

Mathematical Comparative study of Nigeria's Northern and Southern Population Growth for Equitable Resource Allocation and Holistic National Development

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ABSTRACT

Nigeria is one of the developing countries having a humongous population growth. Knowing the population size and growth of her geopolitical zones are becoming importance especially to government as size of a population is good parameter for economic development. The aim of this study is to compare the Nigeria's Northern and Southern population growth for equitable revenue allocation and holistic national development. To achieve this, helpful mathematical models such as Malthusian and Geometric are used to predict each zone. And the results of these models are validated using mathematical model called Mean Absolute Percentage Error (MAPE). Analysis revealed that Northern population is better predicted using exponential growth model and population is estimated to be 131062796 in 2022 with the growth rate 3.67%. On the other hand, Geometric model predicts Southern population better, with the estimate population 110779180 in 2022 and the growth rate of 3.2%.

Key words: population growth, Malthusian growth model, Geometric and MAPE

1.0 INTRODUCTION

Massive population growth in developing countries is one of the most sensitive (or important) problems in the world today. As getting accurate information about the geopolitical zone size will support planning activities such as allocation of available resource and if necessary, creating awareness for implementation of national population policy, hence knowing population size and growth of any nation (and region within) are becoming essential especially to governments as the size of a population is an important parameter for economic development. The population growth rises demands for water, food, energy and other economic needs. The growth of population also necessitates demand for relevant social service, such as housing, health, education and transport, (Andongwisye, as cited NBS, 2006).

Also future population awareness is a major factor for development planning and decision making. Population projection therefore provides future estimates of population figure needed by planners and policy makers (Andongwisye, as cited NBS ,2012). A fundamental problem in allocation of Nigeria's revenue is that since 1970 revenue allocation have been driven to a large extent by political manipulations and formula factors which include

jurisdictional population and state equality rather than economic related factors development imperative which in the recent time, has generated a lot of heat capable of suffocating the whole nation, Adeleke(2013).

In line with Adeleke(2013), Arugu, as cited Okoko(2011), how to equitably share revenue to the various component units of the Federation is one of the

most controversial issues that have confronted the Nigerian State. This assertion was also made by the Report of the Political Bureau (March 1987), that revenue allocation of statutory distribution of revenue from the federation account among different levels of government has been one of the most contentious issues in the nation's political life.

Many countries obtain their actual numeration through census, it is very expensive since it involved a lot of technologies and manpower as a result, census takes a longer period than require to predict future population. Besides, despite the fact population census is a key factor in development planning. However, as Anyanwu (1997) observed, the link between population and revenue allocation resulted in the politicization of census in Nigeria.

There are diverse Mathematical population growth models developed and used which are very helpful in projecting the total population devoid of sentiment (and biasness). The most popular and frequently applied two deterministic models, which we used in this research are exponential and geometric. The logic is that the previous data of the population is used to project the future population. Both models have been applied to predict future population of Northern and Southern Nigeria using the actual data from National population Commission from 2006 to 20011.

Thomas Robert Malthus, in 1798 proposed a mathematical model of population growth called Exponential growth model, is also known as Malthusian growth model. The model postulates that the growth is exponential and without limit. His proposal hinges on the assumption that the population

grows at a rate proportional to the size of the current population, (this assumption holds for bacteria or animal under ideal condition). Mwakisile (2019), on the other hand, geometric model is one of the important models to understand and estimate past and future population trends. Under the geometric change, the successive population totals differ from one another by a constant ratio. Geometric growth is useful for cities or population which has unlimited scope for expansion. To elucidate which of the two models gives a more accurate result we used Mean Absolute Percentage Error (MAPE) that plays a vital role in evaluating the goodness of fit of different models in national and sub-national prediction.

2.0 LITERATURE REVIEW

There are many related published articles in this field of knowledge as could be seen below.

