GDP(-1))	-0.575943	0.005170	-111.3995	0.0000
DLOG(GDP(-2))	-0.431957	0.003735	-115.6593	0.0000
DLOG(GDP(-3))	-0.484850	0.002240	-216.4802	0.0000
D(LBR)	0.985378	0.004853	203.0383	0.0000
D(LBR(-1))	1.378989	0.004566	301.9901	0.0000
D(LBR(-2))	1.139480	0.004767	239.0200	0.0000
D(LBR(-3))	2.657528	0.005878	452.0798	0.0000
DLOG(CAP)	-0.378279	0.000874	-432.8344	0.0000
DLOG(CAP(-1))	0.021992	0.000538	40.86942	0.0000
DLOG(CAP(-2))	0.003413	0.000373	9.144190	0.0028
DLOG(CAP(-3))	0.173948	0.000431	403.5368	0.0000
D(PGR)	-11.29191	0.205290	-55.00466	0.0000
D(PGR(-1))	16.16471	0.542745	29.78324	0.0001
D(PGR(-2))	-14.27015	0.298855	-47.74946	0.0000
D(PGR(-3))	9.249095	0.045424	203.6175	0.0000
C	18.64996	2.235685	8.341947	0.0036

Source: computed by the author

Table 4.0 shows the ARDL model result of the Panel data analysis indicating the short run and long run equations. The chosen level of significance is 5%. The optimal lag for this model was selected using the Schwartz Bayesian Information Criterion (SBIC). The optimal lag selected based on the minimum Schwartz Bayesian Information Criterion of all variables used in this study is four(4). It should also be noted that GDP and CAP are in it log terms.

Long Run Equation Discussion

According to the Long run equation in Table 4.0, Labor force as a percentage of Total population(LBR) proxy to Labor, Capital(CAP) and Population growth rate(PGR) were all statistically significant in the long run. That is, Total population(LBT) proxy to Labor, Capital(CAP) and Population growth rate(PGR) were all significant factors that affect Gross domestic product(proxy to economic growth) in the long run according to the estimation result.

According to Table 4.0, there was a negative significant relationship between economic growth and labor force rate(LBR). That is, there was a negative significant relationship between GDP and LBR in the long run. Furthermore, this signifies that if there was an increase in Labor force rate(LBR) in the long run, there would be a decline in economic growth in the long run and if there was a decrease in Labor force rate, this would lead to an increase in economic growth. Since the relationship between labor force rate and economic growth was a significant one, this means that labor force has a significant effect on economic growth but a negative effect. Labor force has a significant effect on economic growth because the computed probability value for LBR which is 0.0023 is less than the chosen level of significance which is 0.05 (0.0023 < 0.05). This supports the evidence of a negative relationship between economic growth and labor force rate opined by the Solow growth model. We can conclude that there is a negative significant relationship between labor force rate and economic growth in West Africa. However, if there is a 1% increase in Labor force rate, there would be 0.473045% decrease in Economic growth(GDP) while if there is a 1% decrease in Labor force rate, there would be 0.473045% increase in Economic growth(GDP).

Table 4.0 also reveals that capital(CAP) has a significant effect on economic growth(GDP) in the long run. That is, CAP has a statistically significant effect on GDP in the long run. But this significant effect is positive. This alternatively mean that CAP has a positive significant effect on GDP in the long run. Furthermore, this implies that in the long run if there is an increase CAP(produced capital), an increase in economic growth(GDP) would be the resulting effect while if there is a decrease in CAP(capital), a decrease in economic growth would be the resulting effect. The positive relationship between CAP(capital) and GDP is statistically significant because the computed probability value of the coefficient of CAP is less than the chosen level of significance(0.000 < 0.05). The T-statistic and standard error test of significance also support this argument because the T-statistic calculated value for the coefficient of CAP is greater than the T table value at 5%(9.616013 > 1.65) while the standard error of CAP coefficient is less than the coefficient of CAP divided by two(0.151885 < 0.3461415). However, a 1% increase in CAP (produced capital) would lead to 0.692283% increase in economic growth(GDP) while a 0.692283% decrease in economic growth(GDP) would be a resulting effect to a 1% decrease in CAP(produced capital). We can now conclude that in the long run there is a positive significant relationship between CAP(produced capital) and economic growth(GDP) in West Africa.

