"Hierarchical Multiple Regression Analysis of the Effects of Demographic Factors on Population Growth in Nigeria" (1973-2022)

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ABSTRACT

Nigeria's population reached an estimated 200 million by 2019 according to the National Population Commission, ranking it seventh globally and posing challenges for resources and infrastructure. This study examines demographic influences on population growth applying World Development Indicators data (1973-2022) using hierarchical multiple regression in three steps. Results showed that Model 1 (net migration only) was significant ($R^2 = .190$, $p < .01$), with migration positively predicting growth. Model 2 added death rate ($R^2 = .196$, $\Delta R^2 = .006$, $p > .05$), showing no significant improvement; migration stayed significant, but death rate did not. Model 3 included fertility rate, yielding substantial gains ($R^2 = .761$, $\Delta R^2 = .565$, $p < .001$). Fertility was the strongest positive predictor ($p < .001$), death rate a significant negative one ($p < .001$), and migration remained positive. These align with demographic transition theory, emphasizing fertility's dominance in developing nations amid high fertility and declining mortality. Overall, the hierarchical structure of the models demonstrates that although net migration has a consistent positive influence on population growth, the inclusion of fertility rate significantly enhances the model, highlighting its dominant role. The negative effect of death rate in the final model further confirms reductions in mortality contribute to population expansion when fertility levels remain high.

Keywords: Population growth, Death rate, Fertility rate, Net migration, Multiple Regression Analysis

INTRODUCTION

Over time, Nigeria's demographic landscape has changed significantly. The National Population Commission (NPC) report from 2019 states that the country's population reached an estimated 200 million, making it the seventh most populous country in the world. The population is predicted to increase from 200 million in 2019 to 237.5 million by 2025, with an annual growth rate of 2.4-3% driven by a total fertility rate (TFR) of about 5.2 children per woman. Rapid population expansion affects infrastructure development, resource allocation, and general social well-being. It also poses possibilities and difficulties. Effective policymaking and sustainable development depend on an understanding of the causes of population rise. Bongaarts (2009) studied the demographic shift and the expansion of the human population. The author emphasized the consequences of demographic transition, such as longer life expectancies and decreased female fertility, which are seen in developed areas of the world while the least developed countries are seeing significant population growth. With an emphasis on the years 1950 through 2050, the study highlights important population growth patterns, including population size, fertility, mortality, and age structures. Bongaarts and Hogson (2020) extended Bongaarts (2009) work on human population growth and demographic transitions. The focus of the study is on fertility issues in developing countries. United Nations Population Division had categorized population patterns especially with fertility by referring to regions that are more industrialized and urbanized as “more developed regions” while the other category which is less industrialized and less urbanized as less developed regions. Fertility issues spanning a period of 70 years was extensively analysed by the authors. Korgbeelo (2025) examined the elements that influence Nigeria's population growth rate, including migration, birth, and death

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rates. The World Bank's development indicators, the National Bureau of Statistics' demographic statistics bulletin, and the Central Bank of Nigeria provided the annual time series data. The data was analyzed using the Granger Causality test, the Error Correction Model, and the Autoregressive Distributed Lag-approach to Cointegration. According to the predicted short-run and long-run regression results, the population growth rate is significantly positively impacted by the birth rate and net migration rate, while it is significantly negatively impacted by the death rate. Ene et al (2021) use yearly time series data from 1980 to 2018 to examine factors influencing population increase in Nigeria. The Autoregressive Distributed Lag Bound test methodology was the statistical method used. However, the authors discovered that there is a negligible negative correlation between infant mortality and Long-term population growth is negatively but significantly correlated with the maternal mortality rate, but long-term population growth is positively and significantly correlated with per-capital income and the total fertility rate. However, the research suggested that the federal government prioritize family planning and encourage girl-child education in order to prevent early child marriage and childbirths that reduce women's fertility.

Mofoluwawo et al. (2025) studied the origins, consequences, and viable remedies for sustainable national development of Nigeria's growing migration. According to the authors, this tendency is being driven by economic uncertainty, insecurity, and a lack of possibilities, brain drain, lower economic output, and a greater reliance on foreign aid are the causes that the writers stress. However, the researchers suggested a remedy to this issue that the government diversify the economy, enhance security, and make investments in job development and education. Nigeria's population shift and the achievement of sustainable development goals were examined by Abbani (2021). The author outlined the objectives, which included eliminating severe poverty and hunger, enhancing universal access to high-quality education, and improving women's and children's health. The National Population Census Report from 2006 and the National Demographic and Health Surveys from 1980 to 2018 were used in the study to analyze Nigerian demographic trends. The author found that it is typified by a high rate of population expansion, a slow decline in the fertility and death rates, and a poor performance of the sustainable development objectives.

