FERTILITY AND POPULATION GROWTH IN NIGERIA:

A STATISTICAL ANALYSIS

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ABSTRACT

This study examines the relationship between fertility and population growth in Nigeria. Using secondary data from the United Nations website, we analyzed birth and death rates from 2012 to 2022. Our results show a strong positive correlation between fertility rates and population growth, with a correlation coefficient of 0.97. A linear regression model of $y = 0.35x – 0.08$ reveals that 1% increase in fertility rates leads to a 0.35% increase in population growth. These findings highlight the significant impact of fertility rates on population growth in Nigeria.

Key Words: Fertility, Population Growth, Birth rate, Death rate, Correlation Coefficient and Regression Model.

Introduction

Nigeria has historic experience of high fertility rates and rapid population growth, primarily due to high birth rates and relatively low mortality rates (Feyisan, 2002).

The total fertility rate (TFR), which is the average number of children a woman is expected to have in her lifetime, had been consistently high in Nigeria, fluctuating around 5 - 6 children per woman. Factors like low contraceptive use, lack of family planning programs, early marriage and cultural preferences for large families have been cited as contributing factors to high fertility rate. The high fertility rates have resulted in rapid population growth making Nigeria one of the fastest growing countries in the world (Addah, 2022).

Fertility is a major component of population growth. It is the ability of a living organism to be able to reproduce its kind at a particular period of time (Martins et al, 2025).

The most important factor of population growth is the total fertility rate (TFR). The TFR of a population is the average number of children that are born to women over their lifetime. The average woman gives birth to 2.1 children and these children survive to the age of 15 years old, would have replaced herself and her partner upon death. A TFR of 2.1 is known as the replacement rate.

Generally, when the TFR is greater than 2.1, the population eventually increases but when TFR is less than 2.1, the population will decrease, although this may take some time due to factors such as age structure, emigration or immigration (Smoak, 2023).

Prospective population increase would make it more difficult to improve conditions in developing nations since the highest fertility rate is proportional to the lowest income per head; the greatest dependence on agriculture; the lowest use of energy; and the lowest rates of literacy (Glass, 1966).

Fertility in Sub- Sahara Africa (SSA) is the highest in the world, with an average of 4.6 births per woman in 2020 compared to 2.4 globally (World Bank, 2022b). Fertility rate across the continent is declining more slowly more than other regions. A common concern among policy makers is high fertility rate combined with reductions in infant mortality rate leading to increase in child dependency ratios, which is associated with poor economic development, low living standards and illiteracy. Women's fertility rate responds to increase in their earnings and household wealth, using six experiment conducted in Sub-Saharan Africa, the researcher discovered that an increase in the profits of female business owners in Ethiopia and Togo results in more child bearing. It also show a positive fertility response to increasing the value of household assets induced by land formalization programs in Benin and Ghana (Donald, et al, 2024).

Using data derived from the Nigerian segment of the world fertility of 1981/82, an examination of the relationships between fertility and selected indices of women's status was undertaken/ women who are still in their marriage was used for this analysis. The findings indicate that;

- Fertility is lowest among non-working women and highest among women who either had prenuptial and postnuptial working experience or work for financial remunerations in non-familial enterprises
- Female education is significantly inversely proportional to fertility
- Mothers in monogamous unions have lower fertility than their counterparts in polygamous unions.
- The age difference between spouses is negatively correlated with fertility (Feyisetan, 1988)

The traditional Nigeria societies requirements of premarital chastity vary among the ethnic groups from explicitly sanctions against premarital sexual relations to marriage practices that directly or indirectly ensure virginity of new brides.

Nigerian societies have traditionally placed strong emphasis on the importance of premarital sexual abstinence for women, such that the incidence of sexual activity before marriage provides an indication of the extent of erosion in traditional practices and in family control of young women's behaviour since pregnancy and childbirth outside of marriage a not traditionally acceptable in the family support systems in Nigeria (Feyisetan et al, 1989).