Joshua and Amos (2019) pointed out that contemporary issues of Nigeria population census is full of uncertainty arise from issues of politicking involvement, result falsification of population census, religious rivalry and ethnicity stimulation (heat up) from different groups about the inaccuracy and manipulation of figure of population census to suit into desire of certain individual. They maintained that, successive Nigeria government during both colonial and post colonial periods understood the importance of accurate population census as the essential reliable tool for good development planning in a nation. Adequate knowledge of the features or characteristic of population and trends of a nation are therefore, indispensable reliability (a sine qua non) for reasonable development in the nation or country. Simply because development which involves maximum utilization of the nation's human and national resources to improve the conditions of living cannot take place without planning. However, lack of comprehensive population data in quality and quantity generally, has been accepted as one of the factors militating against strategic planning and sustainable development in Nigeria.

Abddrahim, Ramiz and Mohammed (2017) affirmed that massive growth of population in developing countries is one of the importance problems in the world today, particularly to governments, as accurate information obtain about the future population size assist planning activities. In their method of analysis, mathematical modeling and Non linear Regression to estimate the populations until 2100 for Jordan is key. To be specific, they made use of simple exponential growth and Verhulst Logistic growth models. According to Abddrahim et al (2017), exponential growth model can provide an adequate representation to population growth in ideal environment with unlimited resources where as Verhulst Logistic growth model accounts that as population size increase,

population growth rate decreases gradually due to limiting variables. This decrease would get to a stage of stagnation. The population size of individuals at the climax that environment can accommodate or support is carrying capacity. In their analysis using curve-fitting tool of MATLAB, exponential model predicted 123.169 million in 2100 as population of Jordan, with a growth rate of 3.27% per annum, logistic predicted Jordan's population to be 17.346 million in 2100, with growth rate of 4.56%. At comparison they concluded that logistic based models are more reasonable.

According to Isah, Muhammed and Nazaria (2019), secondary source of data and applied historical method of data analysis to unravel issues affecting sustainable development and conduct of population and housing census. The fundamental objective of conducting population and housing census all over the world is also to set fort plans for development which is targeted to be achieved and sustained. In their review, they maintained that conducts of censuses are controversial in many states and societies of the world, especially in relation to sensitive issues of religion, ethnicity and politics of constituencies and resource allocations.

Hironmony, Uzzwal and Haider (2018) opine that size and growth of population in every nation directly affect the situation of the economy, education, culture, policy and environment of that country and detect the cost of natural resources. There are increasing concerns with respect to implication of human population growth for environmental, social and economic development which arouse these problem in population growth. To fix these underline problem, according to Hironmony et al (2018), both the Malthusian and logistic growth models was applied to predict 2080 population of Bangladesh using actual data from 1980 to 2016 collected from the world bank. Their analysis revealed that exponential growth model predicted the population of Bangladesh to be 1191million by 2080 with growth rate of 2,67% approximately while logistic growth model projected Bangladesh total population to be 245.67million in 2080 with the growth rate of 4.03% and the carrying capacity is 245million. They concluded that since logistic gives a very low MAPE of 1.2% against exponential growth model with MAPE of 7%, logistic model gives a better forecasting result as compare to the Malthusian model.

Harod J.T (2018) made use of 1960-2015 Philippines census' data collected from United Nations population Division, United Nations Statistical Division and Eurostat. He applied exponential growth model along side with other mathematical growth models such as Hyperbolic, Logistic, Gompertz, Coalition and Regression. To elucidate the most accurate and effective model, researcher computed individual model using MAPE, and his computation revealed that regression model and logistic growth model with

lowest MAPE 0.468% and 0.616% respectively implies the most accurate prediction.

Adeyeye, Oyetade and Omar (2020) affirmed applicability of differential equation in diverse fields range from sciences, engineering and economic, in their study area of differential equal models, which are commonly used in population growth model was focused on Malthusian model and Verhulst model by which exponential and logistic model were described. They further explained how these models applied to estimate the population of Ban dar Lanpung, Indonesia, and also in the prediction of Huanggang city in China Suyitno, Andriani and Junaidi. In his guest to cater for possible challenges in the research, Adeyeye et al (2020) adopted numerical analysis of Malthus and Verhulst growth model which underscored block method in for casting national population to improve the accuracy resulting from its maximal order of derivative arising from block method and the solution compared well with other method in the literature which confirmed the reliability and applicability of the method.