Using National demographic Health Reports of 2013 and 2014 as well as UNICEF Reports of 2012 on Nigeria’s National Population Projections, Vitalis and Orionye (2021) investigated Nigeria's demographic composition as a treasure for national development or an insurmountable national burden. The study's conclusions show that population expansion is essential to the progress of any economy as it provides labor for the creation of products and services that advance economic development and is a key component in determining a nation's investment potential. The complex relationship between demographic indicators and population growth must be fully understood in order to identify and address these challenges. Comprehending the complex interrelationships among these demographic metrics and their combined influence on population expansion is crucial for well-informed policy formulation.

Aim and Objectives

This study investigates the influence of demographic measures on population growth in Nigeria with the following objectives:

- Investigating the relationship between Nigeria's population growth and net migration.
- To examine the effects of death rate and net migration on Nigeria's population growth.
- Investigating the impact of net migrations, the death rate, and the fertility rate on Nigeria's population growth.

Significance of the Study

This study is significant for several reasons. Firstly, it contributes to the existing body of knowledge by offering a nuanced understanding of the demographic factors influencing population growth in Nigeria. Secondly, the findings will be invaluable for policymakers, demographers, and researchers, providing them with evidence-based insights for developing targeted strategies to manage population growth effectively. Lastly, the study serves as a foundation for future research, fostering a deeper exploration of demographic dynamics and their implications for sustainable development.

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MATERIALS AND METHODS

This project utilized a quantitative research design, employing hierarchical multiple regression analysis. The design allowed for the examination of the relationship between demographic measures and population growth in a systematic and controlled manner.

STUDY AREA:

The study focused on Nigeria as the primary geographical scope due to its relevance to the research question and the availability of comprehensive demographic data. The research covered a specific time frame, considering the latest available data.

DATA COLLECTION:

Data for this project were sourced from reputable sources from World Development indicators (www.databank.worldbank.org).These sources provide comprehensive demographic information, including population size, birth rates, death rates, and net migration from (1973-2022). The dataset covered a specific time period to capture temporal trends, and efforts were made to obtain the most recent and accurate data available. This temporal scope enhances the project's ability to discern patterns and changes in population growth influenced by demographic measures.

STATISTICAL ANALYSIS SOFTWARE

The statistical analysis for this project was conducted using [SPSS], a widely recognized and validated tool for regression analysis. This software facilitated the execution of hierarchical multiple regression, providing statistical outputs necessary for interpretation.

Model Specification

In this multiple regression model, predictor variables are inserted into the regression equations in a particular order, and their effects on the dependent variables are evaluated.

Regression Model (Three Stages)

Stage 1: (Baseline Model)

$$Y = b_0 + b_1X_1 + \varepsilon$$

where
Y is dependent variable (Population Growth);
b_0 is intercept;
b_1 is coefficient for predictor X_1.

Stage 2: (Extended Model)

$$Y = b_0 + b_1X_1 + b_2X_2 + \varepsilon$$

where

X_2 is additional predictor added in the second stage;
b_2 is coefficient for predictor X_2.

Stage 3: (Full Model)

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \varepsilon$$

where

X_3 is third predictor added in the third stage;
b_3 is coefficient for predictor X_3.

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RESULTS & DISCUSSION

Death Rate (Crude)

The time series plot indicates a steady declining trend in Nigeria's crude death rate from 1973 to 2022. This suggests gradual improvements in healthcare services, disease control, and living standards over time. The downward trajectory is relatively smooth, indicating consistent long-term mortality reduction rather than abrupt changes.