In the long run at West Africa according to Table 4.0, there is negative relationship between population growth and economic growth. The effect of population growth on economic growth is considered a significant effect. This means population growth has a negative statistically significant effect on economic growth(GDP). The relationship between population growth(POPR) and economic growth(GDP) is statistically significant because the computed probability value of the estimated coefficient of POPR(population growth) is less than the chosen level of significance(0.0381 < 0.05). The statistically significant relationship between POPR(population growth) and GDP(economic growth) is also supported by the T-statistic and standard error test of significance. This is because the T-statistic calculated absolute value for the coefficient of POPR(population growth) is greater than the T table value at 5%(|-2.097616| > 1.65) while the standard error of POPR coefficient is less than the coefficient of POPR divided by two(0.092679 < 0.0972025). A 1% increase in population growth(POPR) would lead to 0.194405% decrease in economic growth(GDP) while a 0.194405% increase in GDP(economic growth) is the resulting effect of a 1% decrease in POPR(population growth rate). We can now conclude that in the long run, there is a negative significant relationship economic growth and population growth. This result also support the prediction of the

Solow growth model that there is a negative relationship between labor growth(proxy by population growth) and economic growth.

Summarily, the results from Table 4.0 indicates that in the long run there is a significant negative relationship between economic growth and labor rate(LBR), economic growth and population growth(POPR) while there is a positive relationship between produced capital invested in the economy(CAP) and economic growth in West Africa.

Short Run Equation Discussion

The second part of Table 4.0 reveals the short run equation. One important variable that majorly differentiate it from the long run equation is the error correction term(ECT). In the short run according to estimation result shown in Table 4.0, labor force rate(LBR), gross fixed capital formation proxy to produced capital(CAP) and population growth(POPR) has a significant effect on economic growth(GDP). The chosen level of significance here too is 5%. Also note that all the variables in the short run equation are differenced of first order(I(1)).

In the short run according to Table 4.0, there is a positive relationship between labor force rate(LBR) and economic growth(GDP) in West Africa. It is also observed that LBR is statistically significant in the short run that is there is a positive statistically significant relationship between LBR and GDP in the short run. It is a significant relationship because according to the estimation result in Table 8 the probability value for the estimated coefficient of labor force rate is less than the chosen level of significance(0.0000 < 0.05). The T-statistic and standard error test of significance also reveal similar result of significant relationship between GDP and LBR. Absolute value of the computed T-statistic is greater than the T-statistic table value at 5%(203.0383 > 1.65). The computed standard error of the coefficient of LBR in the short run is less than half the coefficient of LBR(0.004853 < 0.492689). A reasonable explanation to this significant positive relationship between labor force rate(LBR) and economic growth(GDP) can be related to the Malthusian theory of population. In the short run as postulated by Malthus population would still be accommodated by the available food in the economy, hence, in this case as population is increasing output per person would also increase. But in the long run, food production would be growing arithmetically while population would be growing geometrically and as a result since population is growing faster than food production then there would be a decline in economic growth. Relating this Malthusian population theory to the significant positive relationship between LBR(labor force rate) and economic growth, in the short run as revealed by Table 8 increasing labor force would lead to an increase in per capita output and per capita income and this in turn would lead to a boost in the economic growth of West Africa. A 1% increase in labor force rate(LBR) would result in 0.985378% increase in economic growth while a 0.985378% decrease in economic growth(GDP) is a result to the 1% decrease in labor force rate. We can now conclude from the result in Table 8 that in the short run, there is a positive significant relationship between economic growth (GDP) and labor force rate(LBR) in West Africa.