Peter and Graham (2019) made use of exponential function by studying a biological population that grows at a rate of 0.2 with a growth function $y' = 0.2y$. they further considered a population of single celled organisms (bacteria) in a habitat where food supply is unlimited and where individual cells divide once a day. They replace the continuous variable y with the discrete variable N to model population size in terms of numbers. So that from an initial population of N_0 and a population N_t after t days thus

$N_t = R^t N_0$. In a nut shell, their paper was streamline to the need for growth models for adequate (sustainable) fisheries. It has, from the start identified certain properties of exponential function that are invariant which make it acceptable for modeling initial growth of populations until the constraints of population density and harvesting take place. Similarly they used logistic equation, ordinary differential equation base on empirical data to model both fish size growth and population growth. Solution obtained from ODE revealed that in a given fishery, for instance, existence of equilibrium of population towards which both nonsustainable (large enough) and growing (smaller) populations will tend.

Ajay and Prajapati (2016) asserted that a Verhulst model with distinct carrying capacity is a simplest way to study population growth due to the fact that equation contains few parameters are related. Researchers used logistic growth model which they considered most accurate to predict population growth of china from 1985 to 2015. They further stressed that exponential model could approximate future population but they cannot define its limit number exactly as population

estimated rises with time tend to infinity. Hence, using logistic equation researcher noted that for China to reach its carrying capacity of 2.2 billion ,it would take over 200 years.

Andongwisye and Allen (2019), asserted that population size plays significant role in economic development. The rise in population boost interest for water, food and other economic needs. They maintain that developmental planning and decision making immensely to the improvement of well being of citizens through the provision of current and reliable data for development planning, policy and service delivery. In the prediction of Tanzania population (2019) used exponential and logistic models as referenced (cohen 1995), Malthusian model assumed that the rate of growth is proportional to the existing population. From their prediction using exponential model from 2013 to 2035 revealed that population of Tanzania at 2035 is expected to be 87538767 with the growth rate of 2.88%, while logistic model projected 85102504 where as the carrying capacity of Tanzania is 2,976,857550, however, comparison of the models with real data from the five census showed that the exponential model is more accurate that the exponential model is more a accurate that logistic model.

3.0 MATERIAL AND METHOD

In this research, the two zones (Northern and Southern) population of Nigeria prediction are done by using the exponential and Geometric models. Secondary data from National population commission for year 2006-2011 are used, being a quantitative data collection with observational method to projecting future population of the zones, shown in Table1 below.

Table1. Actual Six year of Nigerian's Northern and Southern population

year	Northern zone population	Southern zone population
2006	72904369	66527421
2007	75307802	69690479
2008	77796580	71916084
2009	81379395	73202171
2010	83045515	77492592
2011	87561660	79758206

Important factors which influence population growth such as vital coefficient (birth and mortality rate) are considered in this study. Nigeria hosted migrants, refugees inclusive representing just 0.6% Nigeria population in mid-2020, (UNDESA,2020) which is negligible, moreover migration cut across the nation therefore immigration component is not considered in this paper.

3.1 Exponential Model

Thomas Robert Malthus, in 1798 proposed a mathematical model of population growth called Exponential growth model, is also known as Malthusian growth model.

Exponential growth model which plays a key role in modeling animal or bacterial. However, its application falls short of determining carrying capacity of a population. It is a single species population model. It describes the number of species as an exponential function of time.

Basically initial value problem in (1) emerged from Malthus' assumption that population grows at a rate proportional to initial population.

Suppose initial number of individual $N(t_0) = N_0$ at some specific time $t = t_0$ is known, and we wish to project their number (population) $N(t)$ at some future time $t=t_1$, then, this initial value problem can be expressed as

$$\frac{dN}{dt} = rN(t) \quad t_0 \leq t \leq t_1; \quad (1)$$

$N(t_0) = N_0$, Where r is the constant per capita growth rate and $N_0 > 0$.

Using the separation of variable technique on (1) and integrate both side (2) emerge as general solution of (1)

$$N(t) = ce^{rt} \quad (2)$$

Now, application of initial value on (2) yields

$$N_0 e^{r(t)} \quad (3)$$

This projects the population growth if $r > 0$, population reduce if $r < 0$ or no change in population if $r = 0$. From (3)

$$r = \frac{\ln \frac{N}{N_0}}{t} \quad (4)$$

3.2 Geometric Growth Model

Geometric population growth can be defined as the situation where the successive changes in the population differ by the constant ratio. Future population projection is determined by the initial (existing) population.

