

AN ANALYSIS OF THE POPULATION-POVERTY CYCLE IN NIGERIA: IMPLICATIONS FOR HUMAN WELFARE

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ABSTRACT

Population growth matters to sustainable development, however its consequence on poverty is of interest to this study. This study therefore investigates the population-poverty cycle in Nigeria and its implications for human welfare. Specifically, the study evaluated the potential negative consequences of population growth on economic growth, poverty, education, health, food, environment and migration; and how their interaction affects human welfare. Descriptive statistics and the Structural Vector Auto-Regressive (SVAR) technique were used to analyse the stated objectives for the period 1973-2016. The findings indicated that population growth affects economic growth, per capita income, and agricultural output negatively while it leads to increases in emigration and carbon dioxide emissions (environmental degradation). Furthermore, the study revealed that the population-poverty cycle affects human welfare negatively in Nigeria. The study estimated the population threshold in Nigeria to be 116.8 million – beyond which HDI is expected to decrease by 0.23%. This implies that Nigeria's current population which is put at 193 million is detrimental to the attainment of human welfare. The study concludes that the population-poverty cycle is binding on Nigeria and its effect may be underestimated if its latent effect on human welfare is not taken into cognizance. Unless a credible reconciliation is done quickly to control the negative consequences of population growth, human welfare will continuously be given a secondary status in Nigeria. Thus, a caveat is necessary which requires policies that will curb population increase and harness resources to improve human welfare. Therefore, the focus ought to be on providing basic amenities and investments that will increase genuine wealth per capita amongst Nigerians.

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KEYWORDS: Population-Poverty Cycle, Human Welfare, Nigeria Economy, SVAR

INTRODUCTION

Africa is the world's second largest and second most populous continent. According to the United Nations estimate (UN, 2018), the population of Africa is currently 1.3 billion people – an equivalent of 16.64% of the world's total population. The population growth rate of Africa is still extremely high at 2.3% per year with a median age of 19.4 years. This gives us a doubling time of less than 20 years. This hidden momentum of population growth in Africa is worrisome because even if birth rates are controlled, the large existing youthful population has a built-in tendency of expanding the base of potential parents. According to the United Nations Population Division (2015), population will grow to 9.2 billion in 2050 and 90% of it will occur in Africa. Africa is made up of 54 countries and Nigeria is the most populous country in Africa with a population of about 190 million people. The population of Nigeria account for about 15.98% of the total African population and surpasses the population of other West African countries combined. The population growth has seen Nigeria become the 7th most populous country in the world.

According to Todaro & Smith (2011), more than 75 million people are being added to the world's population every year and about 97% of this net population increase is in developing countries. Out of this 97%, Nigeria accounts for 7.3% as the population increases by nearly 5.5 million people every year. According to World Population Prospects by UNPD (2015), the population of Nigeria could pass that of United States by 2050 and by 2100 it could rival China as

the second most populous country in the world. If these projections are realised, what will be the economic and social implications to Nigeria? For many years, development economists and other social scientists have debated the seriousness of the consequences of rapid population growth. Economists are divided along three lines of thought: first, that population growth is not a real problem; second that it is a deliberately contrived false issue; and third, that it is a desirable phenomenon.

The controversy began with Malthus (1798) who posited that there is a threshold population level at which population increase was bound to stop because life sustaining resources which increase at an arithmetic rate, would be insufficient to support human which would increase at a geometric rate. Thus, Malthus believed there is a need to curtail population growth because of the negative economic, social, and environmental consequences associated with it. The population-poverty cycle theory is the main argument advanced by economists who hold that too rapid population growth yields negative economic consequences and thus should be a real concern for developing countries. Rapid population growth can have serious consequences for the wellbeing of all humanity – including their income, health, education, environmental degradation and a wide array of other social problems. Two of the fastest growing economies, China and India also happen to be two of the world's most populous nations, with 1.35 billion and 1.22 billion people respectively (Ashraf & Galor, 2011). Both countries have continued to grow albeit at slower paces.