The 2023-2024 Nigeria demographic and health survey (NDHS) reveal a decline in fertility rates and a concerning rise in zero-dose children; children receiving no vaccinations. The fertility rate has dropped from 6.3 children per women to 4.8 in 2023 (2023-2024 NDHS). Fertility behavior is conditioned by both biological and social factors. These factors include

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high level of infant and child mortality, early and universal marriage, the fear of extinction encourages high procreation.

The traditionally high value placed on marriage ensured not only its universality but also its occurrence early in life with the consequence that child bearing started early in life and in most cases continued until late in the reproductive span (Feyisetan, 2002).

Human Population Growth

Population growth is the increase in the number of people in a population or dispersed group. There has been an increase in the global population growth rate in 2022 approximately to be 0.85% (World Bank, 2022).

The global population has grown from 1 billion in 1800 to 8.2 billion in 2025 (World Population, 2024). The world population growth experienced exponential growth from 18th century, but the growth rate have been declining since the second half of the 20th century. Although population growth rates vary significantly from country to country, and some regions continue to experience increasing growth rate while the overall growth rate is decreasing (NBS, 2023).

The world population has reached 8 billion in November 2022 and it is predicted to peak at 10.4 billion by 2080, and to remain at that level till the end of the century (UN, 2024).

The human mortality rate have been decreasing on the average and the main reason for decreasing population growth rate is low fertility rates. The crude birth rate in Nigeria saw no significant changes in 2022 in comparison to the previous year 2021 and remained at around 36.31 live births per 1,000 inhabitants. The birth rate reached its lowest value of the observation period in 2022. The crude birth rate is the annual number of live birth in a given population, expressed per 1,000 people (Addah, 2022).

Fertility varies based on reproductive behavior patterns, which in turn depends upon factors such as culture and traditions, socio-economic conditions, access to contraception and ecological variables such as population density (Smoak, 2023).

Statistical Theory of Population Growth

This theory is primarily refers to as Malthusian theory which posits that human populations tends to grow exponentially, while the resources needed to sustain them to grow at a much slower linear rate, eventually leading to a point where population out spaces available resources, causing population decline due to factors like famine or war; this concept is often expressed through mathematical growth equations (Malthus, 1798).

Some of the factors that contributed to the decline in fertility and what changes we do expect and the possible consequences of these changes on fertility in Nigeria are in these categories: (1) Fertility desires (2) Marriage (3) contraceptive use (4) postpartum variables, post-partum amenorrhea and post-partum abstinence (5) abortion (6) women's education and female employment (Feyisetan, 2009)

Methodology

Statistical Tools

The statistical tools used in this research to analyze data, interpret results and to draw conclusions are as follows:

- Regression Analysis
- Correlation Coefficient
- Bar chart and Pie chart

Regression Analysis: This is a statistical method used to determine the strength and character of the relationship between a dependent variable Y and one or more independent

variable X. It is graphically depicted using a straight **line of best fit** with the slope defining how the change in one variable impacts a change in other variable (Brian, 2024).

$$Y = a + bX + \varepsilon$$

Where Y is Dependent Variable, X is Independent Variable, a is y-intercept, b is Slope of Variables and ε is Regression residual or error.

Correlation Coefficient: It is a statistical measure of the strength and nature of linear relationship between two random variables X and Y. We apply the Pearson Product-moment of the correlation coefficient in this work.

Data Analysis of Population Growth

Population growth in Nigeria is the world's most rapidly growth nation with an annual population growth rate of 2.38% in 2022 and 2023. It is predicted that within the space of 30years, Nigeria would overtake the United State of America as the third most populous nation in the world (United Nations, 2024).

In 2024, Nigeria population amounted to over 227 million and was estimated to constantly increase in the next decades (O'Neill, 2024).

According to National Population Commission, Nigeria's population is projected to be 234,573,603 in the year 2025, at the growth rate of 2.37% increase from 2024 (NPC, 2023).