Now we wish to write a convenient equation showing connection between population size and demographic process. Let

N_t represent the size of the population at time t .

N_{t+1} represent population size one arbitrary time-unit later.

B_t represent the sum number of births in the interval from time t to time $t+1$

D_t represent the sum number of deaths in the same time.

For convenient we ignore the migration component. Our equation becomes

$$N_{t+1} = N_t + B_t - D_t \quad (5)$$

Where B_t and D_t are raw birth and death rates. For easy manipulation we may switch over from raw birth and death rates to per capita birth and death rates (ie to the number of births per individual in the population per unit time, and the number of death per individual in the population per unit time, respectively). Using the lower case (b_t and d_t) to represent the per capita births and deaths rates yields

$$b_t = \frac{B_t}{N_t} \text{ and } d_t = \frac{D_t}{N_t} \quad (6)$$

conversely

$$B_t = b_t N_t \text{ and } D_t = d_t N_t \quad (7)$$

Now, rewriting the model (5) produces

$$N_{t+1} = N_t + b_t N_t - d_t N_t \quad (8)$$

Suppose per capita rates of births and deaths remain unchanged over time (this suffice leaving off the time subscripts on b and d) hence (8) changed to

$$N_{t+1} = N_t + bN_t - dN_t \quad (9)$$

If $r = b - d$ is replaced in (9) results. Where r is geometric rate of increase. In other word, r depicts the (discrete-time) per capita rate of change in the size of the population.

$$N_{t+1} = N_t + rN_t \quad (10)$$

Further simplification of (10) yields $N_{t+1} = N_t(1 + r)$ (11) where $(1 + r)$ is the ratio of population size at one time to its size one time- unit earlier. And it can be calculated from population count at successive period. Using (11) we can calculate future population starting $t = 0$ to $t = n$, hence

The general equation is of the form $N(n) = N_0(1 + r)^n$

$$or N(t) = N(t_0)(1 + r)^{(t-t_0)} \quad (12)$$

Where $N(t)$ is the time-specific population count; N_0 is initial population; growth rate or geometric percentage increase; $n = (t - t_0)$ is prediction period in year. We can equally obtain r from (12) by simplification as

$$r = \sqrt[n]{\frac{N(n)}{N_0}} - 1, \text{ or } \left(\sqrt[n]{\frac{N(n)}{N_0}} - 1 \right) 100 \quad (13)$$

(expressed in percentage).

3.3 Mean Absolute Percentage Error (MAPE)

Mean Absolute Percentage Error, also known as Mean Absolute Percentage Deviation one of the most veritable metrics used to measure the forecasting accuracy of a model. MAPE has mathematical formula written as

$$MAPE = \frac{100}{n} \sum_{t=1}^n \left| \frac{N_t - P_t}{N_t} \right| \quad (14)$$

Where N_t , P_t and n denote actual, forecasting and number of observations of the population respectively.

The forecast percentage error best represents the accuracy of the forecast. If the forecast error percent is close to or beyond 100%, is an indication that is entirely or very inaccurate. On the other hand, if the

forecast error percent is closer to 0%, this indicate the forecast is accurate. In his interpretation of MAPE, Lewis (1982) postulate thus, <10% is highly accurate forecast, between 10% -20% is good forecasting, 21% - 50% is reasonable forecasting and higher than 51% is inaccurate forecasting.

4.0 RESULTS AND DISCUSSION

To estimate the current and future population of the two geopolitical zones in Nigeria, we need to ascertain growth rate r of the two zones using the exponential and Geometric growth model in (3) and (5). This is possible using the actual population of Northern and Southern Nigeria in Table 1. To start with, we estimate Northern Nigeria population with $t=0$ (ie t_0), for 2006 necessitating $N(0)=72904369$ ie $N_0=72904369$ and year 2009 as $N(3) = 81379395$ for interval of $t =3$ Substitute into (4) to get $r = 0.036658$

General function as model, when substituting into (3) is

$$N(t) = 72904369e^{0.036658t} \quad (8)$$

Where r and $N(t)$ is constant growth rate and time-specific population count for Northern Nigeria. This implies that the prediction growth rate of Northern Nigeria is 3.67% with the exponential model. Similarly, substitute into (6) and (5) to obtain $r = 0.0371338$ and

$$N(t) = 72904369(1 + 0.037133803133)^t \quad (9)$$

for geometric growth rate and predicting model respectively.

