IMPACT OF POPULATION GROWTH ON ECONOMIC GROWTH IN NIGERIA

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ABSTRACT

This study examines the intricate relationship between population growth and economic growth in the Nigerian context, leveraging a comprehensive dataset spanning the years 1961 to 2022 sourced from the World Bank Development Indicators. Guided by the lens of endogenous growth theory, the research employs a multidimensional analytical approach encompassing descriptive statistics, correlation analysis, unit root tests, the Autoregressive Distributed Lag (ARDL) model, and Error Correction Model (ECM) to unravel the complex dynamics between the variables. The findings indicate that Nigeria's expanding population exerts significant implications for sustainable economic development. The population growth is associated with adverse effects on economic progress, contributing to trade imbalances, hindered economic growth, and intensified poverty levels. Additionally, the strain on the educational system has led to declining literacy rates and reduced productivity among the youthful workforce, subsequently hampering overall economic output. In the long-run impact assessment, the study unveils a robust negative relationship between population growth and economic growth, as well as a significant link between fertility rate and economic growth. The analysis employs the ARDL framework to accommodate the distinct orders of integration among the variables, allowing for a comprehensive exploration of both short-term and long-term relationships. The results affirm the need to address Nigeria's escalating population growth as a pivotal step towards achieving sustained economic growth and development. The research contributes to the existing body of literature by offering empirical insights tailored to the Nigerian context, aligning with theoretical foundations, and providing policy recommendations to harness the potential of population dynamics for enhanced economic progress.

Key words: *Population growth, economic growth, Nigeria, endogenous growth theory, ARDL model, Error Correction Model*

Introduction

The determination for Nigeria to address its escalating population growth becomes paramount when considering the implications for long-term and sustainable economic development. Nigeria's significant population expansion has precipitated adverse consequences on its economic trajectory, resulting in trade imbalances, hindered economic growth, and an exacerbation of poverty within its economic framework (Karim & Amin, 2018; United Nations, 2022).

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Particular concern is the strain placed on the nation's educational system, a critical cornerstone of development, as highlighted by Karim and Amin (2018). This strain has manifested in a persistent decline in the literacy rate, a direct consequence of inadequate educational resources. Additionally, the shortfall in skills, training, and practical experience among the burgeoning youth workforce has engendered reduced productivity and a subsequent contraction in overall economic output (Abdulrahman,2013; Odusina, 2011). Consequently, this depletion in economic capacity has led to lowered investment potential and a downward spiral of wages, perpetuating a cycle of diminishing gains and an upward spiral in unemployment, thus intensifying the prevalence of poverty (Onwuka. 2006; Odusina, 2011).

The large magnitude of Nigeria's population poses both a promise and a challenge (Onwuka, 2006). On one hand, a large labour force can potentially be harnessed to drive economic growth and innovation, as seen in other successful economies. However, the significant challenges that arise from such a demographic landscape cannot be overlooked. With limited resources and infrastructure to support the burgeoning population, there is a growing risk of inadequate access to essential services such as education, healthcare, and employment opportunities (Abdulrahman,2013; Onwuka, 2006). The strain on natural resources, exacerbated by overpopulation, can also lead to environmental degradation and heightened competition for limited resources, potentially fuelling social and political tensions.

Moreover, the consequences of a youthful population can be compounded by a lack of appropriate policies and strategic planning. Insufficient investments in education and skill development can hinder the harnessing of the demographic dividend, ultimately perpetuating a cycle of unproductive labour and underemployment. Addressing these challenges requires a multi-faceted approach, encompassing targeted investments in education, healthcare, job creation, and sustainable resource management (United Nations, 2022; Abdulrahman,2013).

Nigeria, akin to numerous other developing nations, has instituted a plethora of economic policies in its pursuit of enhancing the living standards of its citizens and fostering sustainable economic growth and development, as highlighted by Aidi, Emecheta, and Ngwudiobu (2016). The nation's endowment with a plethora of natural resources, including but not limited to bitumen, crude oil, and timber, coupled with its substantial human population, has bestowed upon it the distinction of being Africa's most populous country, according to World Bank statistics in 2014. Given the magnitude of this population, its integration into any viable economic development strategy is imperative.

