

Population growth and fertility decisions nexus in Nigeria

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ABSTRACT

The study of the relationships between population growth and fertility has gained attention, given the prominent role of population transition (changes in mortality, fertility, and population structure) is playing. The study investigated the relationship between population growth rate and total fertility rate. Specifically, the study examined the impact of female education, infant mortality rate, and health expenditure on total fertility rate, as well as determining if there exists a feedback impact between population growth and fertility rate in Nigeria. The study employed the Autoregressive Distributed Lag and SVAR estimation approach over the period 2000 to 2023. The findings revealed that Nigeria's overall fertility rate was positively impacted by population increase, female education, and unemployment rate. On the other hand, health spending was found to negatively impact on fertility rate. Also, while population growth was found to have a significantly positive impact on fertility rate, having the highest magnitude, fertility rate was found to have a positive and insignificant impact on population growth rate. The study therefore advocated for an effective policy of family planning, an increase in female education, as well as an increase in public awareness to reduce the population growth rate and hence the fertility rate.

ARTICLE INFO

Keywords:

Fertility, Population Growth, female education, structural vector Autoregression,

Article History:

Received: 21 Feb 2026

Accepted: 22 Apr 2026

Available Online: 15 May 2026



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1. INTRODUCTION

Fertility rate in sub-Saharan African countries is still at a high rate despite the decrease in the world fertility rate from about 5 live births per woman in 1950 to 2.5 births per woman in 2015 and further to 2.3 births per woman in 2023 (United Nations, World Fertility Report, 2024). Except for South Africa and Mauritius, all other sub-Saharan African nations have not been able to finish the fertility transition (Grimm, Günther, Harttgen & Klasen 2022). Sub-Saharan Africa had a fertility rate of 4.6 in 2020, which dropped from 6.3. Fertility has actually been shown to pose a danger to the 2030 Sustainable Development Goals (SDGs) due to its complex relationships to both the general objectives and the specific targets of the SDGs (Jatana & Currie, 2020; United Nations DESA, 2020). Population growth rates in most African countries are extremely high with rising life expectancy due to a fall in child mortality. Between 2000 and 2019, the sub-Saharan African under-five mortality rate decreased from 151 deaths of 1,000 live births to 76 deaths of 1,000 live births and later decreased to 11.7 deaths of 1,000 in 2023 (World Bank, 2024). Studies have found that a high fertility rate that causes unchecked population growth is a major cause of socioeconomic problems like extreme poverty, unemployment, environmental harm, poor health, food insecurity, and resource depletion (Behrman & Gonalons-Pons, 2020). High levels of fertility persisting despite relatively sustained economic growth seems to have made poverty reduction in most parts of sub-Saharan Africa impossible. From the early 2000s, there has been an increase in GDP per capita in sub-Saharan Africa on average of 3% per annual and about 7% in some countries (Côte d'Ivoire, Ethiopia, and Tanzania), while the poverty headcount index is still as high as 33% (Rodrik, 2018; World Bank, 2024).

Nigeria's population management has been far from ideal. Specifically, the relationship between population and fertility is still unclear in Nigeria. Nigeria is facing a critical challenge of rapid population growth and high fertility rates, which threaten the country's economic, social, and environmental sustainability. Nigeria's population is growing at an alarming rate of 2.1% per annum, making it one of the fastest-growing populations in the world (National Bureau of Statistics, 2024). The total fertility rate (TFR) in Nigeria is 5.076 children per woman, which is significantly higher than the world standard rate of 2.1 children per woman (National Bureau of Statistics, 2024). Over 63% of Nigeria's population is under the age of 25, putting pressure on the country's education, healthcare, and employment systems (United Nations, 2025). Nigeria's rapid population growth and high fertility rates are exacerbating poverty and inequality, with over 87 million people living on less than \$1.90 per day (World Bank, 2024). If left unchecked, Nigeria's rapid population growth and high fertility rates will have severe consequences of increased competition for limited resources (water, land, and energy), deforestation, soil degradation, and pollution, thereby threatening the country's biodiversity and ecosystem. Nigeria's agricultural sector will struggle to keep pace with the growing population, leading to food shortages and insecurity. The country's economy will be unable to absorb the growing workforce, leading to high unemployment and poverty rates. Hence, it has become imperative for a detailed study on the nexus of population and

fertility rate to be carried out in Nigeria. Study of the relationships between population growth and fertility has gained attention as a result of the prominent role of population transition, such as changes in mortality, fertility, and population structure. Some studies have found that a dropping fertility rate is linked to growing population growth, particularly in urban areas. This is as a result of the claim that population increases the opportunity cost of having children, in addition to the greater financial cost of raising them, because of the socioeconomic advantages that come with living in an urban area (Kulu & Washbrook, 2014). There is also the claim in the literature that a decline in population impacts on birth rates, particularly in industrialized Western countries. Thus, there is ongoing discussion on the validity of the exert nature of the population-fertility connectivity (negative or positive) in developing economies (Lerch, 2018).