Furthermore, according to Table 4.0, produced capital (CAP) has a negative effect on economic growth(GDP) of West Africa. That is, there is a negative short run relationship between CAP and GDP in West Africa. The negative relationship between CAP and GDP in the short run is a significant relationship. This invariably means that CAP has a statistically significant negative effect on economic growth(GDP). We can say CAP has a significant effect on GDP because the computed probability value of the estimated coefficient of CAP is less than the chosen level of significance (0.0000 < 0.05). T-statistic and standard error tests of significance also support the significant effect of CAP on GDP. From the T statistic, the absolute value computed T-statistic value of the coefficient of CAP is greater than the T-statistic table value at 5%(|-432.8344| > 1.65). While from the standard error test of significance, the standard error of the coefficient of CAP is less than absolute value of half the coefficient of CAP(0.000874 < |-0.1891395|). A 1% increase in CAP would result in 0.378279% decrease in GDP(economic growth) while a 0.378279% increase in GDP(economic growth) is the resulting effect of 1% decrease in CAP.

Conclusively, in the short run, there is a negative significant relationship between GDP(economic growth) and CAP(produced capital) in West Africa.

Additionally, according to Table 4.0, there is negative relationship between population growth(POPR) and economic growth(GDP) in the short run in West Africa. That is, population growth has a negative effect on economic growth in the short run. The effect of population growth on economic growth according to Table 8 is statistically significant. In short, there is a negative significant relationship between population growth(POPR) and economic growth(GDP) in the short run according to the short run estimation result. According to the estimation result, we can say there is a statistically significant relationship between population growth and economic growth in the short run because the estimated probability value for economic growth(GDP) is less than the chosen level of significance($0.0000 < 0.05$). The T-statistic and standard error tests of significance also support that POPR is statistically significant. This is because the absolute value for the T-statistic computed value for the coefficient of POPR is greater than the T-statistic table value at the chosen level of significance(5%)($|-55.00466| > 1.65$) while on the other hand, because the standard error of the estimated coefficient of POPR is less than half the absolute value of the coefficient of POPR($0.205290 < |-5.645955|$). A 1% increase in population growth(POPR) would decrease economic growth by 11.29191% in the short run while a 1% decrease in population growth results to 11.29191% increase in economic growth(GDP) in the short run at West Africa according to the estimation result in Table 4.0. We can then conclude that in the short run, there is a negative significant relationship between population growth and economic growth in West Africa.

Examining and checking the Error Correction Term in the Short run equation to confirm if the conventional three conditions of Error Correction Term exists:

(1) The error correction term(-0.714937) in the short run equation in Table 4.0 is statistically significant.

(2) The error correction term(-0.714937) is negative.

(3) T he absolute value of the error correction term($|-0.714937| = 0.714937$) is less than one.

Ascertaining that the error correction term(ECT) meets the three condition, the coefficient of the error correction term indicates that about 71.49% of disequilibrium was corrected within one year in West Africa. That is the rate or speed of adjustment from short-run disequilibrium to long run equilibrium is 71.49%. This invariably means it would take the system approximately 17 months to adjust from short run disequilibrium to long run equilibrium and be steady state once again in West Africa.

Conclusively, according to both short run and long run equation in Table 4.0, there is a negative significant relationship between population growth and economic growth in both short run and long run in West Africa. That is, in West Africa according to the result population growth has a negative significant effect on economic growth both in the short run and in the long run. This result is consistent with Dao(2012) who carried out a research on population growth and economic growth too using data from 43 developing countries and concluded that there is a negative relationship between population growth and economic growth. On the other hand, there is a positive significant relationship between produced capital and economic growth in the long run but a negative significant relationship in the short run in West Africa. For labor force rate, there is a negative significant relationship between labor force growth rate and economic growth in the long run but a positive significant relationship between labor force growth rate and economic growth in the short run in West Africa.