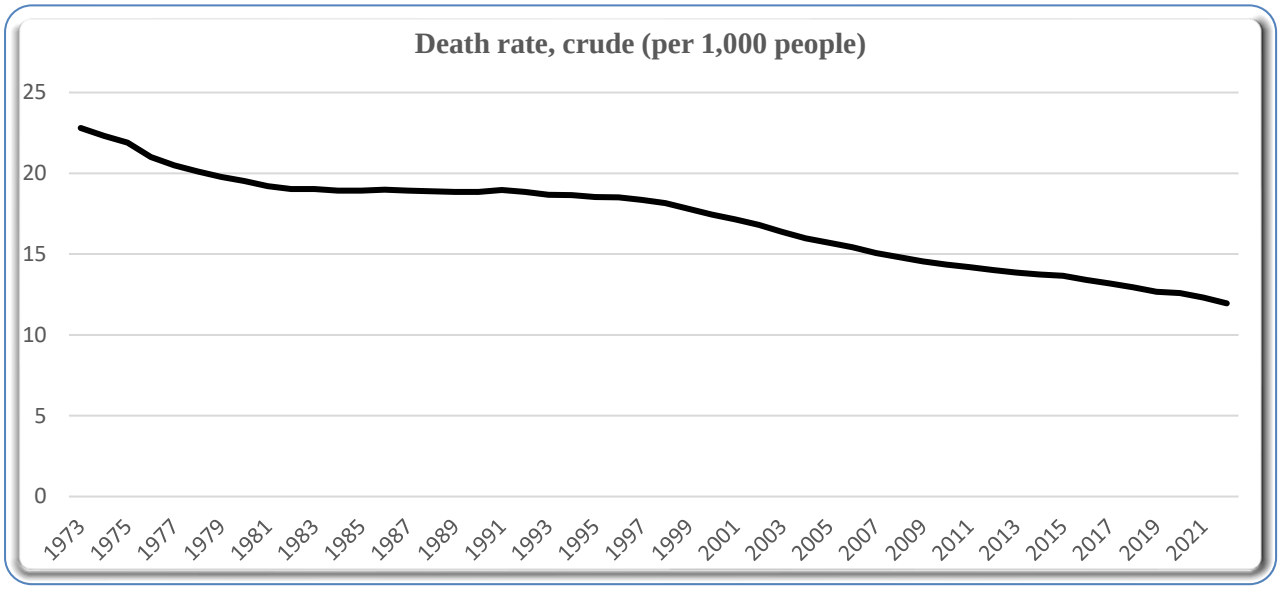

Figure 3.1: Time plot of Crude Death rate in Nigeria (1973-2022)

3.2 Fertility Rate

The fertility rate shows a clear downward trend across the study period. This implies a demographic transition characterized by reduced birth rates, possibly due to increased access to education, family planning, and urbanization. Despite the decline, fertility remains relatively high compared to global averages, indicating a slow transition.

