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Relationship between Population Growth and Industrial Output in Nigeria (1980-2017)

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***Abstract* – This research work focused on the relationship between population growth and industrial output in Nigeria for the period 1980 to 2017. It is particularly interesting to study the relationship between population growth and industrialization in Nigeria because at the present, Nigeria is making rapid effort to advance her economy while undergoi--ng a demographic transition that has been projected to be in a geometric transition. This research developed an Auto-regressive Distributive Lag (ARDL) model using Industrial Output as the dependent variable and Population growth rate, Life Expectancy, total Labour Force (as a percentage of total population that are employed), Capacity Utilization and Human Capital Development as the independent variables. The data were obtained from the World Bank, National Population Commission and Central Bank of Nigeria Statistical Bulletins (various issues). The findings revealed that Population Growth Rate has inverse relationship with Industrial Output both in the short run and long run while total Labour Force and Capacity Utilization also decrease Industrial Output both in the short and long run periods and Life Expectancy has a positive but insignificant effect on Industrial output in Nigeria. Since the Bounds test revealed a long run relationship between population and Industrial Output, we recommended a renewed determination and political will to implement the National Policy on Population for a long term sustainable development that outlines a sectoral strategy to manage our rising population. Also, the Industrial sector must convert the growing population to a producing population by organizing rapid informal trainings in specialized areas to boost industrial productivity.**

***Keywords* – Auto-regressive Distributive Lag, Capacity Utilization, Industrialization, Population Growth.**

I. INTRODUCTION

For many years, it has become established that the economic growth of a nation is significantly dependent on the growth and quality of her population. Human capital is the key to economic growth and development of a nation. This stems from the fact that every other facility and resource required for economic growth is driven by the availability of human capital (Nwosu, Dike and Okwara, 2014). More so, in the absence of effective human capital development, an increasing population can have adverse negative effect on the economic growth of a nation. This is because a lot more resources are taken out to manage and cater for the teeming population that the same can generate (Brand, 2009).

At independence in 1960, Nigeria's population was estimated to be 45.2 million people (NPC, 1991; 2006). Nigeria's population has been increasing for the past 5 decades due to very high birth rates, quadrupling its population during this time (wikipedia, 2018). Nigeria's population growth was fastest in the 1980s after child mortality dropped rapidly and has slowed slightly since then as the birth rate has declined slightly. Nigeria is one of the fastest growing countries in the world in terms of population. With an estimated population of over 190 million and an annual population growth rate of 2.9% (UN, 2018), Nigeria is the most populous nation in sub-Saharan Africa and the tenth most populous in the world (UNDP, 2016). However, the United Nations Developme- -nt Programme asserts that 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 favours and is living in the rapidly expanding urban areas, presently estimated at over 45.2% and will likely hit 55.4% mark by the year 2020 (UNDP, 2016).

With this statistics however, Nwosu, Dike and Okwara, (2014) posited that the population growth shows profound inequities and disproportions when analyzed with develo- -pment indicators such as: 21 doctors per 100,000 people, infant mortality rate of 112 per 1000 live births, maternal mortality of over 980 per 100,000 live births, life expectancy at birth projected at 50 years, industrial capacity utilization less than 50% and most of all, very low industrial sector's production index.

For example, in the 1980s, when population growth rate of Nigeria was exponentially at 2.4% - 3.0%, Nigeria's industrial production base was still around N40 billion to N50 billion annually as compared to other developing countries of the World at the time like Thailand and Indonesia which had industrial output of more than N200 billion annually (Budgit, 2017). Government expenditure on education was N170 million in 1981 and reached N9.75 billion by the end of 2000 (CBN, 2017). With a population figure more than 100 million people and adult population constituting more than half of the total population figure, Nigeria's total labour force was a mere 29% of total adult population in 1981 and currently revolves around 40-50% from the 1990s till present (NPC, 2016).