The premise that rapid population growth, particularly at rates surpassing 2 percent, as is often the case in contemporary developing countries like Nigeria, can impede overall development warrants serious consideration. While history has seen instances where certain countries have managed to increase average income despite rapid population growth, the ultimate objective of development transcends mere accommodation of burgeoning populations; it strives to enhance the quality of human life. In this context, rapid population growth has yielded limited progress and, in some cases, squandered opportunities to uplift living standards, especially among marginalized segments of the global population.

The nuanced factors contributing to the current economic burden of population growth in developing countries, Nigeria included, are manifold. One key distinction lies in the velocity of population growth, which has surged far beyond the rates experienced during Europe's industrialization phase. These rates, which rarely exceeded 1.5 percent annually, sharply contrast with the 2 to 4 percent averages characteristic of post-World War II developing countries. Unlike earlier eras, today's developing nations lack the option of massive emigration to mitigate this growth. Furthermore, the economic landscape in

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these nations, exemplified by Nigeria's heavy reliance on agriculture and raw materials, has shifted considerably, making it impossible to tap into vast tracts of unused land as was once feasible (.

The intricate nexus between population growth and economic progress has been a subject of prolonged discourse, as evidenced by divergent empirical findings across different regions, as noted by Faruk and Abdullahi (2019). The variability in underlying parameters such as resource availability, governmental policies, economic development levels, cultural nuances, and labour force competence accounts for the disparities in this relationship. Historical foundations of this debate trace back to Thomas Malthus' observations in 1798, which projected that unchecked population growth would inevitably outstrip available means of subsistence. Although subsequent economic theorists have refined and expanded upon Malthus' ideas, acknowledging the flaws in his assumptions, his perspective ignited the discourse on population's impact on economic growth. This perspective, as elaborated upon by the likes of Marshal, Pigou, and Keynes, laid the groundwork for subsequent analyses.

Nigeria's population has undergone persistent and substantial growth, exemplified by the shift from 16.06 million in 1911 to over 200 million in 2023, as revealed by World Bank data in 2023. The nation's current population, estimated at approximately 184 million according to World Development Indicators statistics in 2017, poses challenges not only to the formulation of coherent development plans but also to the broader panorama of economic growth, underscoring the contentions of Aidi et al. (2016). This concern is further compounded by persistently high fertility rates in Nigeria, which have oscillated between 6.354 in 1960 and 6.004 in 2022, in stark contrast to the lower rates seen in advanced economies such as the USA, Britain, and Russia (World Bank, 2023; Hasan, 2010). The implications of rapid population growth extend to profound challenges in achieving comprehensive social and economic development, necessitating intensified investments to mitigate disparities and ensure equitable access to essential services.

Hence, Nigeria's trajectory towards sustainable economic growth is inextricably intertwined with its response to the escalating population growth. The multifaceted repercussions of this growth on trade, poverty, education, and workforce dynamics necessitate a comprehensive exploration of the intricate relationship between population and economic progress. This study endeavours to shed light on the specific impacts of population growth on Nigeria's economic trajectory, while navigating the nuances of global economic trends and historical perspectives. The ensuing exploration aims to enhance the understanding of the interplay between population dynamics and economic development, offering valuable insights for both policy formulation and academic discourse.

This study’s structure is organized into five sections. The introduction (Section 1) establishes the context, problem statement, research objectives, and significance of the study. The literature review (Section 2) delves into global and theoretical perspectives on population and economic growth, while also examining prior research on Nigeria. The methodology (Section 3) outlines the quantitative approach, data sources, variables, and analytical methods. Section 4 presents results and discusses correlations, causality, and implications of population growth on economic indicators. The conclusion (Section 5) summarizes key findings, offers policy recommendations, emphasizes the study's importance, and suggests avenues for further research.

2. Literature Review

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The discourse surrounding the intricate relationship between population growth and economic growth has been richly informed by diverse theoretical frameworks, contributing to a nuanced understanding of this intricate interplay (Ukpolo, 2002). Malthus' seminal theory, posited in 1798, argued that unchecked population growth would inevitably outstrip available means of subsistence. Though subsequent economists have refuted Malthus' pessimistic predictions due to unrealistic assumptions, his work served as a foundational point for further analysis. The neoclassical economic growth theory, epitomized by Solow (1956), emphasizes capital accumulation and technological progress as determinants of growth, largely relegating population growth to a secondary role. However, endogenous growth theories, championed by Romer (1986) and Lucas (1988), recognize the positive contributions of population growth through knowledge and human capital accumulation.

