

Research Article

Predicting Population Growth through Births and Deaths Rate in Nigeria using Relevant Statistical Methods

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ABSTRACT: *The study focuses on the socio-demographic analysis of the factors which lead to high birth and deaths rates in South Western region of Nigeria and its consequences on the population/economy. The results revealed that the Crude Birth Rate (CBR) of South West was between 0.59 and 0.78 while the Crude Death Rate (CDR) was estimated to be between 0.19 and 0.24 per '000 yearly population. Using Regression analysis, the study demonstrates that both birth and death rates for the given Sample period, have exerted much significant influence upon the population of South West as observed in the Coefficient of determination (R^2) of 72.3% arrived at in the Regression analysis.*

Keywords: *Birth Rate, Coefficient of Determination. Death Rate, Population, Regression*

1. INTRODUCTION

In the last census exercise conducted by the National Population Commission in 2006, Nigeria's population was put at nearly one hundred and forty million. This is undoubtedly an alarming figure for a country with distressed economy. The consequences of overpopulation is well known, with characteristics of Socio-economic problems such as unemployment or underemployment, low level of per capital income, low standard of living, poverty, huge external debt burden and many more social vices becomes manifested.

According to a survey report published in The Guardian Newspaper, on Monday, December 1st, 2008 on "Why planners are central to Lagos cities development" of South western region. [1], stated that Lagos state population have grown from 300,000 in 1950 to 7.7 million people in 1990. Although the population figure for Lagos was 9.03 million as declared in the controversial 2006 population and housing census. Other statistical sources have estimated the population of Lagos state to be much higher. According to UN estimates of 1999, the population of Lagos state would have expanded to 25 million people by 2015, when it was expected to be the third most populous city in the world. It is difficult to draw the bottom line where the South west will be by then, going by this conflicting figures.

An important area where data collection is essential is human population. Its data collection procedure is usually by direct enumeration of every individual in the territory at approximately the same time. Collecting data on human population involves a complex series of related activities. There is no gainsaying the fact that accurate population statistics is vital to sound development planning and economic management. Apart from information on the stock of the country's population, it is essential to know the rate at which the population is changing, structurally and in the aggregate. Provision of good health

services and facilities has been advanced as a major cause of high birth rate. Adequate and affordable health services enhance the chances of safe delivery, reduce miscarriages, still births and also reduce infant mortality.

According to [2], improvement of life expectancy especially in developing countries like Nigeria and the sharp drop in child mortality can be attributed to the huge investment in the health sector by most government especially in the developing countries. His opinion reflected in the case of South west, considering the huge resources already pumped into the health sector by the movement. It is pertinent to reflect in this study that, health care services for infants up till 12 years in most South west state is now free without my encumbrances. He stressed that improved health increases the enrolment of children in school and make them learn better and generate for the society able bodied and skilled manpower needed for promoting economic growth.

African sociologists have a different view concerning the reason for high birth rates. According to them, some religious groups such as Islamic religious permit a man to marry more than one wife and which is often a precondition for the accord of certain rights and privileges. In the cultural explanation, certain rights and honours are only conferred based on the number of wives and children a man has. Moreover, in the traditional agrarian societies, more children means more hands on the farm. According to [3], polygamy (marriage of one man to more than one woman) is a common indigenous system of marriage in most if not all African countries. According to them, some traditional rulers for example in Cameroon were said to have had as many as 300 wives. They maintained that polygamy is practiced in almost all the religions in Nigeria.

Further causes of high birth rates are high birth fertility and low mortality. According to [4] the size of any population is correlated with the level of fertility and infant mortality. It is positively correlated in the first case and negatively correlated with the later. She argues that the Nigerian population is growing at a high rate of 2.5% per year due to a high fertility rate and a decreasing mortality rate, particularly among infants. [4] further argued that since the population is growing rapidly due to a high fertility rate and a declining mortality rate, an increasing proportion of the population is under 15 years of age and is for the most economically inactive. They are basically dependent on the economically active group.

She thus maintained that as long as Nigerians fertility remains high, the prospect is that the proportion of the population who are children will remain high and finally she maintained that the human resources of a country are similar to the capital resources in that not only can the stock increase through rapid birth rates, but investments can also improve its production capacities. Also urban unemployment opportunities exist in Nigeria because the growth of new job seekers is increasing at a faster pace than the growth of employment opportunities. The genesis of this social problem is traced from high birth, low infant mortality and consequently high turnout of graduates of diversified disciplines who could not be accommodated in the employment market. [5] added to this, by conceptualizing economic growth in terms of human capital as a strategic input. [6] conceived economic growth as a generalized process of capital accumulation in which human capital has a complimentary limits with other forms of capital. From this definition, it becomes clear that the role of human effort in economic development cannot be overlooked. It therefore implies that an increase in population matched with necessary educational and training facilities is capable of providing a nation with skilled labour force whose contributions to economic advancement cannot be over-emphasised

Death on the other hand, is caused basically by several diseases which are environmentally oriented. Poor environmental sanitation as evident in pool sewage disposal system, inadequate supply of clean drinkable water are major causes of some known diseases like Typhoid, Malaria, Cholera and several others.