The major problem identified in this research work is the general belief that growth of population could be to the advantage of a country in terms of the sheer size of her domestic market, better division of labour and increased productivity through improvement in the ratio of labour force to population as well as enhancement of her political and military power. The decreasing output of the industrial sector coupled with Nigeria's over dependence on the oil sector has made many stakeholders to point to the fact that Nigeria is not utilizing her vast population to enhance growth of the industrial sector. It is still unclear whether the recent economic down-turn in Nigeria is a direct consequence of a neglected rapid population growth. Also, the recent rapid population growth in Nigeria as projected

by the UNDP is not known to have been equally associated with unemployment with figures ranging from 17 percent per annum for the entire population to 60 percent for the youths. Problems like job opportunities being fewer than the number seeking for them and a non-proportionate government investment in human capital development have been identified by many researchers to be among the problems working against the optimal growth of the industrial sector in Nigeria.

In the light of the problems identified above, this research work seeks to achieve the major objective of ascertaining the relationship between population growth and industrial output in Nigeria by focusing on the core population growth indices which include population growth rate, life expectancy, total labour force, capacity utilization and human capital development. Pertinent questions raised in order to help guide the study are: What is the relationship between population growth rate and industrial output in Nigeria? To what extent have life expectancy, total labour force, capacity utilization, population growth rate and human capital development affected the output of the industrial sector in Nigeria? The scope of this study is from 1980 to 2017 and it concentrates on the identified indices within the Nigerian economy.

II. Literature Review

Nwosu, Dike and Okwara (2014) defined population growth as the increase in the number of human inhabitants of a given place. Thomas (1973), quoted in Adewole (2016) viewed population of an area as the total number of all individuals alive in a particular point in time. He further asserted that the growth rate of population is the percentage increase in the number of individuals alive in a particular point in time at a given place. Ben (2015) delineated the total population of any area of the earth‘s surface as a representation of a balance between two forces;

1. One is natural change caused by the difference between the number of births and deaths. If births are more numerous than deaths in any period, the total population will increase. However, if they are less numerous it will decrease. This simple relationship is modified by a second force: Migration.
2. Migration: When immigrants are more numerous than emigrants, there will be a population increase. (We assume, of course, that we are ignoring natural change for the moment). When emigrants are more numerous, there will be a population decline (Ben, 2015).

Net changes in population totals are caused by the interaction of four elements: Births and immigrants tend to push the total up: Deaths and emigrants tend to bring the total down (Taylor and Francis, 2008). Although migration may be the most important factor in small areas (for example, in a small village or a city block), it is less significant on the national level. Taylor and Francis opined that for the world as a whole, migration is irrelevant because all movements take place within the limits of the recording area. However, overpopulation is described as a condition where people‘s numbers exceed the carrying capacity of its habitat. In common parlance, the term usually refers to the relationship between the human population and its environment, the earth. Overpopulation does not depend only on the size or density of the population, but also on the ratio of population of available sustainable resources. It also depends on the way resources are used and distributed throughout the population (Aguirre, 2017).

Matching population growth with development is the real object of global and country action towards improved welfare, human development and economic growth. The changing patterns in the size, structure and distribution of population provide useful leads into the persistent shifts in the choice of approaches for managing development (Rostow, 1998 in Nwosu *et al*, 2014). Countries like China, India, Russia etc have utilized their rapid population growth to their advantage by way of human capital development and utilization of skilled man-power for technological advancements (Caldwell, 2002).

Nigeria tends to be least able to cope with the development and environmental consequences of rapid growth due to her low per capital income, indebtedness, and limited capacity for investments [UNFPA 1991]. The situation in Nigeria is not different from what is obtainable from other African countries; her population is large which makes it a “giant” relative to the other African countries.

Nigeria’s Industrial Sector

The structure of the Nigerian economy is typical of an under-developed country (Louis, CheteJohn, Adeotifoluso, Adeyinkafemi, 2016). Between the early 1990s to 2011 and 2012, the primary sector, in particular the oil and gas sector dominated GDP, accounting for over 95% of export earnings and about 85% of government revenue. The industrial sector accounted for 6% and less of economic activities in the years leading up to the 2000s, while in 2011, the manufacturing sector contributed only 4% to Gross Domestic Product (Louis et al, 2016)

The industrial sector in the late 60s and early 70s were characterized by agriculture which was the mainstay of the Nigerian economy at the time. The agric sector provided food and employment for the populace providing more than 90% employment rate for the population and providing raw materials for the nascent industrial sector, generating the bulk of government revenue and foreign exchange earnings (CBN, 2017). Following the discovery of oil and its exploration in commercial quantities in the late ‘70s and ‘80s, the fortunes of agriculture gradually diminished. Nigeria with over 50million unemployed population grappled with the few available white collar jobs thereby neglecting the agric sector (Louis et al, 2016).