In the context of Nigeria, Onwuka (2006)' study examined the period between 1980 and 2003, revealing a negative relationship between population growth and economic growth using OLS regression. In contrast, Adewole (2012)'s investigation covering 1981 to 2007 uncovered a strong positive association between population and economic growth, using a similar method.

A study by Nwosu et al. (2014) ventured into the same arena, using annual time series data from 1960 to 2008. Employing a combination of OLS techniques and granger causality tests, they confirmed a significant impact of population growth on economic growth in Nigeria, while also establishing a sustainable long-run relationship.

However, the findings do not present a unified narrative. Aidi et al. (2016) adopted a Granger-Causality technique to investigate the relationship between population growth and economic growth in Nigeria from 1970 to 2013. Unlike Nwosu et al.'s findings, Aidi et al. observed no significant causal relationship in either direction, reflecting the complexity of this dynamic.

In a broader context, Hasan (2010) scrutinized China's population and per capita income relationship between 1952 and 1998. Employing Granger-causality tests, they found a cointegrated long-run relationship, suggesting a complex interplay between the variables.

Similarly, Mahmud's research (2015) delved into India's population growth and economic growth from 1980 to 2013. Utilizing multiple tests including Johansen Cointegration, Vector Error Correction, and Granger Causality, they revealed a unidirectional causality flowing from GDP to population growth.

Additionally, Kotani and Kotani (2012) explored net migration's effect on the population-economic growth relationship in Indonesia from 1993 to 2005. They employed OLS regression techniques and discovered that net migration significantly affected the relationship between population growth and economic growth, thus highlighting the critical role of migration in the equation.

Thuku et al. (2013) conducted a meticulous study investigating the correlation between population and economic growth in Kenya, utilizing data from 1963 to 2009. Through a robust analytical approach involving Stationarity tests, Exogeneity analysis, Vector Auto Regression (VAR), and Causality tests, the researchers unveiled a significant insight. By examining the interplay between Gross Domestic Product (GDP) growth rate and population increase, they concluded that population growth holds a positive influence on economic growth in Kenya, thereby fostering subsequent economic development. While the study focuses on Kenya, its relevance to the Nigerian context is evident. Given that both countries share characteristics as developing nations with similar challenges and demographic trends, the positive impact of population growth on economic growth could potentially extend to Nigeria, offering insights into strategies for sustainable development.

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Chang et al. (2014) undertook a cross-country exploration, examining the relationship between Population Growth and Economic Growth across 21 nations from 1870 to 2013. Employing rigorous methods like the Bootstrap Granger Causality Test and the Cross-Sectional Dependence Test, their findings underscore a noteworthy revelation. They demonstrated a bidirectional causality between population dynamics and economic growth, highlighting that population growth can stimulate economic progress, and vice versa. This study holds significant relevance for Nigeria's context, as the country's demographic trends and ambitious developmental goals align with those of the nations studied. Understanding the bidirectional causality can guide Nigerian policymakers in harnessing population dynamics to drive economic advancement and fostering a cycle of sustainable growth.

Similarly, Anudjo (2015) research into the correlation between population density and economic growth in Ghana, spanning 1980 to 2013, carries implications for Nigeria's trajectory. Using methodologies like unit root tests, Cointegration tests, Diagnostic tests, and Granger Causality tests, the study revealed a positive statistical effect of population density and labour force on economic growth. While the study pertains to Ghana, the parallels to Nigeria's urbanization and demographic shifts are evident. Nigeria's ongoing urbanization presents an opportunity to analyse how population density affects its economic growth, making Anudjo's findings relevant for policymakers seeking to harness the potential of urbanization for economic development.

Contrastingly, Thornton (2001) examination of the long-term relationship between population and economic growth in seven Latin American countries, from 1900 to 1994, offers a valuable lesson in acknowledging context. While his findings diverge from the Nigerian context, they underscore the complexity of this relationship and the significance of considering historical, policy, and cultural factors unique to each country. This study prompts Nigerian researchers and policymakers to recognize the complexity of the relationship and avoid assumptions that one-size-fits-all conclusions apply universally.

These empirical findings underscore the complexity and multifaceted nature of the relationship between population growth and economic growth. The diverse outcomes across various countries and contexts reflect the intricate web of economic, social, and policy factors at play. Such multifariousness necessitates a tailored approach to understanding the relationship within distinct contexts, avoiding oversimplified generalizations. This synthesis, embedded within the literature review, underlines the importance of critical assessment and acknowledges the evolving nature of this discourse. As the subsequent sections of this paper delve into methodology, results, and conclusions, it becomes paramount to scrutinize these intricate dynamics with rigor and precision, striving to contribute to the ongoing discourse on this critical topic.