The validity of the inverse population-fertility rate relationship in emerging economies and developing countries as a result of the associated challenges of poverty and low literacy, has been questioned by some studies. However, the possibility of feedback connectivity between population and fertility has not been considered particularly for a developing country, Nigeria. Therefore, understanding this controversy in the connectivity of population and fertility rate is imperative for Nigeria. Hence, it is imperative to ask the following questions: What is the impact of female education on the fertility rate in Nigeria? How does the infant mortality rate impact on fertility rate in Nigeria? Does health expenditure impact on fertility rate in Nigeria? Is there a feedback impact between fertility rate and population in Nigeria? The objective of this study is to analyze the nexus between population and fertility rate. It specifically analyzed the impact of female education, health expenditure, and infant mortality rate on total fertility rate. The study also investigated on the existence of a feedback impact between population and fertility rate. The findings of this study contribute to a better understanding of the population trend in Nigeria with the aim of providing effective policy implications that will help in the mitigation of the high population growth rate and for effective resource allocation. Given that poverty and inequality are frequently linked to high fertility rates and population growth, the study sheds light on options for reducing poverty and emphasize the significance of education, especially for women, in affecting reproductive decisions and population increase towards achieving the goals of sustainable development (gender equality, health improvement, and poverty reduction) in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Issues

Population is the total number of people living in a particular topographical region over a period of time. The growth of population is the issue of concern as the limited resource available will need to be shared among the population (Linden, 2021). This is the changes (positive or negative) in the number of people in a place over a period of time. Population growth is major determined by the difference between death rate, birth rate and fertility rate and net. However, the effect of net migration is negligible. When growth of population is positive, then fertility rate is higher than

mortality rate. However, when fertility rate is equal to mortality rate, growth of population is constant. The growth of population also affects the country's age structure, inequality of different forms, migration and the workforce of the country. Nigeria has become the world's 6th most populous country with a population of 236,597,254 and projected to be about 375 million (Worldometer, 2025). Fertility rate is the number of children a woman within the child bearing age will bear in her life time. The total fertility rate of a nation is the average number of children women of would bear if they survive to the end of reproductive life, having same probability of child-bearing in each age interval as it is now. Fertility decision is the choices of family on the number of children they want to bear. Some of the factors that can affect this is the culture, social influence, educational attainment of the woman, aspiration of professional attainment, physical and emotional wellbeing, and the financial status of the family among others.

2.2 Theoretical Literature

Several theories have been put forward on the analysis of fertility and population

Malthusian Hypothesis: this theory postulates that the world's population is growing exponentially in proportion to birth rate while the resources is increasing arithmetically. As a result of this he believed that population will outgrow the resources and there will be scarcity if the population is not controlled (Chowdhury & Hossain, 2018). He recommended that population can be controlled by voluntary restraint, or delaying in marriage. If voluntary checks are not put in place, involuntary checks like war, starvation and illness can come in.

Optimum Population Theory: this was put in place by Edwin Cannan. The theory unlike the Malthusian theory examined the relationship between the size of population of a nation and the wealth/resources of the nation. The theory assumes that with the growth of the population, the percentage of working population in relation to total population will be constant. Also, natural resource, stock of capital and advancement in technology do not change with growth in population (Gupta, 2016). The population provided the needed labour force in the utilization of the resources that will bring about the economic growth. Therefore, efficient utilization of resource is guaranteed if optimum population is reached. However, if population exceeds optimum, there will be unbalanced restraint on the resources affecting the welfare of the people.

Demographic Transition Theory: This theory was put forward by Frank and it states that there is a negative correlation between fertility and industrial growth. Specifically, the demographic transition theory states that there is a demographical shift between high birth rates and high mortality rate for women on the one hand and low birth rate and infant mortality rates given scarce technology, education, the economic development (Ojo, 2016). The theory is important because it examines the different determinant of fertility as it relates to population and the development of the country.