Malaria is one of the commonest diseases that claim many lives in tropical countries like Nigeria. According to [7], malaria strikes an estimated 100 million or more people in the developing countries each year, killing one to two million of them. It is one of the biggest killers of children in sub-Sahara Africa. The economic cost of malaria is also stressed by Anne Mills. According to [8] the impact of the disease on the economy and economic development efforts as seen in reduced productivity caused by worker's illness and its financial burden on individuals and government cannot be over-emphasized.

Due to its widespread nature, precise estimates of the mortality and morbidity of malaria are often hard to come by. Unsurprisingly, there are no accurate statistical estimates of deaths caused by malaria in Nigeria.

[2], in his study in the 2003 world development report, attributed several causes of death to environmental habit and social factors. According to him, many cities suffer from air pollution caused by industries, power plants, road transport and domestic use of coal. He stressed that atmospheric; pollution is a major cause of respiratory disease in urban centres. [2] further stressed that inadequate environmental sanitation and impure water supply are major causes of tuberculosis and typhoid diseases He claims that about 1.3 billion people in developing countries lack access to clean and portable water. [9], in their study on the demand for water in rural areas (with special reference to Nigeria and other five developing countries) emphasized that improving the adequacy and quality of water supply is a priority for rural development and government international donors have an urgent role to play. Such efforts are already ongoing in Lagos state by the United Nation (UN) as discussed in [1].

Other causes of deaths according to medical scientists are those that arise from habits such as tobacco, smoking, alcohol and illegal drugs use or drug abuse. Although tobacco is in illegally use everywhere in the world, but it causes far more deaths than all other "psycho-active" substances

An overview of deaths such as this will never be complete if failure is made to mention those caused by accidents, especially accidents on roads, air and water.

II. MATERIAL AND METHODS

To analyse the data collected, the type of techniques adopted are the simple and multiple regression analysis. The regression models assumed a linear relationship given as follows:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_k X_{ki} + u_i, \quad i = 1, 2, 3, \dots, n \quad (1)$$

where, β_1 = the intercept

β_2 to β_k = partial slope coefficients

u = stochastic disturbance term

and $i = i^{\text{th}}$ observation, n being the size of the population.

This equation identifies $k-1$ explanatory variables (regressors) namely $X_1, X_2, \dots, X_k$ and a constant term that assumed to influence the dependent variable..

This is done by fitting a regression line to the observed sample as an approximation to the true line. If then the true relationship between X s and Y is as giving in (Equation 1). The true regression line is

$$E(Y_i) = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_n X_{ki} \quad (2)$$

And the estimated relationship is:

$$Y_i = b_1 + b_2 X_{2i} + b_3 X_{3i} + \dots + b_n X_{ki} + e_i \quad (3)$$

(Equation 1) is a shorthand expression for the following set of n simultaneous equations:

$$\begin{aligned} Y_1 &= \beta_1 + \beta_2 X_{21} + \beta_3 X_{31} + \dots + \beta_n X_{k1} + u_1 \\ Y_2 &= \beta_1 + \beta_2 X_{22} + \beta_3 X_{32} + \dots + \beta_n X_{k2} + u_2 \\ &\vdots \\ Y_n &= \beta_1 + \beta_2 X_{2n} + \beta_3 X_{3n} + \dots + \beta_n X_{kn} + u_n \end{aligned} \quad (4)$$

We can write the system of (equations 4) in matrix form as shown below:

$$Y = X\beta + \varepsilon \quad (5)$$

Where

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}, \quad X = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix}, \quad \beta = \begin{bmatrix} \beta_0 \\ \beta_1 \end{bmatrix}, \quad \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix} \quad (6)$$

To obtain the consistent estimation of β , we minimise the residual sum of square (SSE) which is normally given as

$$ESS = u'u \quad (7)$$

But $u = Y\beta$ (8)

$$\begin{aligned} \text{Hence, } u'u &= (Y - X\beta)'(Y - X\beta) \\ &= Y'Y - \beta'X'Y - Y'X\beta + \beta'X'X\beta \\ &= Y'Y - 2\beta'X'Y + \beta'X'X\beta \end{aligned}$$

Since the transpose of a scalar is a scalar, thus;

$$Y'X\beta = (Y'X\beta)' = \beta'X'Y$$

Thus,
$$\frac{\sum u'u}{\sum B/B} = -2X'Y - 2X'X\hat{\beta} = 0$$

$$\hat{\beta} = (X'X)^{-1}X'Y \quad (9)$$

Where (Equation 9) is the least square estimates for the parameters of a classical model.