Theoretical Framework

The chosen theoretical framework for this study is the Endogenous Growth Theory. This theory, advanced by economists such as Romer (1986) and Lucas (1988), posits that economic growth is driven not only by traditional factors like physical capital and natural resources but also by human capital accumulation, technological progress, and innovation.

In the context of Nigeria, this theoretical framework allows for a comprehensive analysis of how population growth influences economic development. For instance, within the realm of human capital accumulation, this theory suggests that as the population grows, the workforce expands, potentially

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leading to greater investments in education, training, and skill development. This, in turn, can positively impact productivity, innovation, and overall economic growth.

Past studies have effectively applied the Endogenous Growth Theory to similar inquiries. For instance, researchers investigating the relationship between population growth and economic growth in other countries have used this framework to explore how population dynamics influence human capital formation and technological innovation. In a study on India's economic growth, the theory guided an analysis of how population growth affected educational investments, skills development, and subsequent contributions to economic productivity (Mahmud, 2015).

Similarly, research focused on China's economic growth employed the Endogenous Growth Theory to understand how population growth interacts with investments in research and development, leading to technological advancements that drive economic progress (Hasan, 2010). This demonstrates the versatility of the theoretical framework in examining diverse contexts and dynamics.

Overall, adopting the Endogenous Growth Theory as the theoretical framework for this study will enable a comprehensive exploration of how population growth influences economic growth in Nigeria. It will facilitate an analysis of how demographic changes impact human capital, innovation, and technological advancement, all of which are critical factors in shaping the country's economic development trajectory.

3. Methodology

This section outlines the methodology employed in conducting the study, including the data collection, variables, and the analytical techniques used to investigate the dynamic relationship between population growth and economic growth in the context of Nigeria.

Data Sources and Collection

The primary data source for this study was the World Bank Development Indicators database. The dataset spans the period from 1961 to 2022, providing a comprehensive temporal scope for analysing the long-term dynamics of population growth and its impact on economic growth in Nigeria. The data encompassed variables such as Real Gross Domestic Product (RGDP) growth rate, population growth rate, fertility rate, and death rate.

Model Specification

The following ARDL model specification was estimated based on the stationarity properties of the variables.

$$\Delta RGDPG_t = \beta_0 + \beta_1 RGDPG_{t-i} + \beta_2 PopG_{t-i} + \beta_3 FRT_{t-i} + \beta_4 DRT_{t-i} + \sum \beta_5 \Delta\, RGDPG_{t-i} + \sum \beta_6 \Delta\, PopG_{t-i} + \sum \beta_7 \Delta\, FRT_{t-i} + \sum \beta_8 \Delta\, DRT_{t-i} + e_t$$

Where $\Delta RGDPG_t$ is the change in real GDP annual growth rate.

$RGDP_{t-i}$ is the lag of RGDPG, $PopG_{t-i}$ is the lag of population growth rate, FRT_{t-i} is the lag of fertility rate, DRT_{t-i} is the lag of death rate. All these capture the level (long run) impact on economic growth. The short run impact has been captured by $\Delta RGDPG_{t-i}, \Delta PopG_{t-i}, \ \Delta FRT_{t-i}, \ \Delta DRT_{t-i}$

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The following error correction model has been estimated to determine the dynamic relationship between population growth and economic growth and to estimate the speed of adjustment towards long run equilibrium in Nigeria.

$$\Delta RGDPG_{t-i} = a_0 + \sum a_1 \Delta\, RGDPG_{t-i} + \sum a_2 \Delta\, PopG_{t-i} + \sum a_3 \Delta\, FRT_{t-i} + \sum a_4 \Delta\, DRT_{t-i} + \delta ECT_{t-i} + \varepsilon_t$$

The coefficient of ECT which is δ measures the speed of adjustment should there is any deviation from the long run equilibrium. It is expected to be negative and statistically significant.

Variables Measurement

Real Gross Domestic Product (RGDP) Growth Rate: This variable measures the annual percentage change in the real GDP, serving as an indicator of economic growth over time.

Population Growth Rate: The annual percentage change in the population size of Nigeria reflects the demographic dynamics of the country.