2.3 Empirical Literature

Some studies have been carried out on fertility, population, growth and development. Dao (2012) using a data of 45 African countries investigated on the connectivity between population and economic growth using data of fertility rate, trade openness, per capita GDP growth, and dependence ratio. The result revealed that a negative linkage between population growth and per capita GDP growth. The dependency ratio also positively impacts on growth of GDP per capita while rate of fertility negatively impacts on economic growth. Likewise, the study of Olabiyi (2014) explored the dynamic impact of population on fertility rate using the vector auto regressive (VAR) for the time 1980 to 2010 on fertility, openness of trade, infant mortality and government expenditure. Population growth was revealed to increase with increase in rate of fertility. Infant mortality was also found to be positively related to population growth. Nwosu et al. (2014) employed OLS on the examination connectivity between fertility and increase in population in Nigeria for the period 1960 to 2008. It was revealed from the study population increase significantly impact on fertility rate. It was also found that there is a long run relationship between fertility rate and growth in population. However, in a study related to that of Nwosu et al. (2014) is the study of Aidi, Emecheta, and Ngwudiobu (2016) that investigated on the linkage between the rate of fertility, Nigeria's economic development, and increase in population in Nigeria. Employing the Granger-Causality method for the 1970 to 2013. The study found that contrary to the findings of Nwosu et al. (2014) there was no causality among rate of fertility, economic development and population increase.

Study on the determinant of Indian's was carried out by Singh, Mittal, Sharma, and Smarandache (2022) for the period 1991 to 2021. Population growth was found to be determined by the total fertility rate, infant mortality rate, and crude death rate. In a recent study, Olufunmilayo and Leward (2023) examined the relationship between fertility and urbanization in South Africa and Nigeria. the study made use of the Fully Modified Ordinary Least

Square (FMOLS) and found that increase in urbanization and fertility rate was positively related for both countries which is stronger in Nigeria.

2.4 Gap in literature

While various study has carried out studies on population, fertility and economic growth, majority of the studies have concentrated on either the impact of fertility on population or the impact of population on economic growth. However, the impact of population on fertility rate have not received consideration attention particularly in a developing country like Nigeria with high rate of fertility and population. Hence, this study fills the gap in examining the impact of population on fertility as well as the possibility of the feedback relationship between population and fertility rate.

3. RESEARCH METHODOLOGY

3.1 Theoretical Framework

Malthus' theory of population, which distinguishes between population expansion and growth in food production, serves as the foundation for the research. According to him, the population's power has no boundaries. In 25 years, the population may quadruple, but the existing facilities will not be able to supply the food needed to sustain the growth. The improvement of the existing land, which is steadily declining because of the characteristics of the soils, must be the basis for the annual rise in food production. Malthus' 'Principle' asserts that although sustenance rises arithmetically, population expands geometrically. According to Malthus' theory of growth, population expansion raises product output, but because of the law of diminishing returns, production increments develop more slowly. Wage payments eventually consume all of the economy's production as a result of diminishing returns, which push up the incremental output of further work to zero. When the population has achieved its maximum size and at subsistence level, the economy has reached a stagnant condition. A crucial premise in logical equations is *ceteris paribus*, which holds that all other variables are constant. This would suggest that population and sustenance are directly related, but historically, this has not been the case. Population and sustenance linkages are mitigated by factors including biotechnology, technical advancements, the growing human intellect and inventiveness, natural unpredictability, and chance. The population growth rate is proportional to the current population size and the difference between the carrying capacity and the current population size:

$$dP/dt = rP(1 - P/K) \quad 1$$

Food Supply Growth Model

Food supply grows linearly:

$$dF/dt = b \quad 2$$

where b is a constant representing the rate of increase in food supply.

Equilibrium Point

At equilibrium, population growth rate equals zero:

$$dP/dt = 0 \quad 3$$

Solving for P, we get: $P = K$ 4

3.2 Model Specifications

This study adopts the study of Olufunmilayo and Leward (2023) on the urbanization-fertility nexus in Sub-Saharan Africa.

The study used the model:

$$FER = (\text{URBG}, \text{SCHLF}, \text{FLFP}, \text{GDPG}, \text{INFM}, \text{INF}).$$

Where: FER is fertility rate

URBG is urbanization rate,

SCHLF is school enrolment rate,

FLFP is female labour force participation rate,

GDPG if GDP growth rate,

INFM if infant mortality rate

INF is inflation rate.