Now, using (8) and (9) time-specific simulated population of Northern zone can be constructed base on NPC data and with respect to the chosen models on Table 4.1

Table4.1 Estimated population of Northern Nigeria

Year	Actual population	Exponential	Geometric
2006	72904369	72904369	72904369
2007	75307802	75626486	75626475
2008	77796580	78450242	87450218
2009	81379395	81379433	81379395
2010	83045515	84417993	84417941
2011	87561660	87570008	87569941
2012		90839714	90839630
2013		94231504	94231403
2014		97749938	97749818
2015		105185827	101399604
2016		108399744	105185666
2017		109113276	109113091
2018		113187368	113187159
2019		117413579	117413345
2020		121797590	121797328
2021		126347292	126345001

2022	131062496	131062474
MAP	1.3466	5.1707
E		

As could be seen on table4.1, Malthusian model predicts higher population, 131062496 of Northern Nigeria in 2022 than Geometric Model. On this trend, MAPE of 1.3466% for exponential model gains preference over 5.1707% for Geometric model for its forecasting accuracy. This means by the year 2050 Northern zone will be 203480112 using exponential model.

Following the same format to simulate models that estimate Northern population, time-specific model was simulated, Table 4.2 conveys growth rates and simulated models for fitting Southern Nigeria.

Table 4.2 Time-specific models for Southern zone

models	Simulated Equations	Growth rates
Exponential	$N(t) = 66527421e^{0.03187t}$	$r = 0.03187$
Geometric	$N(t) = 66527421(1 + 0.03238t)$	$r = 0.03238358$

With Table4.2, Southern population can be estimated from 2006 to 2022 and then compare the model to identify the best forecasting one. This can be seen on Table4.3

Table4.3. Estimated population of Southern Nigeria

Year	Actual population	Exponential	Geometric
2006	66527421	66527421	66527421
2007	69690479	68681797	68681817
2008	71916084	70905939	70905981
2009	73202171	73202107	73202171
2010	77492592	75572632	75572719
2011	79758206	78019922	78020036
2012		80546464	80546604
2013		83154823	83154992
2014		85847649	85847849
2015		88627679	88627910
2016		91497734	91497999
2017		94460731	94461033
2018		97519680	97520020
2019		100677688	100678068
2020		103937963	103938385
2021		107303815	107304282
2022		110778666	110779180
MAPE		0.075091	0.075089

It should be observed that, estimation of Southern population in 2022 indicates that Geometric model which predicts 110779180 of its population slightly higher than exponential model with 110778666 attains higher forecasting accuracy with approximate MAPE of 0.075089% over 0.075091% for exponential model. However, both the models are highly accurate in the

estimation of Southern population which is why the MAPE results are extremely closed. Their closeness can also be seen on Fig 4.3 where the graph of the two models is seen to overlap and showing steady growth within the study years. By implication, Southern population will be 162386965 comes 2050.

Comparing the best simulated predictions for Northern and Southern Nigeria from the two models, Table 4.4 emerged.

Table 4.4. Final simulated population.

Year	North	South
2006	72904369	66527421
2007	75626486	68681817
2008	78450242	70905981
2009	81379433	73202171
2010	84417993	75572719
2011	87570008	78020036
2012	90839714	80546604
2013	94231504	83154992
2014	97749938	85847849
2015	105185827	88627910
2016	108399744	91497999
2017	109113276	94461033
2018	113187368	97520020
2019	117413579	100678068
2020	121797590	103938385
2021	126347292	107304282
2022	131062496	110779180

Now, comparing the Northern population to Southern Nigeria at 2022 they are differed by 23758214 hence, making Northern zone population larger than the Southern zone. This can be clearly shown further by pie-chart on Figure 4.1

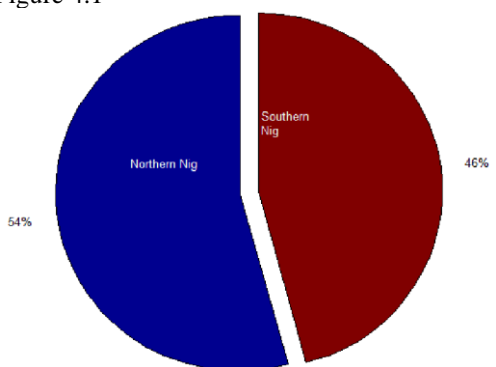


Figure 4.1: Pie Chart of Northern and Southern Nigeria population.