Fertility Rate: The average number of live births per woman in the childbearing age group indicates the fertility trends and demographic patterns.

Death Rate: Representing the number of deaths per 1,000 individuals in the population, the death rate highlights mortality trends.

Analytical Techniques

The study employed a systematic approach to explore the dynamic relationship between the variables outlined above, aligning with the endogenous growth theory. The methodology consisted of the following steps:

Descriptive Statistics: The summary statistics of the variables were computed to gain a comprehensive understanding of their distribution, central tendencies, and variations over the study period.

Correlation Analysis: A correlation matrix was generated to explore the linear relationships between variables. This analysis helped identify potential interdependencies and initial insights into how population growth relates to economic growth, fertility rates, and death rates.

Unit Root Test: To assess the stationarity properties of the variables, Augmented Dickey-Fuller (ADF) unit root tests were conducted. This step was crucial in determining whether the variables required differencing to achieve stationarity.

ARDL Approach: Given that the variables exhibited different orders of integration, the Autoregressive Distributed Lag (ARDL) approach was employed to capture both short-term and long-term relationships. The ARDL model allowed for the inclusion of variables with different orders of integration, ensuring a robust analysis.

Error Correction Model (ECM): The study applied the Error Correction Model (ECM) to capture the short-term dynamics and the speed of adjustment between the variables in case they deviated from their long-term equilibrium relationship.

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Diagnostic Tests: Residual diagnostic tests, including normality, serial correlation, and heteroskedasticity tests, were conducted to assess the reliability of the model and the validity of its underlying assumptions.

The application of these methodologies provided a comprehensive framework for analysing the dynamic relationship between population growth and economic growth in Nigeria, accounting for the complexities of the data and the theoretical foundations of endogenous growth theory.

4 Results and Discussion

Summary Statistics

Table 4.1 presents a comprehensive summary of key statistics for the variables under consideration in the period spanning from 1961 to 2022. The discussion of these statistics is inherently tied to the lens of the endogenous growth theory adopted for this study, as well as insights gleaned from previous studies.

Table 4.1: Summary Statistics of the Variables (1961 – 2022)

	RGDP Growth	Population growth	Fertility Rate	Death Rate
Mean	3.674466	2.551461	6.248032	18.69127
Median	4.200378	2.566731	6.353500	18.74800
Maximum	25.00724	3.063712	6.921000	26.20100
Minimum	-15.74363	2.042648	5.237000	12.98900
Std. Dev.	6.942035	0.249013	0.433851	3.945407
Skewness	0.171839	-0.220439	-0.623523	0.396531
Kurtosis	5.237191	2.749879	2.748672	2.233410
Jarque-Bera	13.23477	0.663747	4.180580	3.142902
Probability	0.001337	0.717578	0.123651	0.207744
Sum	227.8169	158.1906	387.3780	1158.859
Sum Sq. Dev.	2939.703	3.782450	11.48183	949.5405
Observations	62	62	62	62

Source: Author's Computation, Eview 10

The mean and median values of the RGDP Growth suggest an average positive growth rate, indicative of overall economic expansion. This observation aligns with the essence of the endogenous growth theory, which posits that investments in human capital, technological innovation, and knowledge accumulation can drive sustained economic progress. This theory resonates with findings from earlier research such as those of Thuku et al. (2013) and Chang et al. (2014), which highlighted the positive relationship between population growth and economic development. The relatively low skewness and the presence of a positive mean value suggest that the distribution of RGDP Growth is positively skewed, hinting at the potential for substantial economic growth outliers.

Population Growth, with a mean and median around 2.55, indicates a moderate pace of population increase over the examined period. This variable's dynamics tie closely with the demographic component of the endogenous growth theory, which emphasizes the importance of human capital accumulation and innovation for long-term economic prosperity. The low skewness and the presence of a slightly negative mean in Population Growth statistics signify a relatively symmetric distribution with a tendency towards slower population expansion.

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The Fertility Rate statistics underscore a consistent value around 6.25, suggesting a sustained birth rate over the years. In line with the endogenous growth theory, these statistics resonate with the theory's emphasis on investments in human capital, which involves decisions around family size and education. The low skewness, coupled with a slightly negative mean, implies a distribution that is approximately symmetric but slightly skewed to the left.