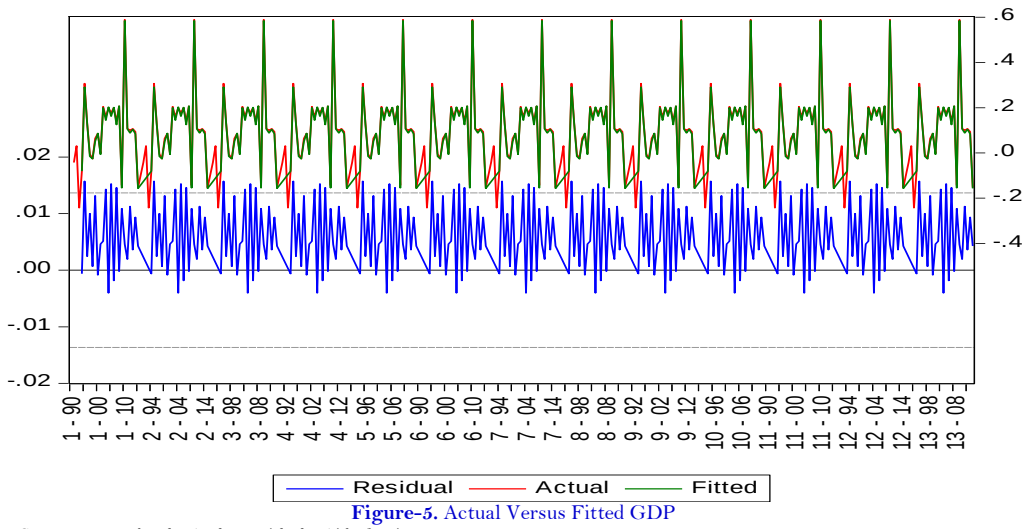


Figure-5. Actual Versus Fitted GDP

Source Drawn by the Author With the Aid of Eviews 7.0.

The blue line represents the residual for the panel ARDL equation, red line represents actual GDP of the 13 West Africa countries and the green line represents the GDP predicted by the panel ARDL equation.

Figure 5 shows the graphical representation of actual GDP and fitted GDP values by the Panel ARDL model. The graph shows there is strong similarities between actual GDP and predicted GDP by the panel ARDL model for the 13 West Africa countries. That is the panel ARDL model almost perfectly predict the actual GDP of the 13 countries. In short, this means that the panel ARDL model equation has a strong predictive power.

4.2.1b. Pairwise Dumitrescu Hurlin Panel Causality Test

Table-4.1. Pairwise Dumitrescu Hurlin Panel Causality Test Result

PAIRWISE DUMITRESCU HURLIN PANEL CAUSALITY TEST			
Null hypothesis	**W-stat**	**Zbar-Stat**	**Probability value**
POPR does not homogeneously cause GDP	4.71296	3.55099	0.0004
GDP does not homogenously cause POPR	1.96301	0.39024	0.6954

Source: computed by the author

Table 4.1 shows Pairwise Dumitrescu Hurlin Panel Causality Test result for economic growth(GDP) and Population growth(POPR). The test results reveals that the null hypothesis of POPR(population growth) does not homogenously cause economic growth(GDP) is rejected because the computed probability value is less than the chosen level of significance($0.004 < 0.05$) which means that it is population growth that causes economic growth. While on the other hand, the null hypothesis of economic growth(GDP) does not homogenously cause population growth(POPR) is not rejected because the computed probability value is greater than the chosen level of significance($0.6954 > 0.05$) which means that it is population growth that causes economic growth. Conclusively, the test reveals that the relationship between population growth(POPR) and economic growth(GDP) in West Africa is unidirectional that is it only moves in one direction. That is, it is population growth that homogenously cause economic growth in West Africa.

4.2.2. For Nigeria

Table-4.2. Long Run Equation

REGRESSORS	COEFFICIENT	STANDARD ERROR	T-STATISTIC	PROBABILITY VALUE
C	10.00700	2.656364	3.767179	0.0007
LOG(CAP)	0.983833	0.087821	11.20273	0.0000*
POPR	-2.900868	1.541301	-1.882090	0.0689**
R^2 = 0.892986 , Adjusted R^2 = 0.886298, Prob(F-statistic) = 0.00000				

** statistically significant at 5%*
*** statistically significant at 10%*
Source: computed by the author

DEPENDENT VARIABLE: LOG(GDP)

Chosen level of significance = 5%, 10%

Table 4.2 shows the long run estimation result for Nigeria. Table 4.2 shows that in the long run, there is a negative relationship between economic growth and population growth.