The Nigerian economy has also witnessed growth in the real economy. In the decade 1991-2010, the Nigerian economy grew on average by 2.08% while in the decade 2001-2010 it grew on average by 8.74% and 2.25% in the period 2011-2016. This shows that amidst these concerns, population growth may be needed for expansion of the labour force in order to meet growth potential. On the other hand, data obtained from Central Bank of Nigeria (2016) shows that Nigeria's average rate of per capita income growth between 1991 and 2016 is 17.90% implying that population growth can be counterbalanced by a corresponding increase in the growth of the economy. This however appears to be illusionary as around a quarter of Nigeria's population still lives at bare subsistence level and more than two-thirds (69%) live on an income that is below 9.7% of per capita income (NBS, 2015). This is corroborated by Ajegi & Okwori (2016) who found that Nigeria's increase in economic might has not automatically trickled down to the populace in terms of improved welfare and quality of life, thus translating to poor living conditions for citizens.

The Human Development Index further substantiates this poor economic wellbeing with Nigeria ranked 152nd remaining in the bottom rungs of the development ladder. This shows that the problem of population growth is not simply one of numbers but it involves the quality of life and material wellbeing. Even though population growth matters to sustainable development, its consequence on poverty is of interest to this study. This study therefore investigates the population-poverty cycle in Nigeria and its implications for human welfare. Specifically, the study intends to; first, evaluate the potential negative consequences of population growth on economic development – economic growth, poverty, education, health, food, environment and migration; second, estimate the threshold population growth for Nigeria beyond which is detrimental to development in Nigeria.

The rest of the paper is structured as follows. Section two presents key issues of the population-poverty discourse, the theoretical underpinning of the research and empirical review. Section three presents the research methodology while section four analyses the economic elasticities of the interrelationships between population and poverty. Section five concludes the paper and attempts some policy recommendations.

Key Issues, Theoretical Underpinning and Related Literature

Fertility, Mortality and Population Trends in Nigeria

Fertility rate is the average number of children a woman would have assuming that current age-specific birth rates remain constant throughout her child bearing years. On the other hand, mortality rate is the number of deaths per 1,000 population while population increase is the net relative increase in population size due to natural increase and net international migration. According to Okwori, Ajegi, Ochinyabo & Abu (2015), since independence, Nigeria has struggled against very high fertility rates and relatively low (or declining) mortality rates resulting in a high ratio of children in the population. Only since the 1980s did fertility rates began to decline, albeit very slowly and averaging 6.09% till date. Data from the Population Reference Bureau

(PRB, 2012) revealed that Nigeria's fertility rate is higher than in Sub-Saharan Africa (5.1%) as a whole and was more than twice the world average fertility rate of 2.5%. Table 1 shows a 5 year average of fertility rate, mortality rate and population in Nigeria from 1991-2016

Table 1: Fertility Rate, Mortality Rate and Population in Nigeria from 1991-2016

Year	Fertility Rate (Total births per woman)	Mortality Rate (Per 1,000 live births)	Population
1991-1995	6.35	124.84	103,200,179
1996-2000	6.162	117.22	116,940,670
2001-2005	6.036	102.84	132,697,465
2006-2010	5.9	87.36	149,866,615
2011-2016	5.688	72.77	178,790,504

Source: World Development Indicators, 2016

Fertility rate has not differed significantly within the period under study. It has been on the downward path from 1991 to 2015 with a difference of 0.66 births per woman, on average, between 1991 and 2016. Mortality rate witnessed decline throughout the period of study from 124.84 deaths between 1991 and 1995 to 72.77 deaths between 2011 and 2016. Population on the other hand has been on a steady increase within the study period, its figures almost doubled– rising from 98.08 million in 1991 to 193.39 million in 2016. Nigeria's sustained population growth rate may continue for the foreseeable future due to cultural and religious preferences. Reduction in mortality rate, implying less number of deaths, has contributed to the growth in population which can be as a result of improved health care. The inability of Nigeria to curtail fertility rate added to the fact that mortality rate is reducing raises concern about the issues of population growth.