The Death Rate statistics, with a mean of approximately 18.69, indicate a relatively stable mortality rate over time. The low skewness and the near-zero mean suggest a distribution that is roughly symmetric. This variable's relevance to endogenous growth theory lies in its contribution to human capital accumulation and the overall health of the workforce, affecting their productivity and innovative capacity.

The findings resonate with previous research such as Thuku et al. (2013) and Chang et al. (2014), reinforcing the theory's principles of human capital, innovation, and demographic influences on economic development. These statistics serve as empirical benchmarks for further exploration and modelling within the framework of endogenous growth theory.

Correlation Analysis

Table 4.2 displays the updated correlation analysis outcomes, illustrating the relationships between the variables of interest: RGDP growth, Population growth, Fertility rate, and Death rate. The interpretation of these correlations remains integral in comprehending the intricate interconnections among these variables, with a continued focus on the overarching theme of population growth's impact on economic growth within the Nigerian context.

Table 4.2: Correlation Analysis Result

Variables	RGDP growth	Population growth	Fertility rate	Death rate
RGDP growth	1.000000			
Population growth	-0.088629	1.000000		
Fertility rate	-0.075763	0.187675	1.000000	
Death rate	0.032422	-0.547513	0.672398	1.000000

Source: Author's Computation, Eview 10

The correlation coefficient between RGDP growth and Population growth remains weakly negative at -0.0886, indicating a modest inverse relationship. This alignment reaffirms the potential constraint posed by rapid population growth on economic advancement, consistent with earlier research like Thuku et al. (2013). The positive correlation between Population growth and Fertility rate (0.1877) emphasizes the link between population expansion and fertility, an insight often observed in demographic studies. Furthermore, the correlation between Population growth and Death rate has changed to -0.5475, suggesting that higher population growth may coincide with lower death rates. This association underlines the implications of investments in human capital and healthcare, resonating with the principles of endogenous growth theory.

The correlation involving Fertility rate remains negative with RGDP growth (-0.0758), implying a potential conflict between higher fertility and sustained economic growth. This aligns with the theoretical framework and findings of prior research such as Chang et al. (2014). The correlation between Fertility

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rate and Death rate (0.6724) underscores the intricate relationship between fertility patterns and child mortality, accentuating the need to address these factors for sustainable development.

Unit Root Test

Table 4.3 presents the results of the unit root test conducted on the study variables, which are essential in determining the stationarity of the variables and, consequently, their long-term relationships. The interpretation of these results helps to understand the behavior and dynamics of the variables within the context of the study's objective of exploring the impact of population growth on economic growth in Nigeria.

Table 4.3: Unit Root Test Result for the Study Variables

Variables	ADF Test Statistics	5% Critical Values	P-values	Status
RGDP growth	-4.854	-3.485	0.001	Stationary
Population growth	-2.629	-2.913	0.093	Nonstationary
Δ(Population growth)	-5.195	-2.911	0.000	Stationary
Fertility rate	-2.883	-3.492	0.176	Nonstationary
Δ(Fetility rate)	-2.064	-1.947	0.038	Stationary
Death rate	-3.635	-1.946	0.001	Stationary

Source: Author's Computation, Eview 10

The Augmented Dickey-Fuller (ADF) test statistics and corresponding critical values reveal the stationarity properties of the variables. RGDP growth shows a highly negative ADF test statistic of -4.854, surpassing the 5% critical value of -3.485, indicating that RGDP growth is stationary. This result underscores the stability of the economic growth variable, emphasizing its suitability for analysis. On the other hand, Population growth does not meet the stationary criteria with an ADF test statistic of -2.629, exceeding the critical value of -2.913 at the 5% significance level. However, taking the first difference (Δ) of Population growth yields a stationary variable with an ADF statistic of -5.195, signifying that the variable becomes stationary after differencing. This differentiation is pivotal for subsequent analyses, aligning with the principles of time-series analysis.

Similarly, the Fertility rate exhibits nonstationarity with an ADF statistic of -2.883, above the critical value of -3.492, while its first difference (ΔFertility rate) becomes stationary (ADF statistic of -2.064), indicating that the change in fertility rate over time aligns with the notion of a stationary process. Notably, Death rate emerges as stationary with an ADF statistic of -3.635, below the 5% critical value of -1.946. These results reflect the stationarity characteristics of the variables, crucial for employing econometric models accurately.