According to Table 4.2, in the long run there is a negative significant relationship between economic growth(GDP) and population growth(POPR) in Nigeria at 10% significant level. This indicates that if there is an increase in population growth, there would be a decrease in economic growth and if there is a decrease in population growth, there would be an increase in economic growth. However, we can conclude that there is a statistically significant negative relationship between population growth(POPR) and economic growth(GDP) at 10% significant level because the computed probability value is less than 10% significant level(0.0689 < 0.10). A 1% increase in population growth(POPR) would lead to 2.900868% decrease in economic growth(GDP) while a 2.900868% increase in GDP(economic growth) is the resulting effect of a 1% decrease in POPR(population growth rate).

Table 4.2 also reveals that in the long run, there is a positive significant relationship between economic growth(GDP) and produced capital(POPR) in Nigeria. This indicates that an increase in economic growth is the resulting effect of an increase in capital while a decrease in capital would lead to a decrease in economic growth. We can conclude that there is a statistically significant positive relationship between capital(CAP) and economic growth(GDP) in the long run because the computed probability value is less than the chosen level of significance(0.0000 < 0.05, 0.0000 < 0.10). A 1% increase in capital(CAP) would lead to 0.983833% increase in economic growth(GDP) while a 0.983833% decrease in GDP(economic growth) is the resulting effect of a 1% decrease in CAP(capital).

The Adjusted R^2 value of 88.63% signifies the predictive power of the equation. This means that 88.93% variation in economic growth is explained by capital(CAP) and population growth(POPR). Probability value of the F-statistic indicates the overall significance of the model. The probability value of the F statistic is less than the chosen levels of significance which signifies that the model is statistically significant.

Conclusively, in the long run capital(CAP) significantly affects economic growth(GDP) positively while population growth(POPR) significantly affects economic growth(GDP) negatively at 10% significant level but it an insignificant factor at 5% significant level in Nigeria.

Table-4.3. Short Run Equation

Regressors	Coefficient	Standard Error	T-Statistic	Probability Value
C	0.038828	0.027296	1.422484	0.1652
DLOG(CAP)	0.737730	0.118666	6.216839	0.0000
D(POPR)	1.752690	1.177359	1.488662	0.1470
ECT(-1)	-0.276394	0.127725	-2.163974	0.0386
R^2 = 0.654159 , Adjusted R^2 = 0.619575 , Durbin Watson stat = 2.070911, Prob(F-statistic) = 0.0000				

Source: computed by the author

DEPENDENT VARIABLE: LOG (GDP)

Chosen level of significance = 5%

Table 4.3 shows the short run equation estimation result for Nigeria with the error correction term inclusive.

Table 4.3 shows that there is a positive relationship between economic growth(GDP) and capital(CAP), population growth(POPR) in the short run. We can further state that there is a positive significant relationship between economic growth (GDP) and capital(CAP) while on the other hand, there is a positive insignificant relationship between population growth(POPR) and economic growth(GDP) in Nigeria.

In the short run according to table 4.3 population growth is considered an insignificant factor affecting economic growth in Nigeria because the computed probability value is greater than the chosen level of significance(0.1470 > 0.05). However, it can be stated that in the short run there is a positive insignificant relationship between economic growth and population growth that is either an increase or decrease in population growth would have little or no effect on economic growth in Nigeria.

There is also a positive relationship between capital(CAP) and population growth(POPR) but a significant one because the computed probability value is less than the chosen level of significance(0.0000 < 0.05). A 1% increase in capital(CAP) would lead to 0.737730% increase in economic growth(GDP) while a 0.737730% decrease in GDP(economic growth) is the resulting effect of a 1% decrease in CAP(capital).

Durbin Watson statistic also confirms that there is little or no presence of autocorrelation because the durbin watson stat value(2.07091) is less than 2.5. Adjusted R^2 value also indicates that 65.42% of variation in Nigeria economic growth(GDP) according to the model is explained by POPR and CAP.