The Theoretical Argument: Population-Poverty Cycles

According to Todaro & Smith (2011), economists who hold that too rapid population growth yields negative economic consequences and thus should be a real concern for developing countries came up with the argument termed '**the population-poverty cycle theory**'. Advocates start from the basic proposition that population growth intensifies and exacerbates the economic, social and psychological problems associated with the condition of underdevelopment. The prospects for a better life for the already born is believed to be retarded by population growth, this is because savings rates are being reduced at the household and national levels. It also severely draws down limited government revenues simply to provide the most rudimentary economic, health and social services to the additional people. This in turn further reduces the prospects for any improvement in the levels of living of the existing generation and helps transmit poverty to future generations of low-income families.

A simplification of the standard Solow-type neoclassical growth equation is used as the basic model by economists to demonstrate these adverse consequences of rapid population growth. Using the standard production function,

$$Y = f(K, L, R, T) \quad 1$$

that is, output is a function of capital, labour, resources and technology. Holding, the resource base fixed, we can derive the result that

$$y - l = \alpha (k - l) + t \quad 2$$

Where: y = rate of GNI growth,
 l = rate of labour force (population) growth,
 k = rate of growth of the capital stock,
 α = capital elasticity of output (usually found to be constant) and
 t = the effect of technological change (the Solow residual in empirical studies of sources of economic growth).

The equation above simply states that the rate of per capita income growth ($y - l$) is directly proportional to the rate of growth of capital-labour ratio ($k - l$) plus the residual effects of technological progress (including improved human and physical capital) assuming constant returns to scale. In the absence of technological change, the higher the rate of population growth (l), the more rapid the rate of capital stock growth (k) must be and thus the greater the concomitant savings and investment rate just to maintain constant levels of per capita income. Moreover, because k may not be independent of l as is traditionally assumed in neoclassical growth models but may in fact be inversely related due to the reduced savings impact implied by the higher dependency burden effects of rapid population growth may even be greater than these models imply. Finally, if low incomes induce poor families to have more children as a source of cheap labour and old-age security, then we have another vicious circle in progress-poor people have large families partly to compensate for their poverty, but large families mean greater population growth, higher dependency burdens, and lower savings, less investment, slower economic growth and ultimately greater poverty.

In an extreme case, a neo-Malthusian population trap can emerge. Population growth can therefore be seen as both a cause and a consequence of underdevelopment. This may have far reaching implications on the poverty cycle should population persist especially for a developing country like Nigeria.

Empirical Arguments: Seven Negative Consequences of Population Growth

According to the empirical research by Cassen (1994), Ahlburg (1994) and McNicoll (1995), seven different categories can arise as the potential negative consequences of population growth for economic development: its impact on economic growth, poverty and inequality, education, health, food, the environment and international migration.

Economic Growth: Evidence shows that rapid population growth lowers per capita income growth in most developing countries, especially countries that are already poor.

Poverty and Inequality: The negative consequences of rapid population growth fall most heavily on the poor

because evidence has shown that the correlation between measures of poverty and population growth at the household level is strong and compelling.

Education: Large family size and low incomes restrict the opportunities of parents to educate all their children.

Health: High fertility harms the health of mothers and children. It increases the health risks of pregnancy and closely spaced births have been shown to reduce birth weight and increase child mortality rates.

Food: Rapid population growth has made feeding the world population very difficult. A large fraction of developing country food requirements are the result of population increases.

Environment: There is an increase in environmental degradation in the form of forest encroachment, deforestation, fuelwood depletion, soil erosion, declining fish and animals stocks, inadequate and unsafe water, air pollution and urban congestion through the contribution of rapid population growth.