The economic transformation strategy agenda, otherwise known as Nigeria vision 20 : 2020 launched in 2009 set out the direction for current industrial policy in Nigeria. The industrialization strategy aimed at achieving greater global competitiveness in the production of processed and manufactured goods by linking industrial activity with primary sector activity, domestic and foreign trade and service activity (NEEDS, 2010). The recent trade policies of the federal government (from NEEDS to date) have sought to reduce the unpredictability of the trade policy regime, establish a schedule to adopt the ECOWAS common tariff (CET) and respect obligations under multi-

-lateral trading systems (Adenikinju, 2005).

The strengthening of the institutional and regulatory frameworks has helped to drive the industrial sector in Nigeria towards sustained growth. These institutional and regulatory frameworks include.

1. Banking sector reforms by the CBN.
2. Increase in pace of privatization and publicly owned companies.
3. Liberalization of the telecommunications sector.
4. Improvement in Standards Organization of Nigeria (SON) standardization of industrial products.
5. Implementation of export incentives by the Nigerian Export Promotion Council.
6. Improvements in the activities of the Bank of Industry (BOI), Nigerian Agricultural Cooperatives and Rural Development Bank (NACRDB), SMEDAN, NITDA, EFCC, ICPC etc.

Population Growth and Industrial Output in Nigeria

Adewole (2012) asserts that population growth affects the growth of the industrial sector in particular and economic development generally in two ways;

1. By promoting industrial production and economic development: This occurs in the developed economies
2. By retarding industrial production and economic development: This occurs in the developing countries like Nigeria.

According to the study committee of the office of the foreign secretary National Academy of Science [SCOFSNAS] 1972, rates of population growth in many less developed Countries are at least half the rates of economic growth and in some cases almost equal the latter. Rapid population growth slows down the growth of per capita income in developing countries and tends to perpetuate inequalities in income distribution.

Jhingan (2005), in his view stated that the growth of population tends to retard the per capita income in 3 ways: It increases the pressure of population on land; it tends to rise in cost of consumption goods because of the scarcity of the cooperate factors to increase their supplies, it tends to a decline in the accumulation of capital because with increase in family members, expenses increase. These adverse effects of population growth on per capita income operate more severely if the percentage of children in the total population is high, as is actually the case in Nigeria. Children involve economic cost in the form of time spent and money expended in bringing them up. In addition, faster population growth makes the choice scarcer between higher consumption now and the investment needed to bring higher consumption in the future.

Improving the industrial production base of any economy depends upon investments. In Nigeria, the resources available for investment are limited. Therefore, rapid population growth retards investment needed for higher future consumption (Adewole, 2012). The International Monetary Fund (IMF) reported in 2017 that it feared that issues such as population, poor foreign exchange management and policy implementation would dwarf industrial output in Nigeria; but the red flag is the population bomb. With the population currently growing at 2.7%, it is expected that industrial output should expand to a higher rate in order to improve human development indices.

The industrial sector in Nigeria suffers from dearth of skilled labour force. Majority of the labour force are not skilled with increasing rate of imported labour to drive its production (Louis et al, 2016). Countries like China and India have proved that "a country's greatest wealth is her people" by transiting from poor, agrarian economies to become world's second and seventh largest economies respectively as Japan, the world's third largest, had done before them (WDI, 2017).

III. THEORETICAL FRAMEWORK

The classical economic theory of population growth as postulated by Malthus stated that a rise in income, particularly among the poorer classes in any country, tends to increase fertility rates but decrease mortality rates. The course of events since Malthus' time has not only negated that theory but has also led to the gradual evolution of the modern theories of demographic transition.

Modern theory of Population; the Optimum Population theory:

Tushar (2016) observed that modern economists have rejected the Malthusian theory of maximum population, which, if exceeded, will spell misery in the country. Instead of the maximum population, the modern economists have substituted the idea of the optimum population.

Meaning of Optimum Population:

By optimum population is meant the ideal size of the population that a country should have, considering her resources. The optimum, according to Dalton and Carr-Saunders (2000) cited in Tushar (2016) means the best and the most desirable size of a country's population consistent with her resources. It is the right number. When a country's population is neither too big nor too small, but just that much which the country ought to have, it is called the optimum population.