The researcher collected secondary data for a period of eleven years from the World Bank website of birth and death rate in Nigeria from 2012 to 2022 (per 1,000 inhabitants) for data computation and analysis, thus:

Years	Birth Rate Per Thousand Population *(x)*	Death Rate Per Thousand Population *(y)*
2022	36.61	12.43

2021	37.12	13.08
2020	37.47	13.00
2019	37.85	12.99
2018	38.25	13.24
2017	38.69	13.44
2016	39.13	13.64
2015	39.51	13.80
2014	40.07	13.89
2013	40.6	14.00
2012	41.24	14.19

Table 1: *Birth and death rate in Nigeria from 2012 to 2022*

Source: Nigeria Population Commission

We compute to analyze the relationship between x and y leading to population growth in Nigeria within the period of 11 years under review.

Hence,

$$\bar{x} = \frac{\sum_{i=1}^{n=11} x_i}{N} = \frac{426.54}{11} = 38.7764 \approx 38.78 \tag{1}$$

$$\bar{y} = \frac{\sum_{i=1}^{n=11} y_i}{N} = \frac{147.7}{11} = 13.4273 \approx 13.43 \tag{2}$$

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Data Computation of Annual Population Growth

Year	X	Y	X − X̄	Y − Ȳ	(X − X̄)²	(Y − Ȳ)²	XY	X²	Y²
2022	36.61	12.43	-1.17	-1.00	4.7089	1.0000	455.06	1340.9	154.50
2021	37.12	13.08	-1.66	-0.35	2.7556	0.1225	485.53	1377.89	171.09
2020	37.47	13.00	-1.31	-0.43	1.7161	0.1849	487.11	1404.00	169.00
2019	37.85	12.99	-0.93	-0.44	0.8649	0.1936	491.67	1432.62	168.74
2018	38.25	13.24	-0.53	-0.19	0.2809	0.0361	506.43	1463.06	175.30
2017	38.69	13.44	-0.09	0.01	0.0081	0.0001	520.00	1496.92	180.63
2016	39.13	13.64	0.35	0.21	0.1225	0.0441	533.73	1531.16	186.05
2015	39.51	13.80	0.73	0.37	0.5329	0.1369	545.24	1531.04	190.44
2014	40.07	13.89	1.29	0.46	1.6641	0.2116	556.57	1605.60	192.93
2013	40.60	14.00	1.82	0.57	3.3124	0.3249	568.40	1648.36	196.00
2012	41.24	14.19	2.46	0.76	6.0516	0.5776	585.20	1700.74	201.36
	426.54	147.7	-0.04	-0.03	22.018	2.8323	5734.94	16561.68	1986.04

Table 2: *Birth and Death rate of data analysis*

We compute for the person product moment correction coefficient

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})\,(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2\,\sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

$$r = \frac{11(5734.94) - (426.54)(147.7)}{\sqrt{(11(16561.8) - (426.54)^2)(11(198.04) - (147.7)^2)}} = \frac{84.382}{\sqrt{7541.6767}} = 0.9717 \qquad (3)$$

The result analysis shows that there is a very strong relationship between the birth rate and death rate for population growth rate to occur.

We therefore compute for the linear regression model using table 2, hence

$$Y = a + bX + \in \qquad (4)$$

Where

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{(147.7)(16561.68) - (426.54)(5734.94)}{11(16561.68) - (426.54)^2} = \frac{-21.172}{242.108} = -0.08 \qquad (5)$$

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} \qquad (6)$$

$$b = \frac{11(5734.94) - (426.54)(147.7)}{11(16561.68) - (426.54)^2} = \frac{84.382}{242.1084} = 0.35 \qquad (7)$$