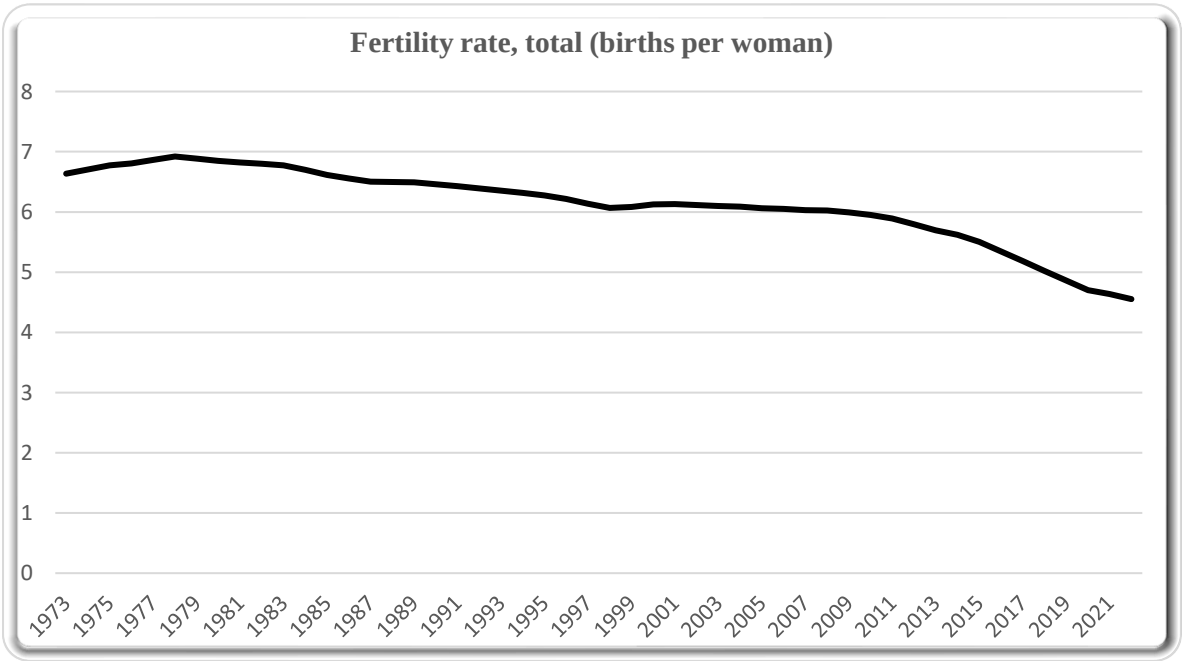

Figure 3.2: Time plot of fertility rate in Nigeria (1973-2022)

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Net Migration

The net migration series exhibits substantial fluctuations over time, with periods of both positive and negative migration. This volatility suggests that migration in Nigeria is influenced by economic conditions, political stability, and external opportunities. Unlike other variables, no clear long-term upward or downward trend is evident.

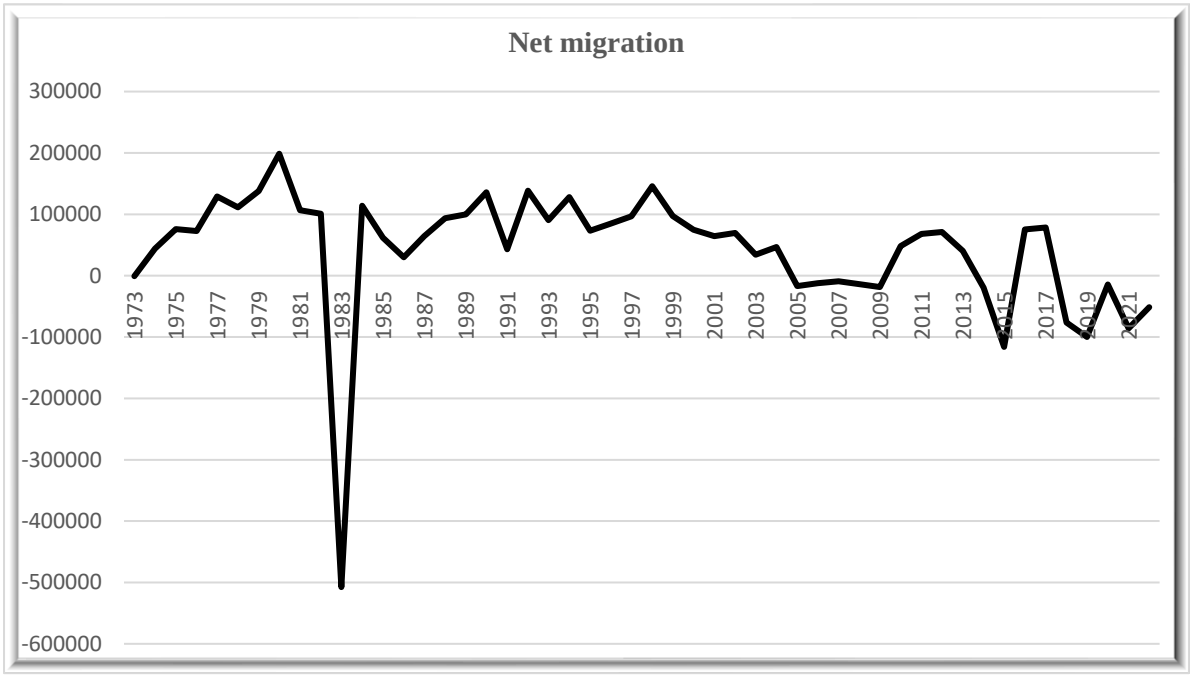

Figure 3.3: Time plot of Net Migration in Nigeria (1973-2022)

Population Growth

The population growth rate demonstrates a moderate declining trend, especially in later years. This pattern aligns with the observed reduction in fertility rates and death rates. While growth remains positive throughout the period, the gradual slowdown indicates the early stages of demographic stabilization.