Given a certain amount of resources, state of technical knowledge and a certain stock of capital, there would be a definite size of the population at which real income of goods and services per capita would be the highest. This is the optimum size. The optimum size can, therefore, be defined as the size at which per capita income is the highest.

Under-population and Over-population:

If the population of a country is below the optimum, i.e., below what it ought to be, Tushar (2016) noted that then the country is said to be under-populated. The number of the people is insufficient to take the fullest possible advantage of the natural and capital resources of the country.

The resources are vast; much can be produced; but there are not enough people to carry on the work of production efficiently. Under such conditions, increase in population will be followed by an increase in the per capita income. But this increase cannot go on indefinitely. When the shortage of man-power has been made up, the per capita income will reach the maximum, and we shall say that the optimum has been reached.

If, however, the population still goes on increasing and the optimum is exceeded, then we shall have a state of over-

population. There will be too many people in the land. The resources will not be sufficient to provide gainful employment to all. They will be thinly spread over the teeming millions.

IV. Empirical Review

Nwosu, Dike and Okwara (2014) investigated the time series role of population growth on economic growth in Nigeria and how economic growth is affected through population growth by using annual secondary observation of population growth rate and GDP from 1960 to 2008. Their empirical results support the fact that population growth has a significant impact on economic growth. Their study also found that there is a sustainable long run equilibrium relationship between economic growth and population growth. They also found evidence of unidirectional causality between population growth and economic growth.

Adewole (2012) examined the effect of population on economic development in Nigeria by using trend analysis with the scope spanning between 1981 and 2007. His study analyzed two models using Real GDP and Per capita income as dependent variables and Population growth rate as the independent variable in both models. His findings revealed that population growth has positive and significant impact on economic sustainability proxied by real gross domestic product (RGDP) and Per Capita Income but with a negative slope in the Real GDP model. He recommended a sustained improvement of the social/ human welfare of the people and population related policies to promote growth in national output as population increases. Such policies include food subsidy, employment generation, public health provision, etc.

Ogujiliba (2016) examined how changes in population dynamics affect household portfolio choices (expenditure on food, monetary transactions, goods and services and non-cash expenditure) in Nigeria given the fact that Nigeria is going through a demographic transition. His study established a link between demographic variables and household expenditure components using the Vector Error Correlation Methodology. His results suggest that population growth in Nigeria can produce significant effects on the economy via the expenditure profiles of households. The results also suggest that other factors such as real per capita income, ratio of other expenditure categories to total expenditure, influence the growth of household expenditure components.

Onwuka (2013) studied the impact of Nigeria's growing population on the country's development. He empirically tested the association between population growth and economic development in Nigeria between 1980 and 2013. His model used growth rate of GDP as a function of population growth rate, capital output, oil production and agric output. He found that growth in population outweighs that of output and this has hindered the capacity of successive governments to efficiently provide social services to the people, thereby negatively affecting development. His recommendation based on the findings is that curbs on population growth through appropriate policies that would integrate the country's population programmers into the mainstream development efforts are necessary. That way, higher per capita consumption of social services by the citizens would be facilitated and which ultimately would boost their access to the benefits of development.

V. Model Specification

The model specified for this study follows the empirical works of Adewole (2012), Onwuka (2013) and Nwosu et al (2014) who in their separate works specified Gross Domestic Product as dependent on population growth rate in a simple regression model. However, our model introduced other determinants of population growth namely life expectancy, total labour force, capacity utilization and human capital development index. In functional form, the model is specified thus:

$$INDO = F(PGR, LEX, TLF, CAPU, HCDI) \quad \ldots(1)$$

Where:
INDO = Industrial Output growth rate
PGR = Population Growth Rate
LEX = Life Expectancy
TLF = Total Labour Force
CAPU = Capacity Utilization
HCDI = Human Capital Development Index (proxied by government expenditure on education, health and social services).

Expressing the model above in an econometric form, we have:

$$INDO_t = \alpha_0 + \alpha_1 * PGR_t + \alpha_2 * LEX_t + \alpha_3 TLF_t + \alpha_4 CAPU_t + \alpha_5 HCDI_t + \varepsilon_t \quad \ldots(2)$$

Where α_0 is the intercept, α_1- α_5 are the unknown parameters of the model to be estimated and ε_t is the stochastic error term.