The above was modified for the objectives of this current study as:

$$TFR = f(\text{PGR}, \text{FEDU}, \text{IMOR}, \text{HEXP}, \text{UNEM}) \quad 5$$

URBG was dropped and replaced with population growth while school enrolment was replaced by female education. Also, GDP growth rate and inflation were dropped while health expenditure and unemployment were introduced for appropriate capturing of the objectives of the study. Introducing the error term we have:

$$TFR = \beta_0 + \beta_1\text{PGR} + \beta_2\text{FEDU} + \beta_3\text{IMOR} + \beta_4\text{HEXP} + \beta_5\text{UNEM} + \text{ut} \quad 6$$

Where; TFR is Total Fertility Rate. PGR is Population Growth Rate, FEDU is Female Education, IMOR is Infant Mortality Rate, HEXP is Health Expenditure and UNEM is Unemployment rate. $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are the parameters of the model to be estimated, while ut is the stochastic error term. It is expected a priori that $\beta_0 > 0, \beta_1 > 0, \beta_2 < 0, \beta_3 < 0, \beta_4 > 0, \beta_5 < 0$

3.3 Method of Data Analysis

The Autoregressive Distributed Lag (ARDL) and SVAR were used for the estimation. The ARDL was used to analyze the impact of population

4.2 Presentation and interpretation of the ARDL result

Table 4.5: Long Run ARDL Regression Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TFR(-1)	1.147754	0.159721	7.185982	0.0004
PGR	0.136376	0.277925	0.490695	0.6411
PGR(-1)	-1.213099	0.396394	-3.060338	0.0222
PGR(-2)	0.755641	0.352496	2.143690	0.0758
FEDU	-0.000164	0.000229	-0.715442	0.5012
FEDU(-1)	-0.000892	0.000583	-1.530477	0.1768
IMOR	0.075354	0.001190	63.31813	0.0000
IMOR(-1)	-0.126939	0.031529	-4.026130	0.0069
IMOR(-2)	0.054906	0.029243	1.877577	0.1095
HEXP	-8.20E-05	0.007578	-0.010823	0.9917
HEXP(-1)	-0.013280	0.009811	-1.353601	0.2246
HEXP(-2)	0.025723	0.011784	2.182900	0.0718
UNEM	-0.086316	0.034574	-2.496582	0.0467
UNEM(-1)	0.151833	0.073191	2.074479	0.0834
UNEM(-2)	-0.161632	0.050895	-3.175773	0.0192
C	0.041345	0.684599	0.060393	0.9538

R2=0.899979
Adj R2=0.899928
F(sat)= 19380.28
F(pro)= 0.000000
DW= 1.904313

Source: Compiled from E-views

As presented in Table 4.5, shows it was revealed that the model was properly fitted given the an R² and R² adjusted of 0.899979 and 0.899928 respectively. This shows that about 90% of the changes in the fertility rate was accounted for by the independent variables. The test for the presences of autocorrelation using the DW revealed that there was no autocorrelation given a figure of 1.904313 which is less than 2 the bench mark.

In the determination of the impact of the variables on fertility rate, it was revealed from the result that previous levels of fertility were found to impact current levels of fertility positively and substantially. This was in line with our expectation and theory. Specifically, 1% increase in previous levels of fertility leads to 1.2% increase in the fertility rate. The current level of population was found to be positively related to fertility rate as expected although not significant while the first lag of population was found have a negative and significant impact on fertility rate. 1 % increase in current population growth rate leads to a 0.14% increase in fertility rate while 1% increase in last year's population growth rate leads to about 1.2% fall in fertility rate. The results of the examination of the relationship between fertility decisions and population increase align with a recent World Bank report. However, the effect of population in different countries differs. Nwosu et al. (2014) in a study for Nigeria population growth significantly impacts on fertility. As observed by LeRoy (2022) population control contributes to fertility rate sustainability. Nevertheless, the response of nations in turning the growing population to effective workforce through human capital development (education and health) which can substantially lead reduction in poverty and sustainable economic development is most important.

It was also revealed from the result that in Nigeria, female education and health expenditure in current year and first lag has a negligible and unfavorable impact on the overall fertility rate. According to the model, holding all other variables constant, 1% increase in female education, results in a 0.0002% fall in the overall fertility rate and 1% increase in health expenditure leads to very minute fall in fertility rate. These results are in accordance to our expectation. Infant mortality rate was found to have a positive and highly substantial impact on fertility rate. Ceteris paribus, the overall fertility rate rises with 0.07% units for every 1% increase in infant mortality. This was in contrast to the finding of Olufunmilayo and Leward (2023), that revealed a negative impact on infant mortality rate. Contrary to our expectation, unemployment rate was found impact on fertility rate negatively and substantially at 5% significance level. When all other things are held equal, Nigeria's overall fertility rate drops by around 0.08% for every 1% rise in the country's unemployment rate. The reducing effect of income of women from their higher level of education and decision to reduce the rate of giving birth is corroborated to the outcome of Atama, Ebimngbo, Uzoma, Iwuagwu and Asadu, (2021)'s study. They argued that with the development of the economy develops, women often tend to move to the secondary sector which makes then less compatibility with child rearing.