As indicated on Figure 4.1, blue sector represents the Northern Nigeria while red sector depicts Southern part, and their respective percentage population.

Population variation probably, may due to some factors. Firstly, the Northern Nigerians marry at the

early age than Southerners that encourages higher fertility rate, Secondly, larger population of Northern Nigerians practice polygamous marriage that help them giving rise to many children. Thirdly, this part of country is bordered with other nations that share common traits hence, become ease to migrate and feel belong, etc. Also from our computation we could see that population growth rate of Northern zone is 3.7% and is higher than Southern growth rate of 3.2%. On the other hand, Southern Nigeria constitutes larger population of citizen who practice monogamy. They don't marry at early age neither do they like given birth to many children, hence resulting having lesser population. Besides, this zone is bounded by other nations that do not share similar socio-economic cultures (language and others) asuch possibility of emigrants hiking her population is rare.

To demonstrate further the progressive growth of the two zones Fig. 4.2 is constructed. It is observed that both zones are growing exponentially. However, it could be observed that Northern Nigeria exhibited rapid growth while Southern part maintained smooth and gentle growth from 2006 through 2022 which boiled down to growth variations observed.

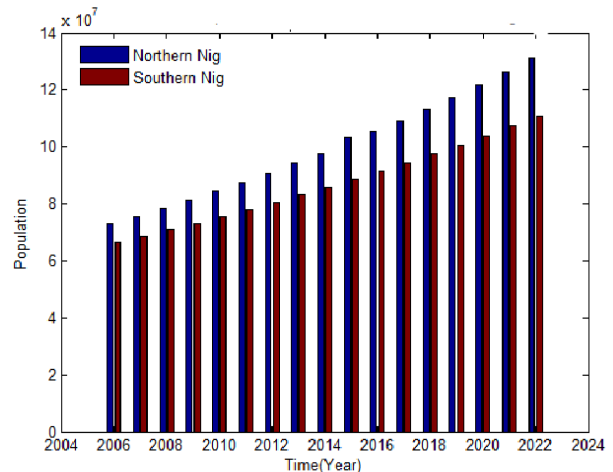


Figure 4.2: Multiple Chart of Northern and Southern Nigeria population.

Besides the fact that the performance of the two models are extremely similar that necessitated overlapping of the graph seen on Figure 4.3, it is also observed that both Northern and Southern Nigeria manifested steady growth alike within the study years

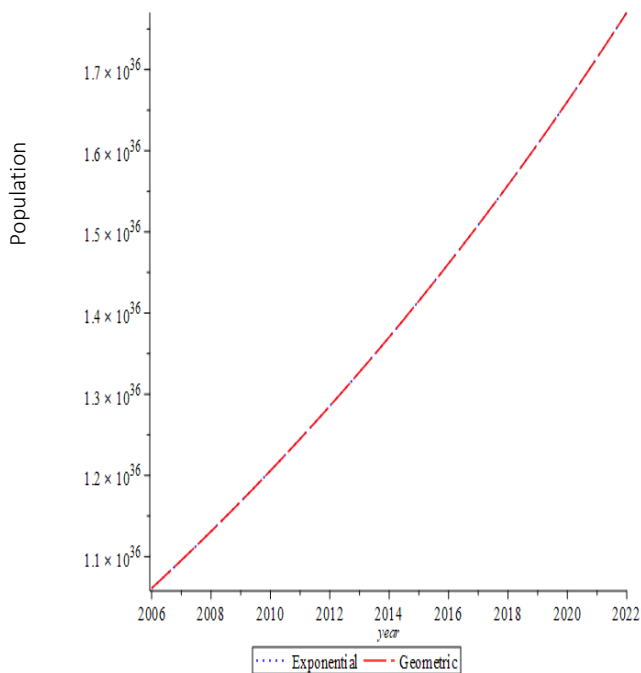


Figure 4.3: Exponential and Geometric steady growth of Northern and Southern Nigeria.