Therefore the model of the linear regression is $y = 0.35x - 0.08$

Data Computation of Population Growth and Results Analysis

YEAR	X	Y	POPULATION GROWTH(1000)
2022	36.61	12.43	24.18
2021	37.12	13.08	24.04
2020	37.47	13.00	24.47
2019	37.85	92.99	24.86
2018	38.25	13.24	25.01
2017	38.69	13.44	25.25
2016	39.13	13.64	25.49
2015	39.51	13.80	25.71
2014	40.07	13.89	26.60
2013	40.60	14.00	26.60
2012	41.24	14.19	27.05
TOTAL	**426.54**	**147.7**	**278.84**

Table 3: *Data Analysis of annual population Growth rate*

Source: Nigeria Population Commission

Pie chart computation of Annual population Growth rate from 2012 to 2022

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Degree	34.9^0	34.4^0	33.8^0	33.2^0	32.9^0	32.6^0	32.3^0	32.1^0	31.6^0	31.0^0	31.2^0

Table4: *Pie chart Data analysis of annual population growth rate*

Results and Discussion
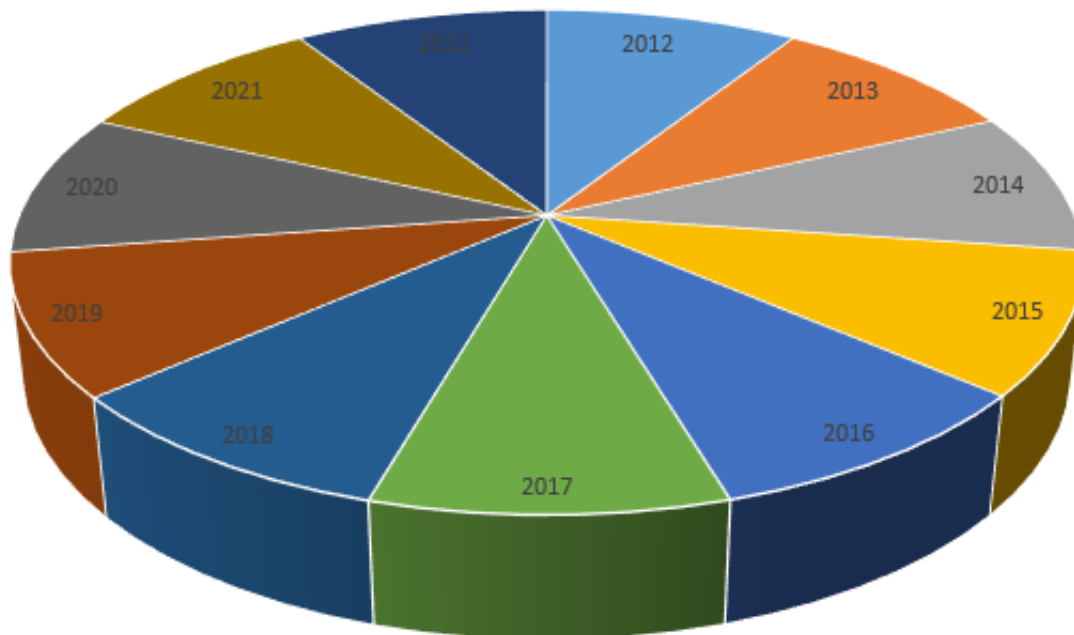
Figure 1: *A Pie Chart Representation Showing Annual Population Growth Rate from 2012 to 2022*
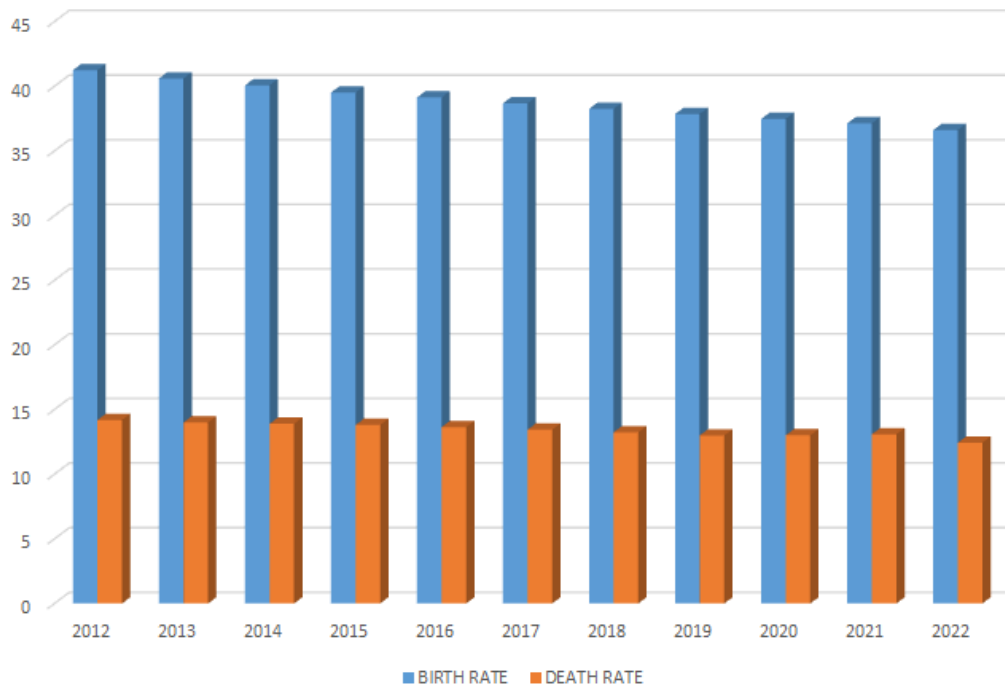
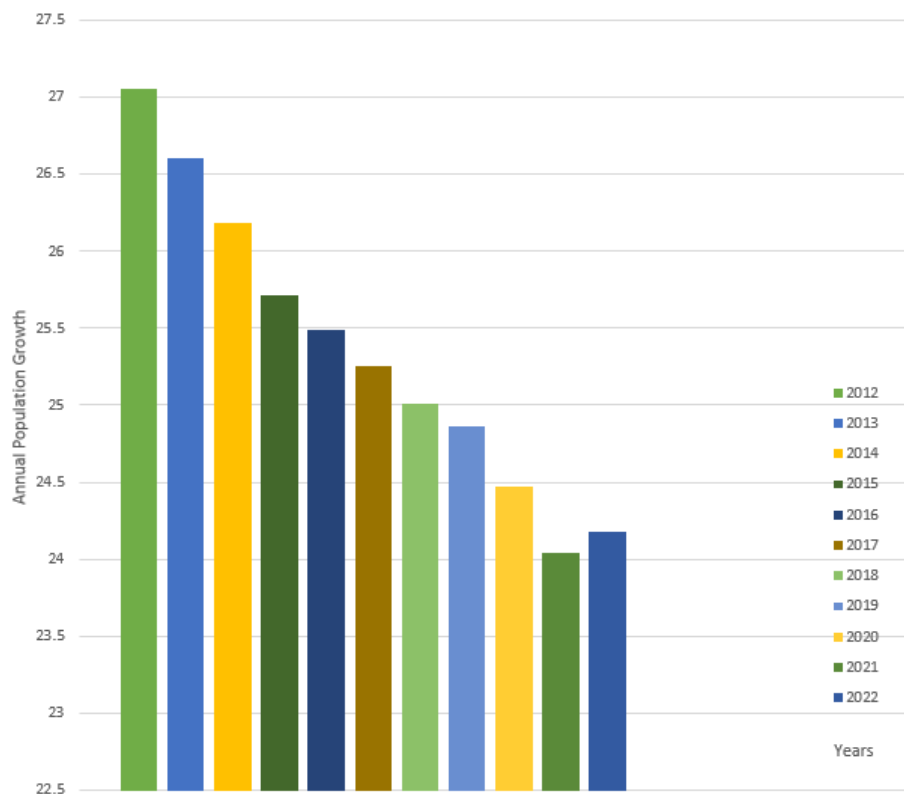*Figure 2*: *Graphical Representation of Birth and Death Rate from 2012 to 2022*