VI. Methodology

The ex-post-facto research design is employed for this study. The Secondary data were sourced from the Central Bank of Nigeria (CBN) Statistical bulletin, National Population Commission Annual bulletins and the National Planning Commission Annual abstracts (various issues). The period of study covers 1980 to 2017. The Autoregressive Distributive lag (ARDL) is used to model the relationship between population growth rate and industrial output in Nigeria by estimating the lagged values of population growth rates and its indices with a view to projecting future growth in industrial output.

Test for Unit Root:

The analyses start with the test for Unit Root or stationarity; since most economic time series data are non-stationary. The test is conducted using the Augmented Dickey-Fuller (ADF) Unit Root test.

The null hypothesis of the unit root i.e. $\partial > 0$ (non-stationary) is tested against the alternative hypothesis of ∂

< 0 (stationary) at 5% level of significance. The ADF t-statistic is compared with the 5% critical value and if it is greater than the 5% critical value, the null hypothesis of no stationarity is rejected. The test enables us to avoid regression results that are spurious.

ARDL Bounds Test for Cointegration:

In order to empirically analyze the long-run relationships and short run dynamic interactions among the variables of interest we apply the autoregressive distributed lag (ARDL) cointegration technique the ARDL bounds test is based on the assumption that the variables are I(0) and I(1) (Pesaran et al, 2001).

Short Run and Long Run Estimation of the ARDL Model:

The short run equation in our model is given as follows:

$$D(INDO)_{t-1} = \alpha_0 + \alpha_1 D(PGR)_{t-1} + \alpha_2 D(LEX)_{t-1} + \alpha_3 D(TLF)_{t-1} + \alpha_4 D(CAPU)_{t-1} + \alpha_5 D(HCDI)_{t-1} + ECM(-1)$$

Where "D" represents the first difference operation of the variables, ECM(-1) is the one period lag of the model residual. The parameters α_1 ***to*** α_5 are the short run coefficients of the model while the coefficient of ECM(-1) is the long run speed of adjustment of the model. The sign of the coefficient of ECM(-1) should be negative and significant as well for holding the long run equilibrium (Dhungel, 2014).

The long run equation can be stated thus:

$$INDO = \alpha_0 + \alpha_1 PGR + \alpha_2 LEX + \alpha_3 TLF + \alpha_4 CAPU + \alpha_5 HCDI + U_t$$

Where the variables INDO, PGR, LEX, TLF, CAPU, HCDI are as defined in equation 1 while the parameters α_1 ***to*** α_5 are the long run coefficients and "U" is the error term.

VII. Data Analysis

The Unit Root test carried out on the variables is summarized in Table 1 below:

Table 1. Unit Root Test.

Variables		ADF statistics at Level	ADF statistics at First Difference	Order of integration
INDO		-1.664266	-5.316667	I(1)
PGR		-3.062168	-6.461258	I(0)
LEX		-3.027149	-9.366816	I(0)
TLF		-2.184378	-3.030234	I(1)
CAPU		-2.656964	-3.087650	I(1)
HCDI		-5.119611	-9.344002	I(0)
Critical Values	1%	-3.621023	-3.626784	
	5%	*-2.943427*	*-2.945842*	
	10%	-2.622989	-2.627420	

Source: Extracted from Eviews9 Output

The table above shows that the variables have mixed order of integration. Industrial output (INDO), Total Labour Force (TLF) and Capacity Utilization (CAPU) are all stationary at first difference i.e. integrated of order I(1) while Population Growth Rate (PGR), Life Expectancy (LEX) and Human Capital Development (HCDI) are stationary at level i.e. integrated of order I(0). The determination of the order of integration of the variables establishes the fact that the statistical properties of the variable are constant and do not change over time. Also, since there is no second order integrated I(2) variable, we go ahead to estimate the long run relationship amongst the variables using the ARDL Bounds test.

ARDL Bounds Test

The bounds test carried out on the variables is summarized below:

Table 2: ARDL Bounds Test

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.755737	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Extracted from Eviews9 Output
F-statistic = 4.7557

The ARDL Bounds test above shows that the F-statistic value of 4.7557 is greater than both the I(0) and I(1) bounds critical values at 5% hence we reject the null hypothesis stated above. Therefore, we conclude that there exists a long run relationship among the variables i.e. Population Growth Rate has a long run effect on industrial sector's output in Nigeria.