International Migration: Many observers conclude that population growth in developing countries is the major consequences of the increase in international migration, both legal and illegal. Though many factors spur migration, an excess of job seekers (caused by rapid population growth) over job opportunities is surely one of them. Some of the economic and social costs of international migration fall on recipient countries, increasingly in the developed world which has recently taken on political importance.

REVIEW OF EMPIRICAL LITERATURE

Aidi, Emecheta & Ngwudiobu (2016) carried out a study on Population Dynamics and Economic Growth in Nigeria using time series data spanning from 1970 to 2014. The data were analysed using ordinary least square estimation technique. The result revealed among other that all the core variables (i.e. fertility, mortality and net-migration) of the study are inversely related to economic growth during the investigated period. The study further revealed that gross fixed capital formation (GFCF) and savings are strong drivers of economic growth in Nigeria. The study recommended that the Nigerian government should make direct efforts toward checking the alarming fertility rate in Nigeria. There was no result on the effect of population dynamics (fertility rate, mortality rate and net migration rate) on economic growth.

Lawanson (2016) examined the effect of rapid population growth on economic development in Nigeria using the ordinary least square technique. The study showed that population has a positive but insignificant effect on economic growth (at first difference) and a negative but significant effect on economic growth (at first difference lagged) in Nigeria}. One of the recommended suggestions is that the focus of the Federal Government of Nigeria should be expanded to include quality empowerment programmes aimed at promoting entrepreneurial development in the country. This would, in turn, boost the production of goods and services locally.

Okwori, Ajegi, Ochinyabo & Abu (2015) investigated the potency of increasing population on economic development in Nigeria hinging the background of analysis on Malthusian

population theory. Using the Vector Error Correction (VEC) Mechanism to estimate a time series covering a 31 year period of 1982 – 2012, the study found out that population growth has no significant impact on economic development in Nigeria within the study period – giving credence to the theoretical underpinning. The study recommends among others that the government should embark on enlightening campaigns to intimate the populace on the dangers of overpopulation and its attendant consequences. The PCIG variable used in this study best measures the living standard of individuals in any country which in turn indicates economic development.

Tartiyus, Dauda & Peter (2015) analysed the impact of population growth on economic growth in Nigeria using secondary data obtained from the World Development Indicators from 1980-2010 which were analysed using regression analysis as well as descriptive statistics. The result revealed that there is a positive relationship between economic growth (proxied by GDP growth) and population, fertility and export growth; while negative relationships were found between economic growth (proxied by GDP growth) and life expectancy, and crude death rate. The paper recommended among others that the average population growth rate of Nigeria should be maintained since it is found to impact positively on economic growth in Nigeria within the period of study and that measures should be adopted to check the crude death rate of Nigeria as it affects economic growth negatively.

Mahmud (2015) in a research population growth and economic development in India: developed an Econometric Model taking India as a case study using time series data from 1980 to 2013. The study employed the Johansen Cointegration Test and Vector Error Correction Model to find out whether the relationship between population growth and economic growth is positive, negative or neutral, and whether the relationship is short run or long run. The study further used Granger Causality Test to find out the direction of causality between the variables. The study found that the relationship between population growth and economic growth is positive and there exist a unidirectional relation, running from economic growth to population growth. The policy implications of the outcome suggest among other things that, government should take population as virtue by investing more resources in human capital development through quality education, infrastructures as well as encouraging small and medium scale industries to achieve the long run economic growth.

Abdullah, Shah, Sargani, Ali & Siraj (2015) examined the effect of increase in population on the economic growth of Bangladesh using data from 1980 to 2005 by employing multiple linear regression model. The result reveals that economic growth and population are both negatively correlated and that an increase in population will have a negative impact on the economic growth of Bangladesh. The study recommended that government can focus on family planning programs to overcome the negative consequences of rapidly increasing population.