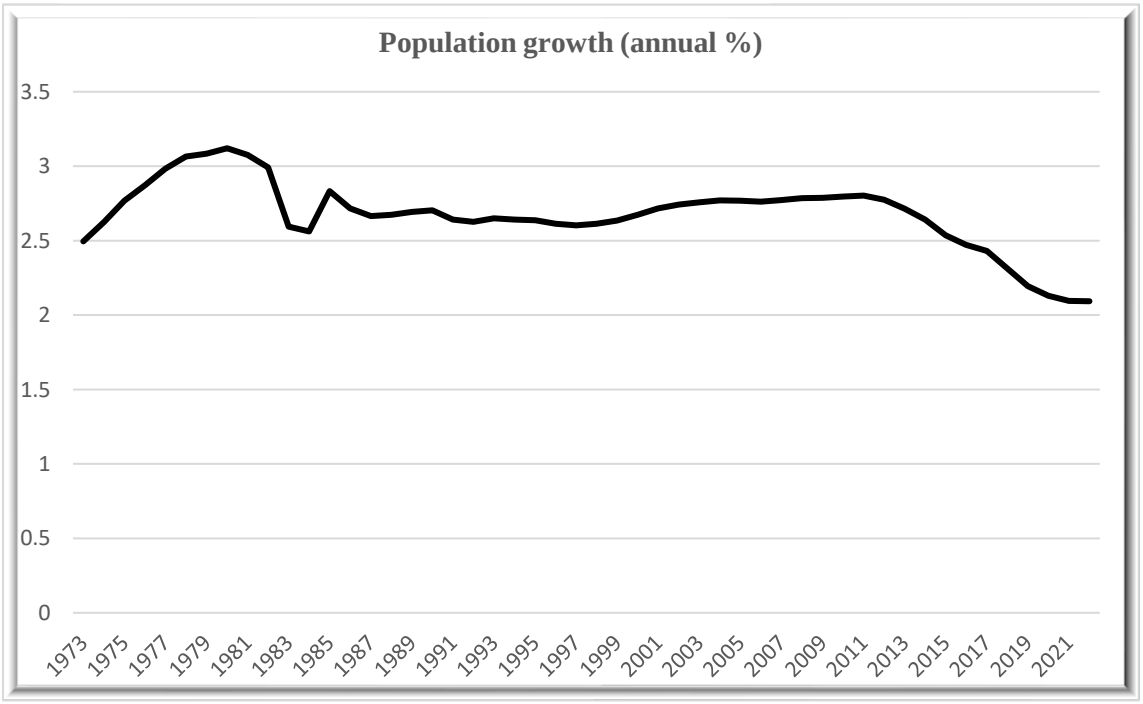

Figure 3.4: Time plot of Population Growth in Nigeria (1973-2022)

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Collectively, the plots suggest that Nigeria is undergoing a demographic transition, characterized by declining mortality and fertility rates, alongside a gradually slowing population growth rate. However, the instability in net migration highlights the role of external socio-economic factors in shaping population dynamics.

Table 3.1: Summary of Inter-Correlations among the Predictors of Population Growth

	Net migration	Fertility rate, total (births per woman)	Death rate, crude (per 1,000 people)
1. Net migration	1	.350*	.387**
2. Fertility rate, total (births per woman)	.350*	1	.904**
3. Death rate, crude /(per 1,000 people)	.387**	.904**	1

Note: $*$ Significant at $p < 0.05$. Also $**$ Significant at $p < 0.01$

Table 3.1 illustrates that both net migration and fertility rate have a significant positive correlation with

(r(49) =.350, p<.05) while net migration and death rate also have similar relationship r(49) =.387, p<.05. This implies that there is an association between greater fertility rates and higher net migration as evident with statistically significant trend. Both fertility rate and death rate exhibited a very strong association with r(49) =.904, p <.05 which suggests that greater death rates is associated with higher fertility rates.

In emerging nations like Nigeria, demographic change of this nature is expected since the country is undergoing transition, higher death rates due to infant/child mortality, inadequate healthcare are being compensated for by high fertility rate, orchestrated by encouragement of the couples to have more children, in order to secure surviving offspring for work, security, and support in old life.

Table 3.2: Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Population Growth.