Auto-Regressive Distributive Lag Selection and Short Run Estimates

The lag distribution and short run estimates of the ARDL population growth rate – industrial growth model is shown below as follows:

Table 3. Cointegrating Form.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INDO(-1)	1.140130	0.162700	7.007555	0.0000
D(PGR)	-0.424556	14.501128	-0.029277	0.9770
D(LEX)	1.079386	0.861256	1.253270	0.2281
D(LEX(-1))	1.139259	0.739887	1.539774	0.1432
D(TLF)	-2.912710	4.220603	-0.690117	0.5000
D(TLF(-1))	-6.185222	4.667206	-1.325252	0.2037
D(TLF(-2))	-1.695792	3.345916	-0.506824	0.6192
D(TLF(-3))	-5.562230	3.168133	-1.755681	0.0983
D(TLF(-4))	1.695792	3.345916	0.506824	0.6192
D(CAPU)	-0.594318	0.894797	-0.664193	0.5160
D(CAPU(-1))	1.347769	0.746242	1.806076	0.0898

D(CAPU(-2))	1.557663	1.281552	1.215451	0.2418
D(MPDI)	0.076116	0.093073	0.817813	0.4255
D(HCDI(-1))	-0.273236	0.091801	-2.976413	0.0089
D(HCDI(-2))	0.321824	0.103080	3.122068	0.0066
D(HCDI(-3))	-0.158431	0.093359	-1.697005	0.1091
D(HCDI(-4))	-0.117013	0.101683	-1.150767	0.2667
CointEq(-1)	-0.436484	0.162700	-14.97530	0.0000

Source: Extracted from Eviews9 Output

The lag selection follows the Akaike Info Criterion. The AIC selects the best fitted lag for the model with the lowest AIC. The ARDL model selected a lag structure of 1, 0, 1, 4, 2, 4 which means that one lag period is chosen for the dependent variable (Industrial Output), No lag for the first independent variable (Population Growth Rate), one lag for Life Expectancy, Four lag periods for Total Labour Force, two lags for Capacity Utilization and four lags for Human Capital Development. The lag structure shows the maximum number of years it takes for the variable to bring about a change in the current value of industrial output.

We can see from the table that Population Growth rate (PGR) has no lag periods hence the current years' rate of population growth decreases industrial output by 0.425 units. Also, Life Expectancy has one period lag and it shows that a unit increase in Life Expectancy in the previous year and current year will lead to a corresponding increase in industrial output by 1.14 units and 1.08 units respectively.

Total Labour Force on the other hand has 4 lag periods. The coefficients for the whole 4 years prior to the current year are negative which means that TLF has inverse relationship with Industrial Output in the previous years and current year. Capacity Utilization is positive in the first lag period (1.348) but changed to negative in the current year (-0.594). This reveals that capacity utilization of the manufacturing sector is gradually decreasing given the effects of population growth rate.

Furthermore, Human capital development index (HCDI) proxied by expenditures on education, health and social services shows negative coefficients in the first and third period lags while being positive in the second period lag and current year. This represents a fluctuation in the effect of HCDI on industrial output which is attributed to the unsteady and inadequate government expenditures on the development of human capital.

The speed of adjustment of the model is estimated at 0.436 which is approximately 43.6%. This means that the rate at which the model returns to long run equilibrium is 43.6% estimated annually.

Long Run Estimates

The Long run estimates of the ARDL model is summarized below:

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PGR	-0.174249	0.051032	-3.414505	0.0170
LEX	0.910593	0.549464	1.657239	0.1169
TLF	-0.836562	0.535914	-1.561002	0.1381
CAPU	-0.157778	0.042628	-3.701276	0.0043
HCDI	0.028298	0.091677	0.308668	0.7616
C	27.282490	20.097264	1.357523	0.1935

R-squared = 0.951; Adjusted R-squared = 0.935
Source: Extracted from Eviews9 Output

INDO = 27.2825 – 0.1742*PGR + 0.9106*LEX – 0.8366*TLF – 0.1578*CAPU + 0.0283*HCDI

The long run coefficients of the model show that Population Growth Rate has a negative relationship with Industrial Output decreasing it significantly by 0.174 units. Life Expectancy has a positive but insignificant relationship with industrial output meaning that as life expectancy increases, Industrial output increases by 0.9106 units which is in line with the apriori expectation.