Ukpong, Ekpebu & Ofem (2013) in their research discussed the issues of poverty and population growth in Nigeria. The Ordinary Least Squares (OLS) regression analysis was used to estimate the relationship between poverty rate, population growth and real growth of Gross Domestic Product (GDP) in Nigeria. The results show that there is a positive relationship between poverty rate and population growth, and negative relationship between GDP real growth rate and poverty rate in Nigeria. Hence, the need for the government to implement strict policies to reduce the country's population growth, while ensuring increased investment in human capital development, agriculture and technology for greater productivity and poverty reduction. The study failed to specify the variable used to capture poverty rate.

Thuku, Gachanja, and Almadi (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 population growth and economic growths are both positively correlated and that an increase in population will impact positively on economic growth in the country. The study concludes that in Kenya inadequate government policies, rather than population growth is responsible for the woes including, famines that besiege the nation.

Ali, Ali & Amin (2013) used Autoregressive distributed lags technique to investigate the population and economic development relationship in Pakistan. The results of the study indicate that population growth has positively and significantly contributed to economic development but negatively affected by unemployment rate. HRD is although positive but insignificant. It is concluded that population growth is positive to the development of the economy on one hand but on the other hand it creates a problem of unemployment and leads to lacking of educational and health facilities. The government is advised to utilize this additional workforce efficiently as a policy tool to achieve high and desired level of growth.

Mamingi & Perch (2013) examined the effect of population growth on economic growth/development in Barbados for the period 1980-2010. Using the Autoregressive distributed lag approach to cointegration, the study revealed that population growth and population density positively and significantly affects economic growth, economic growth negatively and significantly affects population growth, natural increase rate positively and significantly affects population growth, also that net international migration negatively and significantly impacts population growth. The study failed to give any recommendations. The results from this study have policy implications on the grounds that, with increases in population comes a larger markets and these are transformed into growing consumption accompanied by rise in investment which is the needed prerequisite for economic growth.

Adewole (2012) in his study, the effect of population on economic development in Nigeria used OLS method to examine the relationship spanning the period 1981-2007. The study revealed that population growth has positive and

significant impact on economic sustainability. The study recommended among others that to serve national objective of economic development, public health, and welfare and environmental conservation, Nigeria should establish policies to influence the rate of growth of their population and to adopt politically and ethically acceptable measures towards this end that is within her administrative and economic capability.

Bremner, López-Carr, Suter & Davis (2010) in their research ‘Population, poverty, environment, and climate dynamics in the developing world’ reviewed extant evidence and offers a conceptual framework for the investigation of complex dynamics among human population growth, environmental degradation, poverty, and climate change. The paper introduces theories relating to population growth, environmental degradation, the impact on human well-being, and potential relations with climate change. Poverty is discussed in detail as both a contributing factor to and consequence of population growth and environmental change. It is suggested that researchers need to strengthen their efforts to communicate what is known about the complexity of population, poverty, and environment relationships to policymakers and the public. The paper discussed climate dynamics using a Vicious Circle Model (VCM) to explain the relationships between population, poverty, environment, and climate but the narrative descriptive methodology is rather weak to get good results.

METHODOLOGY

Method of Study

This study employed both descriptive and empirical tools to analyse the stated objectives. Exploratory Data Analysis (EDA) is used to examine the data on population, economic growth, poverty, education, health, food, environment and international migration. EDA is appropriate for this study because it allows for summary statistics to reveal the important characteristics of the population-poverty cycle in Nigerian. This approach also allows the paper provide evidence insight into the relationships in a clear and concise manner. Thus, The EDA will help to analyse the extent of disparity and determine the size of the deficits vis-à-vis foreign aid and borrowing. Furthermore, the Structural Vector Auto-Regressive (SVAR) method is used to evaluate the effect of population on the proxies for economic development. There are recent developments and improvements in the VAR methodology, however, the use of SVAR in the analysis of monetary policy effects have

produced relatively better and robust results (CBN, 2014). In addition, the SVAR is theoretically suitable and offers the benefit of imposing restrictions on variables of interest. The SVAR model is presented as:

$$Ax_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{31} & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{41} & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{51} & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ \alpha_{61} & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ \alpha_{71} & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ \alpha_{81} & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ \alpha_{91} & \alpha_{92} & \alpha_{93} & \alpha_{94} & \alpha_{95} & \alpha_{96} & \alpha_{97} & \alpha_{98} & 1 \end{bmatrix} \begin{bmatrix} POP \\ GDP \\ PCI \\ LIT \\ LEX \\ AGRC \\ CO_2 \\ MIG \\ HDI \end{bmatrix}$$