Examining and checking the Error Correction Term in the Short run equation to confirm if the conventional three conditions of Error Correction Term exists:

(1) The error correction term(-0.276394) in the short run equation in Table 4.3 is statistically significant.

(2) The error correction term(-0.276394) is negative.

(3) T he absolute value of the error correction term(|-0.276394| = 0.276394) is less than one.

Ascertaining that the error correction term(ECT) meets the three condition, the coefficient of the error correction term indicates that about 27.64% of disequilibrium was corrected within one year in Nigeria. That is the rate or speed of adjustment from short-run disequilibrium to long run equilibrium is 27.64%. This invariably means it would take the system approximately 43 months to adjust from short run disequilibrium to long run equilibrium and be steady state once again in Nigeria.

Conclusively, there is a positive significant relationship between economic growth(GDP) and capital(CAP) in both long run and short run in Nigeria at both 5% and 10% significance level. On the other hand, there is a negative significant relationship between population growth(POPR) and economic growth(GDP) at 10% significance level in the long run but a positive insignificant relationship between population growth and economic growth in the short run.

Table-4.4. Short Run Post-Estimation Test

Test Statistic	F-Statistic(Probability Value)	Conclusion
SERIAL CORRELATION (Breusch-Godfrey Serial Correlation LM Test)	2.165767(0.1335)	0.1335 > 0.05, 0.649 > 0.05...accept H_0 that is there is no serial correlation
NORMALITY (Jarque-bera test Statistic)	2.027051(0.3629)	0.3629 > 0.05...accept H_0 that is the residuals are normally distributed
HETEROSCEDASTICITY (Breusch-Pagan-Godfrey Heteroskedasticity Test)	2.005359(0.1344)	0.1344> 0.05,...accept H_0 that is there is no evidence of heteroscedasticity.

Source: computed by the author

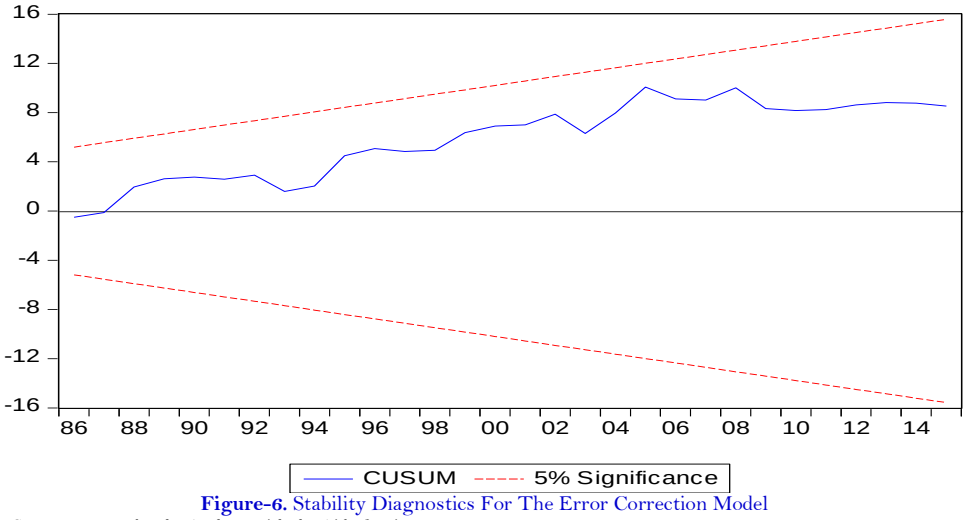


Figure-6. Stability Diagnostics For The Error Correction Model

Source: Drawn by the Author With the Aid of Eviews 7.0.