Short run estimation: the outcome of the cointegration that showed a long run relationship among the variables requires that we carry out a short run estimation to determine the speed of adjustment to long run equilibrium, as presented in Table 4.6, the R² and R² adjusted of 0.799972 and 0.799951 shows that the model is well fitted. Autocorrelation was also found to be absent in the result given a DW statistics of 1.704313.

The result revealed that population growth in the current period has a positive and substantial impact on the fertility rate only at 10% level of significance while the previous year population growth was found to have a negative substantial impact on fertility rate at 5% level of significance. This supports that Nigeria fertility rate tend to increase with the increase in population growth in the short run. Contrary to the outcome of the study of

Nwosu et al. (2014), that found that there is no long run relationship between fertility rate and population growth. The study also showed that there is a weak and negative impact of female education and health expenditure on total fertility. Specifically, 1% increase in female education and health expenditure, reduces fertility rate by 0.0002% and 0.000008% fall in total fertility rate in Nigeria. However, as expected, fertility rate is negatively yet significantly impacted by the government's health expenditures, which implies that government spending on health, both capital and ongoing, has traditionally discouraged fertility in Nigeria. This can be in the continuous creation of awareness of the need to reduce number of children per women and the use of contraceptives to avoid unwanted pregnancies.

Table 4.6. Short Run ARDL Regression Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PGR)	0.136376	0.069154	1.972057	0.0961
D(PGR(-1))	-0.755641	0.077817	-9.710551	0.0001
D(FEDU)	-0.000164	9.72E-05	-1.685550	0.1429
D(IMOR)	0.075354	0.000357	210.8706	0.0000
D(IMOR(-1))	-0.054906	0.001016	-54.06631	0.0000
D(HEXP)	-8.20E-05	0.002385	-0.034385	0.9737
D(HEXP(-1))	-0.025723	0.003445	-7.466491	0.0003
D(UNEM)	-0.086316	0.010355	-8.335750	0.0002
D(UNEM(-1))	0.161632	0.014007	11.53931	0.0000
CoIntEq(-1)*	-0.147754	0.007661	19.28544	0.0000

R2= 0.799972
Adj R2= 0.799951
DW= 1.704313

Source: Compiled from E-views

In line with our expectation, unemployment was found to have a negative and substantial impact on fertility rate. As the rate of unemployment increases, people find it difficult to keep very large families as a result of low welfare form unemployment hence reducing fertility rate. Infant mortality rate both in the current year and the previous year were found to have a substantial impact on fertility rate although the previous year came out to be negatively impacting fertility rate while the current year was found to impact fertility rate positively. The short run estimate results show that the error correction term (ECM term (-1)) has a substantial and expected negative sign. The error correction term of -0.147754, reveals that about 14% of the short-run disequilibrium is corrected by speed of adjustment to return to equilibrium in the long-run.