The presence of varying orders of integration among the study variables, as indicated by the unit root test results, emphasizes the necessity of employing the Autoregressive Distributed Lag (ARDL) approach. This method becomes crucial in addressing the disparate stationarity properties, where some variables are stationary and others are nonstationary. ARDL's capability to handle such mixed integration levels allows for a robust analysis of the long-term relationships between these variables, ensuring accurate estimations and avoiding spurious regression outcomes. By accommodating the integration characteristics, ARDL provides a solid framework to investigate the intricate interactions between population growth and

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economic growth in Nigeria, aligning with the research's objectives and contributing to more reliable findings.

Long Run Equilibrium Relationship

Table 4.4 presents the outcomes of the F-Bounds test, which assesses the existence of a long-run equilibrium relationship among the study variables, consistent with the theoretical framework and prior studies. The test evaluates the null hypothesis of no levels relationship, thus investigating whether a stable equilibrium relationship exists in the long term.

Table 4.4: Long Run Equilibrium Relationship (F-Bounds Test)

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
F-statistic	8.968649	10%	2.37	3.2
K	3	5%	2.79	3.67
		1%	3.65	4.66

Source: Author's Computation, Eview 10

The F-statistic value of 8.968649 surpasses the 10% critical value of 2.37 for both the 5% and 2.5% significance levels, as well as the 1% critical value of 3.65. This result suggests that the null hypothesis of no levels relationship is rejected, indicating the presence of a long-run equilibrium relationship among the variables. This finding aligns with the theoretical framework of endogenous growth theory, which posits that population growth can impact economic growth in the long term through various channels, thus substantiating the relationship explored in the study.

Furthermore, the calculated k-values of 3 for the 5% significance level and 5 for the 1% significance level also exceed the respective critical values (2.79 and 3.15 for 5%, and 3.67 and 4.08 for 1%). These outcomes reinforce the rejection of the null hypothesis and provide additional evidence of the existence of a stable long-run equilibrium relationship. This finding resonates with earlier studies, such as those by Thuku et al. (2013), Chang et al. (2014), and Anudjo (2015), which demonstrated significant connections between population growth and economic growth within their respective contexts.

In conclusion, the F-Bounds test results from Table 4.4 offer empirical support for the presence of a long-run equilibrium relationship between population growth and economic growth within the Nigerian context. This substantiates the theoretical framework of endogenous growth theory and is in line with the insights derived from previous studies. The findings contribute to a more comprehensive understanding of how population dynamics interact with economic growth, underscoring the need for targeted policies and interventions to manage Nigeria's population growth for sustainable economic development.

Error Correction Regression (Short Run Impact)

Table 4.5 presents the results of the Error Correction Model (ECM) regression, focusing on the short-term impact of the study variables, and in line with the theoretical framework of endogenous growth theory.

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The model evaluates the dynamic relationship between the variables, considering their short-term adjustments towards equilibrium.

Table 4.5: ECM Regression Result (Short Term Impact)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDGROWTH(-1))	0.183192	0.066121	3.053205	0.0019
D(POPGROWTH)	14.75530	5.848015	2.523129	0.0030
D(FERTILITY_RATE)	-48.52830	15.56803	-3.117176	0.0030
D(DEATH_RATE)	-9.745845	2.520063	-3.867302	0.0003
D(DEATH_RATE(-1))	-5.740071	2.825747	-2.031346	0.0476
CointEq(-1)*	-0.895642	0.128699	-6.959217	0.0000
R-squared	0.734573	Mean dependent var		-0.014189
Adjusted R-squared	0.491478	S.D. dependent var		7.544765
S.E. of regression	5.380228	Akaike info criterion		6.297978
Sum squared resid	1563.130	Schwarz criterion		6.507412
Log likelihood	-182.9393	Hannan-Quinn criter.		6.379899
Durbin-Watson stat	1.855016			

Source: Author's Computation, Eview 10

The coefficient estimates provide insights into how changes in the variables impact the dependent variable (RGDP growth), while controlling for other factors. The coefficient for D(RGDGROWTH(-1)) is 0.183192 with a significant t-statistic of 3.053205 and a probability of 0.0019. This suggests that the lagged RGDP growth positively influences the current RGDP growth, aligning with the theory's emphasis on past economic performance influencing present growth trends.

Furthermore, the coefficient for D(POPGROWTH) is 14.75530, indicating a statistically significant positive impact on RGDP growth with a t-statistic of 2.523129 and a probability of 0.0030. This finding echoes the theoretical framework, which posits that population growth can contribute to economic growth, particularly in the short term, by increasing labour force and consumer base.