The cumulative sum of residuals test for stability signifies that the model is stable over time that is between 1982 and 2015 because the blue line falls within the two red line. That is at 5% significance level , CUSUM test for stability signifies that the Error Correction Model is stable between the period of 1982 and 2015.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

To accomplish the objectives of this study and filling the knowledge gap which this study aims to fill, the main findings of this study from the estimation results can be summarized below:

(1) According to the GDP panel ARDL regression equation, in the short run there is a negative significant relationship between Economic growth(GDP) and population growth(PGR), produced capital(CAP) in West Africa. On the other hand, in the long run there is also a negative relationship between economic growth and population growth in West Africa. On the other hand, in Nigeria there is a negative significant relationship between economic growth(GDP) and population growth(POPR) at 10% significance level in the long run but a positive insignificant relationship between economic growth(GDP) and population growth(POPR) in the short run.

(2) Other factors that significantly influences economic growth of West Africa and Nigeria includes Capital(CAP) and Labor force growth rate(LBR) both in the short run and long run. In the short run there is a positive significant relationship between economic growth(GDP) and labor force growth(LBR) while there is a negative significant relationship between economic growth(GDP) and capital(CAP) in West Africa. In the long run, labor force growth rate(LBR) has a negative significant effect on economic growth(GDP) while capital(CAP) has a positive significant effect on economic growth(GDP) in West Africa. On the other hand, in Nigeria there is a positive significant relationship between capital(CAP) and economic growth(GDP) both in the short run and long run.

(3) The Pairwise Dumitrescu Hurlin Panel Causality Test reveals that population growth homogenously cause economic growth that is there is a unidirectional causal relationship between population growth and economic growth in West Africa. The granger causality test reveals that population growth(POPR) granger cause economic growth(GDP) that is the link between economic growth(GDP) and population growth(POPR) is unidirectional in Nigeria. Conclusively, there is a one way link between population growth and economic growth both in West Africa and Nigeria.

5.2. Recommendations

Based on the result from the findings of this study, population control measure can be put in place in West Africa. This would help increase food and other resources available per populate and this would help drive economic growth and also would reduce pressure on the limited available resources. Technological advancement in West Africa can also help absorb population growth in West Africa. Introduction of Technology to different sector of West Africa economy would increase productivity in these sectors and this would also boost economic growth. There should be a reduction in capital flight by providing a conducive environment for investment free from political instability, war, corruption and economic instability, so as to ensure more capital is pumped into the West African economy and more capital translates to increase in economic growth of West Africa in the long run. There should also be an investment in human capital through education and training, this would increase the availability of highly skilled labor and also the technical productivity of workers. As a result, this leads to boost in efficiency of labor and this translates to boost in economic growth of West Africa. Tax holiday can be given to indigenous industries and basic infrastructural facilities such as electricity, water, good road network and good communication sector can also be provided to increase the productivity and efficiency of local industries and also encourage foreign industries investment in West Africa. On the other hand, in Nigeria, there should be provision of basic infrastructure to boost investment which would as a result boost economic growth. Awareness should also be made concerning family planning techniques and contraceptive technology so as to control population growth in Nigeria in the long run. This would also prevent population from growing faster than the limited resources available to satisfy the unlimited wants of the populates.

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REFERENCES

Adediran, O.A., 2012. Effect of population on economic development in Nigeria: A quantitative assessment. International Journal of Physical and Social Sciences, 2(5): 1-14. *View at Google Scholar*

Aniceto, O.J.C. and P.M. Ernesto, 1999. Population growth and economic development in the Philippines. Philippine Institute for Development Studies, Series No. 99-22.

Becker, S.G., L.E. Glaeser and M.K. Murphy, 1999. Population and economic growth. American Economic Review, 189(2): 145-149. *View at Google Scholar*

Bloom, D.E. and B.R. Freeman, 1988. Economic development and the timing and components of population growth. Journal of Policy Modeling, 10(1): 57-81. *View at Google Scholar*

Bloom, D.E. and G. Williamson, 1998. Demographic transitions and economic miracles in emerging Asia. World Bank Economic Review, 12(3): 419-455. *View at Google Scholar* | *View at Publisher*

Boserup, E., 1965. The conditions of agricultural growth: The economics of Agrarian change under population pressure. London: G. Allen and Unwin.