- Where:**
- POP** = Population
 - GDP** = Gross Domestic Product
 - PCI** = Per Capita Income
 - LIT** = Literacy Rate
 - LEX** = Life Expectancy
 - AGRC** = Agricultural Output
 - CO₂** = Carbon-dioxide Emission
 - MIG** = Total Migrants
 - HDI** = Human Development Index

Data and Sources

The data on nominal GDP, agricultural output, and population were collected from the Central Bank of Nigerian (CBN) Statistical Bulletin while the data for literacy rate, life expectancy, carbon dioxide emission, and total migration employment were obtained from World Development Indicator (WDI); and Human Development Index was gotten from HDI reports (different years). Per capita income was computed by the authors using the data on population and GDP. The data were sourced to cover the period of 44 years from 1973-2016.

Stylised Facts on the Consequences of Population Growth in Nigeria

According to Jhingan (2007), the consequences of a rapidly increasing population are to retard all development efforts in a country unless accompanied by high rates of capital accumulation and technological progress. Table 2 presents a picture of the variables that population growth is likely to affect in Nigeria within the period 1991-2015.

Table 2: Data on Development Indicators

Year	GDP (₦'billion)	Poverty (₦)	Literacy Rate (%)	Life Expectancy (Years)	Food (₦'billion)	CO ₂ Emissions (kt)	Migration (persons)
1991-1995	1,484.58	14,139.89	55.34	46.086	367.62	50,353.78	459,810
1996-2000	4,936.92	41,953.01	55.05	46.352	1,311.68	48,952.98	477,929
2001-2005	14,471.85	107,880.28	54.36	47.708	4,364.09	95,271.59	583,964
2006-2010	39,942.71	264,342.64	51.70	50.322	10,167.99	88,691.53	811,278
2011-2016	83,244.16	462,963.47	52.68	52.48	17,641.58	85,780.3	1,150,479

Source: CBN Statistical Bulletin and World Development Indicators, 2016

Per capita income captures the average income earned per person in a country and is the proxy for poverty. It is calculated by dividing the total income by total population. GDP and per capita income figures have increased

tremendously from ₦596.04 billion and ₦6,076.74 in 1991 to ₦101,489.49 billion and ₦524,785 in 2016 respectively. As earlier stated, Nigeria’s large GDP figures has not translated into an improved well being of its populace, and

the country still remains in the bottom rungs of the development ladder despite its increased GDP figures because she has not been able to transfer the gains from growth into economic betterment for her citizens. Rapid population growth may therefore lower per capita income growth in developing countries if there is no corresponding growth in GDP, especially those dependent on agriculture putting pressure on the environment.

Throughout the study period it can be seen that health has improved generally from the reduction in mortality rate to the increment of expected age (life expectancy) at birth. This may be because of improved health care/system, better living styles as well as better nutritional choices and practices. Even though healthcare has improved, the continuous growth in population should still be a concern because rural development does not cut across the country equally. The Nigerian healthcare system shows spatial variation in terms of availability and quality of facilities in relation to need especially in the rural areas. The urban areas, predominantly occupied by the rich and about 50% of the population enjoy the best of medical facilities and care. The poor who resides in the rural area mostly suffer from the inequality of gaining sufficient information about the benefits of healthcare systems and facilities. Furthermore, despite the improved figures from health indicators (mortality rate and life expectancy), Nigeria is ranked 152 in the Human Development Index (HDI) and classified under Low Human Development.