Conversely, total labour force (TLF) and Capacity Utilization (CAPU) each decreases Industrial output by 0.8366 and 0.1578 units respectively. However, only capacity utilization decreases industrial output significantly.

Human capital development has a positive coefficient of 0.0283 showing a positive relationship with industrial output, but the positive relationship did not significantly enhance the growth of industrial sector's output.

Finally, the adjusted R-squared is 0.935 meaning that population growth rate and its indices account for up to 94% of the changes in industrial sector's output. It also has a significant joint impact on the industrial sector with F-statistic value of 28.93.

VIII. Summary and Implications of the Findings

The analyses of the relationship between population growth rate and industrial output gave us some interesting findings which are summarized as follows:

1. Population growth rate decreases the rate of industrial output in Nigeria. The decrease is more significant in the long run than in the short run. This means that as the population increases, industrial output decreases. This is not in line with economic apriori expectation and confirms the fact that the growing population in Nigeria has not been adequately utilized for the growth of the industrial sector. As stated by Onwuka (2013), "growth in population outweighs that of output and this has hindered the capacity of successive governments to efficiently provide social services to the people, thereby negatively affecting development". This assertion gives credence to the fact that Nigeria's population growth rate outweighs industrial production hence affecting the rate of economic growth.
2. Life Expectancy has a positive relationship with industrial output. As Life expectancy increases, it tends to increase industrial output. This means that the higher the survival rate, industrial sector will be better for it given the sector's need for active labour. But this variable is not significant which is seen in the negative effect of industrial labour force on industrial production.

Total labour force shows a negative effect on industrial output both in the short run and the long run. What this implies is that the labour force absorbed by the industrial sector is not enough when compared to the population growth rate and the life expectancy and this has resulted in decreasing output of the industrial sector.

3. The manufacturing capacity utilization has inverse relationship with industrial output decreasing it by 0.594 units and 0.158 units in the short run and long run respectively. However, human capital development index proxied by government expenditure on education, health and social services has positive but insignificant impact on the growth of the industrial sector in Nigeria. This implies that the pattern of government expenditure has helped to equip a large percentage of the population towards impacting positively on the industrial sector but this has not been very significant in terms of achieving the desired rapid growth of industrial production as witnessed in other advanced nations of the world.
4. Population growth rate was found to have long run impact on the industrial sector jointly accounting for up to 94% of the variations in industrial output.

IX. Conclusion and Recommendations

Nigeria's population reached 182 million in 2016 according to the International Monetary Fund (IMF) estimates with a rate of growth of 2.5%. This research work modeled the relationship between the growth rate of population and industrial sector's output with particular emphasis on the key variables that determine population growth namely life expectancy, total labour force, rate of capacity utilization and human capital development. Our findings led to the conclusion that Nigeria's growing population has not been effectively utilized to revolutionalize the industrial sector. The sector still grapples with low labour force utilization, inadequate capacity utilization and absence of skilled man-power to grow its productions. Given the less than expected impact of population growth rate on industrial sector's output in Nigeria, it is, therefore, recommended that:

1. There should be a renewed determination and political will to implement the National Policy on Population for sustainable development that outlines a sectoral strategy to manage our rising population. This National Policy on Population was rolled out in the year 2004 but ignored thereafter. By going back and re-enacting and possibly modifying its provisions, Nigeria would have set out on the right track to utilizing the abundant human resources for growth of the industrial sector.
2. There should be a rapid increase in government interv--ention in education, health and social services. By investing more in these areas, indigenous man-power will be built, total skilled and employable man-power will be enhanced and the industrial sector will be better off for it.
3. Continuous geometric population growth will only add more pressure on other indices like capacity utilization, total labour force, life expectancy etc. and these can only contribute more to decreased industrial activities given the inadequate man - power development. Increase in life expectancy without a corresponding increase in industrial labour utilization will only spell doom for the nation. In the light of this, the industrial sector in Nigeria should look inwards towards the training and re-training of their man-power and not depending on the government. Non-formal training centres should be established to enroll the teeming youth population and train them in areas that need specialty so as to convert the growing population into a producing population thus driving the needed growth in the economy.

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