Model		B	t	R^2	ΔR^2	P-value	Collinearity Statistics	
							Tolerance	VIF
1	Constant	2.640	122.616			.000		
	Net migration	7.114E-007	3.325	.190	.190	.002	1.000	1.000
2	Constant	2.551	16.145			.000		
	Net migration	6.599E-007	2.824			.007	.851	1.176
	Death rate, crude (per 1,000 people)	.005	.569	.196	.006	.572	.851	1.176
3	Constant	.403	1.784			.081		
	Net migration	6.577E-007	5.107			.000	.851	1.176
	Death rate, crude (per 1,000 people)	-.097	-8.712			.000	.177	5.656
	Fertility rate, total (births per woman)	.627	10.318	.761	.565	.000	.182	5.483
Dependent Variable: Population Growth (annual %)								

The hierarchical multiple regression analysis was conducted in three steps to examine the predictors of population growth in Nigeria. Model 1 as shown in Table 3.2 considered net migration as the only predictor and is expressed as:

$$Population\ Growth = \beta_0 + \beta_1 Net\ Migration + \varepsilon$$

the estimated coefficients:

$$Population\ Growth = 2.640 + 7.144 \times 10^{-7} Net\ Migration$$

The model was statistically significant (R^2 = .190, p < .01), indicating that net migration explains 19.0% of the variation in population growth. The positive coefficient implies that an increase in net migration leads to an

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increase in population growth. This supports the view that migration contributes directly to population dynamics by altering population size (Todaro & Smith, 2020). Similarly, the Model 2 introduced death rate alongside net migration:

$$Population\ Growth(PG) = \beta_0 + \beta_1 Net\ Migration + \beta_2 Death\ Rate + \varepsilon$$

Substituting the coefficients:

$$Population\ Growth = 2.551 + 6.559 \times 10^{-7} Net\ Migration + 0.005 Death\ Rate$$

The model showed a slight increase in explanatory power (R^2 = .196, ΔR^2 = .006), but this increment was not statistically significant (p > .05). While net migration remained significant (p < .01), death rate was not a significant predictor (p > .05), suggesting that mortality does not independently explain population growth when migration is controlled for. This implies that the effect of mortality may be conditional on other demographic factors (United Nations, 2022).

Additionally, Model 3 incorporated fertility rate, giving the full model:

$$Population\ Growth = \beta_0 + \beta_1 Net\ Migration + \beta_2 Death\ Rate + \beta_3 Fertility\ Rate + \varepsilon$$

Substituting the coefficients:

$$PGrowth = 0.403 + 6.577 \times 10^{-7} Net\ Migration - 0.097 Death\ Rate + 0.627 Fertility$$

This model showed a substantial improvement in explanatory power (R^2 = .761, ΔR^2 = .565, p < .001), indicating that 76.1% of the variation in population growth is explained by the combined predictors. Fertility rate emerged as the strongest and most significant positive predictor (p < .001), while death rate became a significant negative predictor (p < .001), and net migration remained positively significant. This result is consistent with demographic transition theory, which identifies fertility as the primary driver of population growth in developing economies, with mortality exerting an inverse effect (Bongaarts and Hogson, 2020; United Nations, 2022).

CONCLUSION

The demographic landscape of Nigeria has undergone substantial changes over the years. According to the National Population Commission (NPC) report (2019), the country's population reached an estimated 200 million, making it the seventh most populous country globally. Such rapid population growth presents both opportunities and challenges, impacting resource allocation, infrastructure development, and overall societal well-being. Understanding the factors that contribute to population growth is essential for effective policymaking and sustainable development. The hierarchical structure of the models demonstrates that although net migration has a consistent positive influence on population growth, the inclusion of fertility rate significantly enhances the model, highlighting its dominant role. The negative effect of death rate in the final model further confirms that reductions in mortality contribute to population expansion when fertility levels remain high.

RECOMMENDATIONS

Family planning initiatives should be expanded and special priority attached. Educational campaigns and mobilization should be targeted toward the rural and northern areas where the birth rate is very high (Average of six children per woman), free contraceptives should be distributed to highly prone areas to mitigate the effect fertility plays in Nigeria's population expansion.

Lowering Fertility: Bangladesh model which involved introduction of reproductive health into curriculum of primary school should be emulated.

Exploit Mortality Gains: Investments in healthcare should be sustained while simultaneously limiting excessive growth in fertility.

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Control Impact of Migration: Agreements on labour export should be made with Gulf nations and member states of Economic Community of West African Countries and at the same time plan for reintegration of returnee.

Leverage Demographic Dividend: Fertility and Mortality savings should be invested on training of youths in vocational and technical skills for greater economic output.

Data-Driven Monitoring: To evaluate the performance of policies and programs, regular surveys should be put in place to monitor hierarchical model predictors.

By taking these evidence-based actions, Nigeria may move toward Stage 3 of the demographic transition, stabilizing growth at 250–270 million while reaping the economic rewards of a balanced age distribution.

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