According to HDI report (2016), Nigeria records 69.4 infant deaths per 1,000 live births, 108.8 under-5 deaths per 1,000 live births, 346 and 379 deaths per 1,000 people for female and male adults respectively. This is poor compared to Norway, ranked number 1 in the HDI with 2.0 infant deaths per 1,000 live births, 2.6 under-5 deaths per 1,000 live births, 44 and 69 deaths per 1,000 people for female and male adults respectively.

Agricultural GDP covers the contributions of agriculture to the economic growth and well-being of a nation. In Nigeria, the contributions of agriculture to growth, even though has been on a continuous rise throughout the period of study, is not commensurate to the growth in population. Despite the fact that agriculture contributes meaningfully to Nigeria's GDP, the sector is not doing so well, and this could be because Nigeria imports most of her agricultural consumables. Also, the contribution to GDP comes from other sectors of the economy like services and industry. The

direct effect of rapid population on agriculture is land loss and degradation. The livelihood and future food security of the populace is threatened as intensive agriculture and irrigation contribute to land degradation particularly salination, alkalization and water logging which then contribute to soil erosion and loss of nutrients. The United Nations Population Fund (UNFPA, 2012) opined that the pressure exerted on environmental resources is causing the decline in food production which is unsustainable as population increases.

Within the period of study, as population increases, carbon dioxide emission, proxy for environmental sustainability, increases also. Carbon dioxide emission more than doubled during the study period from 45,000kt in 1991 to 96,000kt in 2016, just as population figures almost doubled during the study period. The middle player between population and the environment is poverty, which is also a cause and effect. The cycle which links up these three elements is a complex phenomenon, as population increases, poverty increases and the environment degrades rapidly. This is because the poor, who rely on natural resources more than the rich, deplete natural resources faster as they have no real prospects of gaining access to other types of resources. Also, degraded environment can accelerate the process of impoverishment, again because the poor depend directly on natural resources. According to Todaro & Smith (2011), the very poor cause considerable environmental destruction as a direct result of their poverty.

Population growth in rural areas has also pushed LDCs into unsustainable practices, such as the burning and cutting down of tropical forests in order to plant crops, over-cropping and subsequent depletion of fragile arable land and over-pumping of groundwater. Population growth is a cause for concern and contributes majorly to environmental degradation. Dependence on natural resources increases as population grows because every individual needs water, food, land, minerals and so on. Also, there will be an increase in the production of waste, chemical pollution and carbon dioxide emission increasing environmental hazards, long term poverty and difficulty in solving environmental and economic problems.

RESULTS AND DISCUSSION

Table 3 presents a diagnostic test for the variables used in the study of the population-poverty cycle. All the variables are stationarity at first difference.

Table 3: Unit Root Test

Variable	Levels (Trend & Intercept)	1st Difference (Trend & Intercept)
HDI	0.32	-4.18
Population	0.98	-4.03
GDP	1.04	-4.68
Per Capita Income	-2.39	-5.25
Literacy Rate	-1.38	-4.35
Life Expectancy	-1.55	-4.45
Agric. GDP	-1.59	-6.27
CO ₂ Emissions	-1.91	-5.16
Total Migration	-1.65	-5.27

Critical Values: 1% – 3.61; 5% – 2.94; 10% – 2.61

Source: Test Results

The study estimated the elasticities of key economic variables in response to population increases in Nigeria.