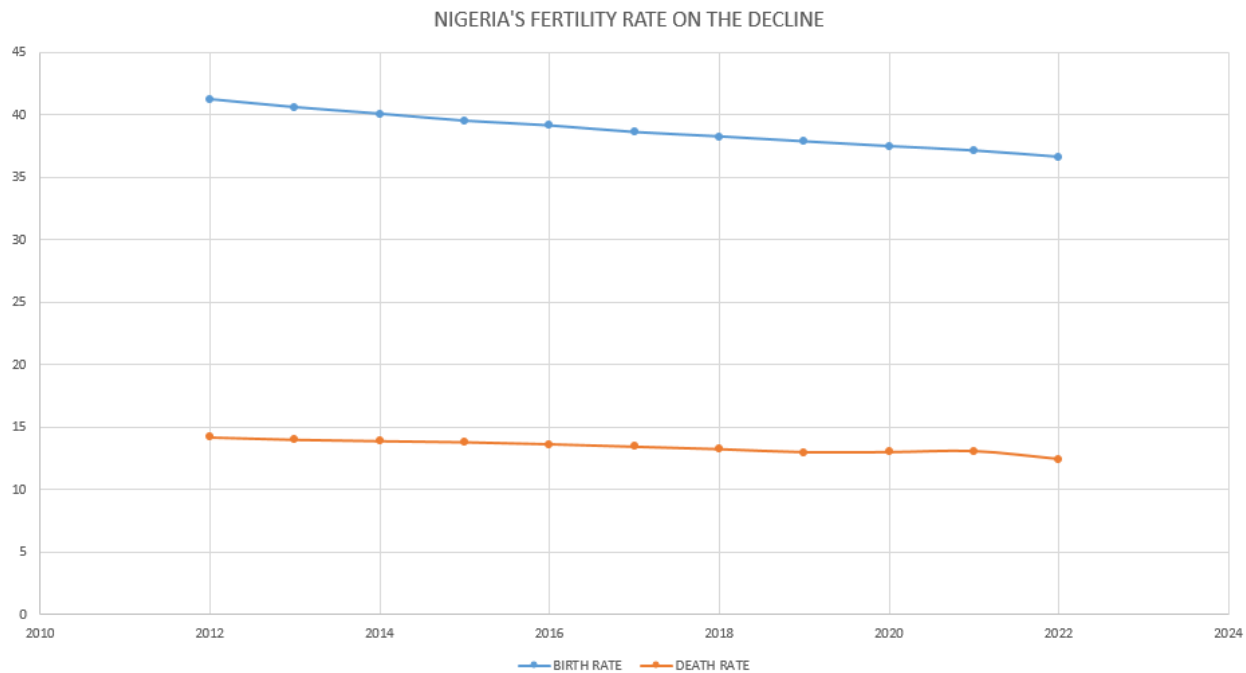**Figure 3:** *Graphical Representation of Human Population Growth in Nigeria from 2012 to 2022*