Now having evaluated the population trends of the two zones, it is relevant to reveal their respective revenue generations and sources of livelihood.

In term of economic resource, the north is said to be breadbasket of Nigeria. A significant proportion of the food we eat in Nigeria comes from the North. The North occupies larger percentage of Nigeria land mark, giving it comparative advantage over the South in terms of agriculture, raw materials and livestock. Large chunk of the North is arable and supportive of year-round food production. In 2021 total estimation of Northern Gross Domestic Products (GDP) is 50.13% (en.m.wikipedia.org/w). Similarly, South is known to be deeply involves in agriculture. The agricultural products produced which are largely cash crops include cocoa, rubber, palm oil, timber, cashew, citrus, rice, yam, colanut, cowpea, cassava, maize and plantain. South solely relied on agriculture as its mainstay before exploration of oil and gas inception. Today, the oil wealth account for over 85% of the national revenue and over 90% of foreign exchange is sourced mainly from Southern Nigeria. In 2021 total estimation of Southern GDP is 114.28% (en.m.wikipedia.org/w).

Surprise to note that when agricultural products: cotton, groundnut, cocoa and palm oil were the mainstay of the Nigeria economy, revenue allocation was base on derivation, but when crude oil produced from one region within Southern Nigeria as the major sustaining economy of the country from the 1970s the derivation criteria was trash off in preference for skewed formula designed by Nigeria State which gives

unwarranted advantage to the majority ethnic groups controlling the Nigeria state at the expense of some regions from minority hence thrown up uniform or holistic development in the Nigeria.

5.0 CONCLUSION

Using data from National Population Commission, this article evaluates comparatively the Nigeria's Northern and Southern population growth rate for equitable revenue allocation and holistic national development. In determining this, helpful mathematical models such as Malthusian and Geometric are used to predict each zone. And the results of these models are validated by the use of MAPE. It is also clearly shown that Mathematical model is a better alternative for predicting population growth with lesser cost.

Finally, simulation shows that, in 2022, population of Northern and Southern Nigeria are estimated to be 131062796 and 110779180 respectively. Moreover, the growth rate of the two zones, 3.7% and 3.2% for Northern and Southern population respectively, are on a high side. The study also previewed the socio-economic status of each the two zones as well as their source of revenue generations and contribution to national economic growths. The research equally acknowledged deprivation of some regions' legitimacy by shifting from derivation principle in resource allocation that enable them to recover their losses arising from mining of minerals and exploration of gas and oil which form the mainstay of Nigeria economy today to other criteria such as equality of states, population, social development factors and land mass, with just 13% as revenue allocation enshrined in the 1999 constitution of the Federal Republic of Nigeria which is disproportionate with environmental hazard incurred by the suffering regions. Okoko and Nna(1996).

6.0 RECOMMENDATION

Sequel to the research finding the following recommendations is made;

Government should embrace a just and fair revenue sharing system by taking into account the population of the two zones.

On the other hand, while government is considering the population of each zone in revenue sharing to abhor lopsided allocation, derivation principle should be giving premium due to the fact that some regions lost their source of livelihood in the course of mining of minerals and exploration of oil. This mean 13% as derivation revenue enshrined into constitution of the Federal Republic of Nigeria is insufficient.

Each region should properly embrace economic growth factors such as investment in workforce education, product output(as determined by investment in

physical capital), national resources within zones and entrepreneurship.

Besides, government should embark on full implementation of national population policy by prioritize family planning in her budget as done in China, to forestall adverse effect on Nigeria living standards, bitter conflict among geopolitical zones and many other hazards in future. Moreover, (Agog, as cited Shilpa, 2014) insinuated, uncontrolled human population growth has been a threat to the earth's resources and to the habitat themselves.

This study uses observational method to sort data from general national population commission into two zones without compromising its accuracy and reliability. Although, this research is able to address variables affecting population growth of the two zones to get significant objective, however, improvement can be made with further research using other encompassing models like coalition model (an advance exponential model) that takes cognizance of rising and falling population in an unlimited resource environment and Gompertz model.

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