Bucci, A., 2003. Population growth in a model of economic growth with human capital accumulation and horizontal R&D. Milan: University of Milan.

Dao, M.Q., 2012. Population and economic growth in developing countries. International Journal of Academic Research in Business and Social Sciences, 2(1): 6-17. *View at Google Scholar*

Dawson, D.J. and R. Tiffin, 1998. Is there a long-run relationship between population growth and living standard? The case of India. Journal of Development Studies, 34(5): 149–156. *View at Google Scholar* | *View at Publisher*

Ehrlich, P., 1968. The population bomb. New York: Ballantine Books.

Furuoka, F., 2009. Population growth and economic development: New empirical evidence from Thailand. Economics Bulletin, 29(1): 1-14. *View at Google Scholar*

Furuoka, F. and Q. Munir, 2011. Can population growth contribute to economic development? New evidence from Singapore. Economics Bulletin, 31(4): 3226-3239. *View at Google Scholar*

Gideon, K.T., P. Gachanja and A. Obere, 2013. The impact of population change on economic growth in Kenya. International Journal of Economics and Management Sciences, 2(6): 43-60. *View at Publisher*

Jhingan, M.L., 2007. The economics of development and planning. 39th Edn., New Delhi. India: VRINDA Publications Ltd.

Klasen, S. and D. Lawson, 2007. The impact of population growth on economic growth and poverty reduction in Uganda. Departmental Working Paper No 133. Department of Economics, University of Goettingen.

Kónya, L., 2006. Exports and growth: Granger causality analysis on OECD countries with a panel data approach. Economic Modelling, 23(6): 978–992. *View at Google Scholar* | *View at Publisher*

Kothare, R., 1999. The impact of population growth on economic growth in India. Journal of Social Science India, 410: 1-14. *View at Google Scholar*

Malthus, T.R., 1798. An essay on the principles of population. Cambridge: Cambridge University Press.

Mankiw, N.G., D. Romer and D.N. Weil, 1992. A contribution to the empirics of economic growth. Quarterly Journal of Economics, 107(2): 407-437. *View at Google Scholar*

Martin, P., 2009. Demographic and Economic Trends: Implications for International Mobility United Nations Development Programme Human Development Reports. Research Paper 2009/17.

NBS, 2010. Statistical news: Labour force statistics. No. 476. Abuja: The NBS Publication.

Oramah, I.T., 2006. The effect of population growth in Nigeria. Journal of Applied Sciences, 6(6): 1332-1337. *View at Google Scholar*

Pesaran, H.M., Y. Shin and R.J. Smith, 2001. Bounds testing approaches to the analyses of level relationships. Journal of Applied Econometrics, 16(3): 289-326. *View at Google Scholar* | *View at Publisher*

Porter, C.B., 1996. Health, wealth and population in the early days of the industrial revolution. London: George Routledge & Sons. pp: 111-121.

Simon, J.L., 1987. Population growth, economic growth and foreign aid. Cato Journal, 7(1): 159-193. *View at Google Scholar*

Thirlwall, A.P., 1993. Growth and development with special reference to developing economies. 5th Edn.: University of Kent at Canterbury. pp: 143-155.

Thornton, J., 2001. Population growth and economic growth: Long-run evidence from Latin America. Southern Economic Journal, 68(2): 464-468. *View at Google Scholar* | *View at Publisher*

Thuku, G.K., P. Gachanja and O. Almadi, 2013. The impact of population change on economic growth in Kenya. International Journal of Economics and Management Sciences, 2(6): 43 – 60.

Tournemaine, F., 2007. Can population promote income per-capita growth? A balanced perspective. Economics Bulletin, 15(8): 1-7. *View at Google Scholar*

Tsangyao, C., C. Hsiao-Ping, D.W. Frederick and G. Rangan, 2014. The relationship between population growth and economic growth over 1870-2013: Evidence from a bootstrapped panel-granger causality test for 21 countries. IPAG Business School Working Paper Series 2014-477.

United Nations, 2007. World population prospects: The 2006 revision. New York: United Nations.