4.3 SVAR estimation

Table 4.7: SVAR regression results

	TFR	PGR	FEDU	IMOR	HEXP	UNEM
TFR(-1)	-2.373681 (2.97387) [-0.79818]	0.234439 (0.22845) [1.02621]	-382.3285 (271.294) [-1.40928]	-51.57403 (39.7986) [-1.29588]	-5.695053 (9.65071) [-0.59012]	-1.736893 (1.98703) [-0.87411]
TFR(-2)	7.045833 (4.87229) [1.44610]	0.492572 (0.37429) [1.31603]	450.5041 (444.479) [1.01356]	100.9417 (65.2046) [1.54808]	3.782024 (15.8114) [0.23920]	3.872990 (3.25549) [1.18968]
PGR(-1)	-5.214578 (3.05164) [-1.70878]	0.616666 (0.23443) [2.63054]	48.47802 (278.389) [0.17144]	-63.55931 (40.8393) [-1.55633]	-4.905269 (9.90390) [-0.49533]	-7.151368 (2.03900) [-3.50730]
PGR(-2)	6.235221 (2.16445) [2.88074]	-0.624734 (0.16627) [-3.75730]	-104.0251 (197.454) [-0.52683]	78.28898 (28.9663) [2.70276]	5.436098 (7.02401) [0.77393]	4.560918 (1.44621) [3.15371]
FEDU(-1)	0.008952 (0.00321) [2.78694]	0.001122 (0.00025) [4.54761]	-0.204283 (0.29303) [-0.69713]	0.114636 (0.04299) [2.66673]	-0.003368 (0.01042) [-0.32306]	-0.012032 (0.00215) [-5.60598]
FEDU(-2)	0.015911 (0.00495) [3.21311]	0.000757 (0.00038) [1.98876]	0.225750 (0.45174) [0.49974]	0.210689 (0.06627) [3.17928]	-0.012888 (0.01607) [-0.80201]	-0.001259 (0.00331) [-0.38055]
IMOR(-1)	0.458066 (0.34291) [1.33582]	0.008136 (0.02634) [0.30885]	-20.64947 (31.2822) [-0.66010]	7.999896 (4.58907) [1.74325]	-2.030661 (1.11280) [-1.82482]	0.162091 (0.22912) [0.70745]
IMOR(-2)	-0.400786 (0.33516) [-1.19579]	-0.012682 (0.02575) [-0.49254]	18.43120 (39.5757) [0.60281]	-6.286310 (4.48542) [-1.40150]	1.939506 (1.08767) [1.78318]	-0.168213 (0.22394) [-0.75114]
HEXP(-1)	0.283826 (0.08168) [3.47491]	0.006935 (0.00627) [1.10520]	-3.627510 (7.45121) [-0.48683]	3.699152 (1.09309) [3.38414]	-0.467578 (0.26506) [-1.76404]	-0.199165 (0.05457) [-3.64940]
HEXP(-2)	0.106108 (0.12082) [0.87821]	-0.009353 (0.00928) [-1.00766]	-5.236749 (11.0223) [-0.47511]	1.265679 (1.61695) [0.78275]	-0.561838 (0.39209) [-1.43292]	0.130394 (0.08073) [1.61518]
UNEM(-1)	1.779131 (0.27874) [6.38287]	-0.064010 (0.02141) [-2.98939]	38.47022 (25.279) [1.51292]	23.55372 (3.7024) [6.31426]	2.375814 (0.90454) [2.62654]	1.534498 (0.18624) [8.23932]
UNEM(-2)	0.255514 (0.48940) [0.52209]	-0.060773 (0.03760) [-1.61650]	-67.25349 (44.6461) [-1.50637]	3.775019 (6.54953) [0.57638]	-5.165954 (1.58819) [-3.25273]	-1.362404 (0.32700) [-4.16637]
C	-39.27979 (6.39244) [-6.14472]	-0.756147 (0.49107) [-1.53981]	64.70068 (583.150) [0.11095]	-524.0738 (85.5485) [-6.12605]	32.51078 (20.7440) [1.57220]	-1.099989 (4.27120) [-0.25754]
R-squared	0.991572	0.998940	0.636635	0.994065	0.904033	0.987535
Adj. R-squared	0.980335	0.997526	0.152148	0.986152	0.776077	0.970915

Sources: Author's Computation using e-views

In analyzing the feedback relationship between population growth and fertility rate, the result showed that for the total fertility equation, population growth was found to have a positive significant impact on fertility rate at the second lag. Population was also found to have the greatest magnitude on fertility rate as compared to other variables. Growing populations can lead to major societal issues and even influence government policy decisions including the government decision of fertility rate control in Nigeria. In addition to this, female education was found to have a significant impact on fertility rate at both first and second lag. At the same time, health expenditure and unemployment were also found to have significant impact on fertility rate at only first lag. For the population growth equation, the result revealed that fertility rate has a positive and insignificant impact on population growth rate both in the first lag and second lag. This is against the findings of Olabiyi (2014) and the study of Singh, Mittal, Sharma and Smarandache (2022) who found in the study of Indian that fertility rate is a significant determinant of population growth. Infant mortality rate was found to be positively related with population growth in the first lag and negatively related in the second lag. However, in all infant mortality rate had no significant impact on population rate This is in correspondence with the Olabiyi (2014) that also found that population growth is positively related to population growth. The result also revealed that in line with our expectation, the first lag of population has a positive and substantial impact on current population. The second lag was also found to have a substantial impact on current population but with negatively related to it. Previous levels population growth rate was also found to have the greatest magnitude on the current population growth in comparison to other variables. Following the lags of population growth impacting on current population growth rate, contrary to our expectation, the first lag of female education was found to have a positive and substantial impact on population growth rate while the first lag on unemployment was found to have a negative and substantial impact on population growth. The above result indicates that increase in female education increases population growth rate and unemployment rate reduces population growth rate.