The test statistic used for the goodness of fit are the coefficient of determination (R^2), the student-t, F- distribution and the standard error test

III. RESULTS AND DISCUSSION.

3.1 Analysis of Population and Birth Rates

The estimated regression model is: Population = 10,666,394.87 + 389.89 Births i.e $Y = 10,666,394.87 + 389.89X_1$

The value of 'r' for model produced by this regression is 0.596. which shows a positive correlation between the population of Lagos state and recorded births. $R^2 = 0.356$, which shows that only 35.6% of the variation in the population (Y) of Lagos state is explained by the birth recorded. $F = 1.656$ with a significant value of 0.288. It means that the recorded birth of Lagos state do not explain very well the variation in population of Lagos state. Though the t values of $\beta_0 = 3.553$ and that of $\beta_1 = 1.287$ fall in the positive critical region but that of β_1 is less than +2. This implies therefore that only β_0 estimate is significant. For the Standard error test, only the estimates of β_0 is also statistically significant since its standard error is less than half of its estimate i.e. $3,001,803 < 5,338,642.93$.

In summary, birth rates for the given sample period has not exerted much significant influence upon the population of Lagos state as reflected in the coefficient of determination of 35.6% and the test of significance carried out for the regression coefficients.

3.2 Analysis of Population Death Rates

The estimated model is Population = 9,509,306.013 + 1,632.248 Deaths i.e.

$$Y = 9,509,306.013 + 1,632.248X_2$$

In this analysis, $R^2 = 0.663$, which shows that only 66.3% of the variation in the Population (Y) of Lagos State is explained by the deaths recorded. $F = 5.192$ with a significant of 0.094, it means that the recorded deaths of Lagos state do not explain very well the variation in the Population of Lagos state. Both the t values of $\beta_0 = 4.587$ and that of $\beta_2 = 2.427$ fall in the positive critical region therefore implying that the two estimates are statistically significant since the standard error are less than half of their estimates i.e. $2,073,034.081 < 4,754,653.007$ for β_0 and $672.435 < 816.124$ for β_2 .

In summary, death rates for the given sample period exerted much significant influence upon the population of Lagos state than the recorded births as reflected in the coefficient of determination of 66.3% and the test carried out for the regression coefficients.

3.3 Analysis of Population, Birth and Death Rates Combined

The estimated model is Population = 8,518,030 + 181.380 Births + 1,373.199 Deaths

$$\text{i.e. } Y = 8,518,030 + 181.380X_1 + 1,373.199X_2$$

$R^2 = 0.723$, which shows that 72.3% of the variation in the Population (Y) of Lagos State is explained by the combined effect of births and deaths recorded in Lagos state hospital.

$F = 2.609$ with a significant value of 0.277, it means that the recorded births and deaths of Lagos state do not explain very well the variation in the Population of Lagos state.

The t statistics is also used as a guide, since t for $\beta_0 = 3.099$ is well above +2, this show that β_1 and β_2 are statistically insignificant.

In summary, the combined effect of birth and death rates for the given sample period exerted much significant influence upon the population of Lagos state than both the recorded births and deaths when considered individually as reflected in the coefficient of determination of 72.3%. This shows that 72.3% of the variation in (Y) is accounted for by the variation in (X_1) and (X_2). The remaining 27.7% of the variation in population figure of Lagos State that is not accounted for by the births and deaths recorded in Lagos state hospital may be due to other factors such as immigrants and emigrants.

IV. CONCLUSION

Going by the existing literature, including the ones reviewed in this study, there seems to be an in exhaustive work on birth and death rates with special reference to Nigeria population and the economy. There is general believe that economic stagnation is often linked with over population and poor investment in health services. In recent times, policy makers in most part of the globe has taken these twin problem very seriously and in fact have considered them as major obstacles in their wheels of progress.

With Nigeria's population currently put at over 140 million people compared with Gross Domestic Product (GDP) that is not too encouraging and inflation still sky-rocketing, there is the fear that future living standards may substantially depreciate. From the multiple regression analysis carried out, it can be reasonably concluded that the remaining 27.7% of the variation in population figure of Lagos state that is not accounted for by the births and deaths recorded in Lagos state hospital may be due to other factors such as immigrants and emigrants.

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