Table 4: Structural VAR Estimates

Dependent Variables	Alpha Coefficients	Probabilities
Regressor: Population		
GDP	-3.51	0.0103
Per Capita Income	-3.11	0.0000
Literacy Rate	0.06	0.6760
Life Expectancy	-0.07	0.9584
Agric. GDP	-2.19	0.0362
CO ₂ Emissions	2.09	0.0215
Total Migration	2.58	0.0036
LR Test for Over-Identification: Chi-Square = 19.14, Prob. = 0.0000		

Source: Test Results

Table 4 shows that an increase in population is likely to reduce economic growth, per capita income and agricultural output due to its negative effect. This corroborates the Malthusian postulation which asserts that as population increases, the means of subsistence is likely to reduce. In Nigeria, population growth would most likely exert a negative effect on economic growth because, consumption expenditure accounts for a major part of national income which may not directly stimulate economic activities leading to growth. If population affects GDP negatively, there would be a ripple effect on per capita income which eventually increases poverty. On the other hand, agricultural output is expected to reduce because, population increases may lead to land fragmentation and high labour to land ratio which may affect output.

An increase in population is likely to affect literacy rate positively and life expectancy negatively; however the coefficient of population does not significantly affect them. Population growth exerts a positive and significant effect on carbon-dioxide emissions and migration. This shows that population growth leads to environmental degradation because as CO₂ increases, the environment gets degraded.

The growth in population may also affect migration especially the working age because inadequate social welfare has caused a lot of citizens to seek greener pasture abroad.

Table 4 shows that the model is not over-identified which is suitable and indicates that the condition with respect to the minimum number of restrictions to be imposed on the variables has been met. The likelihood ratio test shows that the *p* value of obtaining a chi-square value of as much as 19.14 is statistically not different from zero, leading to the rejection of the hypothesis that the model is over-identified.

Implications of the Population-Poverty Cycle on Human Welfare

From the above analysis, it is clear that population growth affects economic growth, per capita income, and agricultural output negatively while it leads to increases in emigration and carbon dioxide emissions (environmental degradation). It is therefore important to examine the implications of the population-poverty cycle on human welfare. Table 5 presents the effect of population, GDP, per capita income, literacy

rate, life expectancy, agric output, CO₂ emissions and migration on Human Development index (HDI).

Table 5: Structural VAR Estimates

Variables	Alpha Coefficients	Probabilities
Dependent Variable: Human Development Index		
Population	-0.01	0.0225
GDP	0.02	0.9054
Per Capita Income	0.03	0.3989
Literacy Rate	-0.02	0.1199
Life Expectancy	0.04	0.0349
Agric. GDP	-0.05	0.0279
CO ₂ Emissions	-0.03	0.0267
Total Migration	-0.01	0.0189
LR Test for Over-Identification: Chi-Square = 19.14, Prob. = 0.0000		

Source: Test Results

Table 5 shows that the population-poverty cycle affects human welfare in Nigeria. While population, literacy rate, agric output, CO₂ emissions, and emigration postulates a negative and significant relationship with HDI, GDP, per

capita income, and life expectancy postulate a positive relationship. The result suggests that GDP and per capita income have the potentials of stimulating improvements in HDI, but its impact is yet to be felt as its coefficients are not statistically significant.

The study estimated the population threshold in Nigeria to be 116.8 million. Thus, other things being equal, a population of 116.8 million or lower is a signal that human welfare will improve in Nigeria. The result reveals that an increase in population beyond the optimal threshold will cause HDI to decrease by 0.23%. This implies that Nigeria's current population which is put at 193 million is detrimental to the attainment of human welfare.

CONCLUSION

The paper concludes that the population-poverty cycle is binding on the Nigerian economy and its effect may be underestimated if its latent effect on human welfare is not taken into cognizance. Thus, the growth in population affects economic growth, leads to a decline in per capita income and deepens poverty. This mismatch which results in the population-poverty cycle also has imminent consequences on environmental degradation and raises concern about sustainable development and human welfare. Unless a credible reconciliation is done quickly to control the negative consequences of population growth, human welfare will continuously be given a secondary status in the Nigerian economy.

Thus, a caveat is necessary. The policies that will curb population increase and harness resources to improve human welfare are what are needed. Therefore, the focus ought to be on providing basic amenities and investments that will increase genuine wealth per capita amongst Nigerians.

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