Table 4.8: Impulse Response results

Response of TFR:		TFR	PGR	FEDU	IMOR	HEXP	UNEM
Period							
1	0.178083 (0.02685)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)
5	29.75375 (46.6596)	-0.627273 (19.4487)	-4.643852 (8.90658)	2.223759 (27.1866)	-0.840309 (4.12892)	0.656735 (20.1486)	
10	34211.89 (8516.9)	4265.989 (15758.9)	-223.7532 (22687.9)	5624.508 (28949.3)	2222.270 (8601.62)	2917.834 (20200.5)	
Response of PGR:		TFR	PGR	FEDU	IMOR	HEXP	UNEM
Period							
1	-0.001226 (0.00291)	0.013625 (0.00205)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)
5	-0.808897 (5.16345)	-0.190130 (1.90580)	-0.507195 (0.62075)	0.030164 (2.29979)	-0.353859 (0.54750)	0.093323 (1.60384)	
10	1356.208 (4708.45)	-188.4690 (1832.73)	-229.9989 (954.452)	-71.58246 (2516.18)	-58.33731 (573.248)	-105.7201 (1976.17)	
Response of FEDU:		TFR	PGR	FEDU	IMOR	HEXP	UNEM
Period							
1	-0.407415 (3.46306)	1.862320 (3.45112)	16.13351 (2.43222)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)
5	607.7755 (10511.7)	305.1907 (3558.73)	1054.646 (839.190)	-185.1529 (4230.93)	651.2334 (1039.79)	-220.9667 (2920.03)	
10	-3333822 (852061)	213662.2 (375408)	434657.6 (210335)	-42005.03 (519215)	54723.58 (1160370)	94505.12 (4003058)	
Response of IMOR:		TFR	PGR	FEDU	IMOR	HEXP	UNEM
Period							
1	2.373905 (0.36003)	0.052838 (0.03168)	0.002590 (0.03066)	0.143805 (0.02168)	0.000000 (0.00000)	0.000000 (0.00000)	0.000000 (0.00000)
5	418.3142 (812.540)	4.521782 (299.098)	-70.42136 (116.562)	49.73136 (416.363)	-14.63350 (47.9648)	23.85533 (300.893)	
10	487358.0 (140579)	60196.51 (27079.7)	-12343.33 (31876.8)	84235.45 (483542.)	26391.07 (106238.)	45234.55 (334189.)	
Response of HEXP:		TFR	PGR	FEDU	IMOR	HEXP	UNEM
Period							
1	0.385052 (0.10868)	0.119336 (0.09010)	-0.235545 (0.08083)	0.030569 (0.07246)	0.339198 (0.05114)	0.000000 (0.00000)	0.000000 (0.00000)
5	34.70688 (565.054)	14.48142 (185.310)	54.61304 (38.0335)	-11.17723 (211.426)	34.11797 (60.3017)	-12.95559 (142.977)	
10	-170094.6 (40351.3)	11512.37 (201965.)	23505.36 (95159.3)	-2133.819 (272271.)	3585.564 (56878.1)	4766.442 (211155.)	
Response of UNEM:		TFR	PGR	FEDU	IMOR	HEXP	UNEM
Period							
1	0.032175 (0.02490)	0.079811 (0.02152)	-0.018951 (0.01729)	0.053508 (0.01502)	-0.012632 (0.01252)	0.058064 (0.00875)	
5	18.12607 (131.590)	12.03470 (14.8832)	-1.539058 (8.26481)	14.85144 (21.1484)	0.969563 (7.81786)	10.94167 (11.1989)	
10	3709.170 (199253.)	3449.186 (41098.1)	-5087.641 (8231.19)	6662.702 (52846.8)	-2486.863 (12636.1)	5319.610 (3387.4)	

Sources: Author's Computation using e-views

Table 4.8 and Figure 4.1 demonstrate how the unemployment rate and infant mortality rate responded favorably to the overall fertility rate from lag 1 to lag 10. From the second lag to the last lag, the reaction is strong, but not at the beginning. At lag 10, the overall fertility rate is still positively impacted by the infant mortality and unemployment rates, in contrast to the population growth rate which complement the findings by Olufunmilayo and Leward (2023). It is easy to comprehend that once an infant dies, folks might readily adapt and desire to have another child. Some people may eventually learn about it and decide to rethink their reproductive choices.