NIGERIA'S FERTILITY RATE ON THE DECLINE

Figure 4: *Birth and Death Rate on the decline*
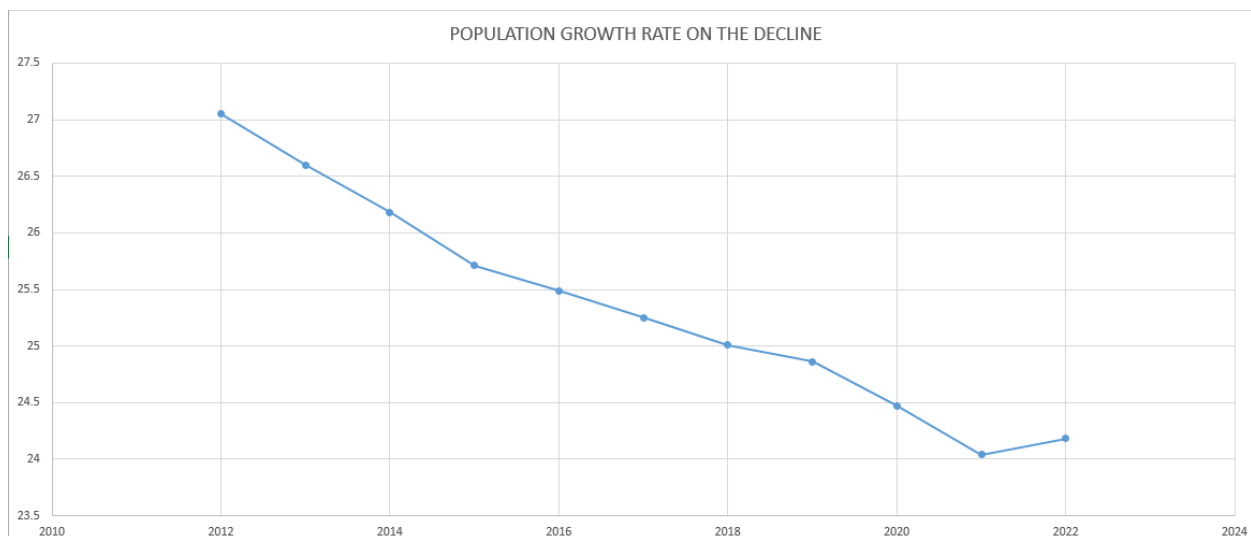

POPULATION GROWTH RATE ON THE DECLINE

Figure 5: *Nigeria's Population Growth Rate on the Decline*

For declines in fertility to be sustained as shown in figure 4 and 5, there must be changes in fertility norms towards smaller family size. Fertility norms usually reflected by the demand for children which are most often measured by the number of children desired under prevailing social and economic conditions. In order to make predictions about future course of fertility in Nigeria, there is the need to investigate certain patterns of change in fertility norms (Feyisetan, 2002).

The graphical representation in figure1, 2, 3, 4 and 5 of the data in table 3 and 4 shows a decline in Nigeria's fertility rate from 2012 to 2021 and then increases in 2022. The fertility rate is referred to as the average number of children a woman has in her lifetime which is the primary factor driving population growth. When fertility rate is high, population growth is also high and vice versa (United Nations, 2024).

Conclusion

The data analysis from table 2 shows that the correlation coefficient is 0.9717 having a linear regression model of Y = 0.35X - 0.08 which has a strong positive effect of fertility on population growth over the period of eleven years under review. The pie chart from table 4 as shown in the computation leads to the graphical representation in figure 1 indicating a slight percentage decrease on a yearly basis, meaning there is a decrease in annual fertility and a decline in population growth rate over the years.

Looking at the bar chart in figure 2, the result also confirm a strong positive correlation between birth and death rate leading to annual population growth rate on the decline as shown in figure 3, 4 and 5.

The graphical representation in figure 4 and 5, shows that the birth rate and death rate are gradually decreasing over the years leading to Nigeria's fertility rate declining with about 1.32% yearly.

The decline in desired family size is an important underlying force for the current fertility transition. Some other factors which are associated with the decline in fertility over the years include increased use of contraception, changes in nuptiality patterns, particularly in the proportion marrying before age 20 and increased education of women are expected to generate further declines in fertility rates (Feyisetan, 2002).

Birth and death rates decreases significantly from 2012 to 2021 as shown in figure 5. Hence there is the existence of population growth as a result of fertility proportionality to population growth. However the decline in fertility rate was not characterized by a declining population growth as observed in the figure 3, hence there is an increase in the population growth in Nigeria.

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