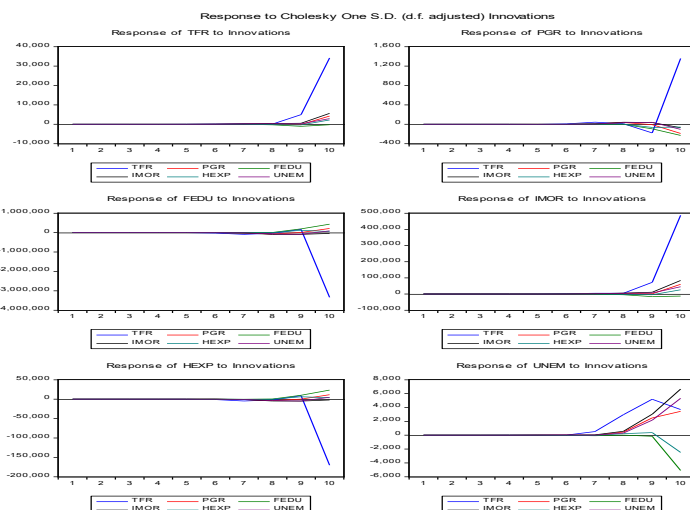


Figure 4.1

The overall fertility rate is slightly impacted by female education and population growth rate. There should be a delayed reaction to shocks due to inertia and the unique characteristics of reproductive behavior. For example, raising female education will have a variety of effects on the fertility rate. A higher level of education among women may result in a lower birth rate, which would further reduce fertility. However, because it takes time to decide to have children and to become pregnant, this effect is not immediate. In a similar vein, it takes some time for the effect of health spending on the overall fertility rate to become apparent. As a result, we may observe that the influence is not as evident during the early phase. Additionally, the effect of health spending on the overall fertility rate diminishes over time.

It was further revealed that fertility rate positively but insignificantly impacts on population growth rate. In addition to this, infant mortality rate was positively related with population growth in the first lag and negatively related in the second lag. The result also revealed that in the response to shock in population growth rate that fertility rate responded largely and positively to this population growth rate from lag 5 to 10. However, from lag 1 to 5 fertility rate responded slightly and negatively. Infant mortality, health expenditure, female education and unemployment rate responded favourably to the population growth almost all through the period, from lag 1 to about lag 5 positively for infant mortality, health expenditure and unemployment rate. Then infant mortality, health expenditure and unemployment rate were found to respond negatively to population growth at lag 10.

5. POLICY IMPLICATIONS AND CONCLUSION

5.1 Policy implications

Following the findings of the study, the study suggests the following policy implications are made.

- The government need to start a family planning initiative and utilize it as a tool to educate the public about the serious risks posed by population growth and its effects on the economy.
- The government ought to implement measures to encourage education for women. Even while this would probably help reduce fertility, significant efforts must be made to lower dropout rates, especially to guarantee primary school completion and secondary school continuing.
- Families should be prevented from having many children and from making greater investments in each of them due to the persistently high spending on health and child health services. Given the tight relationship between fertility and child mortality, addressing the problem from both perspectives is essential. When one succeeds, it will encourage success in the other.
- Ultimately, it is evident that the Nigerian government still has to invest more in promoting health and lowering the nation's mortality rate, as only a healthy workforce can make a significant contribution to the growth of output.

5.2 Conclusion

This study sought to evaluate the overall effect of population expansion on fertility decisions as well as determining the feedback relationship between population growth rate and fertility rate in Nigeria using yearly time series data. Population growth rate (PGR) and total fertility rate (TFR), are closely connected and are taken into consideration in this study. It illustrates the inverse relationship between fertility and population growth rates. The study also demonstrates that the coefficient calculated on the once-lag population growth rate is positive but substantial when the total fertility rate

is directly determined. To sustain this enormously expanding workforce, Nigeria must boost its economy by increasing domestic investment and saving rates. Otherwise, this enormous workforce might turn into a negative force due to unemployment. Nigeria must also increase educational spending in order to develop its human capital and young productivity. It is imperative that an "education for all" policy be developed and put into effect. In order to draw in international investment and encourage domestic investment, they must also ensure peace and security in their own nations.

Acknowledgments: We are grateful to our friends who invested their suggestions and valuable comments with respect to this paper.

Funding: This research did not receive any form of funding from any source.

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