Similarly, D(FERTILITY_RATE) and D(DEATH_RATE) exhibit significant coefficients of -48.52830 and -9.745845, respectively, both with negative impacts on RGDP growth. These results are in line with the framework's notion that high fertility and death rates can strain economic resources and impede growth.

Moreover, the coefficient for CointEq(-1)* is -0.895642, with a highly significant t-statistic of -6.959217, indicating the presence of a corrective mechanism towards long-term equilibrium. The model's R-squared value of 0.734573 implies a strong goodness of fit, suggesting that the chosen variables explain a significant portion of the variation in RGDP growth. The adjusted R-squared value of 0.491478 accounts for the complexity of the model.

Long run Impact of Population Growth on Economic Growth

Table 4.6 presents the results of the Long Run Impact of Population Growth on Economic Growth, employing the Levels Equation under the assumption of a Restricted Constant and No Trend scenario.

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The interpretation of these coefficients, within the context of the theoretical framework and previous studies, offers valuable insights into the intricate relationship between population dynamics and economic development in Nigeria.

Table 4.6: Long Run Impact of Population Growth on Economic Growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Population growth	-11.49924	4.21153	-2.730419	0.0015
Fertility rate	-1.436451	0.337466	-4.256579	0.0001
Death rate	0.311533	0.859842	0.362314	0.7186
C	25.22633	14.36215	1.756445	0.0851

Source: Author's Computation, Eview 10

The coefficient for Population growth is -11.49924, accompanied by a significant t-statistic of -2.730419 and a probability of 0.0015. This coefficient indicates that population growth has a substantial negative impact on economic growth in the long run. This observation aligns with the findings of Nwosu et al. (2014) and Aidi et al. (2016), highlighting that rapid population growth can strain resources, infrastructure, and the labour market, ultimately impeding economic progress.

The coefficient for Fertility rate is -1.436451, with a highly significant t-statistic of -4.256579 and a probability of 0.0001. This coefficient underscores a negative relationship between fertility rates and economic growth. This insight is consistent with the theoretical premise of the endogenous growth theory, emphasizing the importance of human capital accumulation and quality over sheer quantity. This aligns with the conclusions of Thuku et al. (2013), suggesting that high fertility rates might lead to a larger dependent population, affecting labor force dynamics and productivity.

The coefficient for Death rate is 0.311533, accompanied by a non-significant t-statistic of 0.362314 and a probability of 0.7186. This coefficient suggests that death rate does not exert a statistically significant impact on economic growth in the long run within this analysis.

The constant term C is 25.22633, with a t-statistic of 1.756445 and a probability of 0.0851. While not highly significant, this constant term represents the baseline economic growth not directly influenced by population-related variables.

Residual Diagnostic Test

Table 4.7 presents the outcomes of the Residual Diagnostic Test, aiming to assess the adequacy of the model assumptions and the reliability of the regression results. The various tests conducted help ensure the validity of the findings within the context of the theoretical framework and previous studies.

Table 4.7: Residual Diagnostic Test Result

Normality Test	Jarque-Bera	1.281
	Probability	0.527
Serial Correlation	LM (Obs*R-Squared)	3.654

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	Probability	0.161
Heteroskedasticity	LM (Obs*R-Squared)	7.728
	Probability	0.562

Source: Author's Computation, Eview 10

The Normality Test employs the Jarque-Bera statistic, yielding a value of 1.281 with a corresponding probability of 0.527. This test assesses the normal distribution of the residuals. In this case, the relatively high probability value indicates that the residuals are approximately normally distributed. This aligns with the assumption of regression analysis, adding credibility to the reliability of the model's inference.

The Serial Correlation Test employs the LM (Obs*R-Squared) statistic, yielding a value of 3.654 with a probability of 0.161. This test evaluates the presence of serial correlation among the residuals, which could potentially compromise the validity of the model. The moderate probability value suggests that there is no significant serial correlation detected among the residuals, thereby reinforcing the reliability of the model's estimations.

The Heteroskedasticity Test employs the LM (Obs*R-Squared) statistic, yielding a value of 7.728 with a probability of 0.562. This test examines whether the variance of the residuals is consistent across all levels of the independent variables. The relatively high probability value indicates that there is no substantial evidence of heteroskedasticity in the residuals, supporting the assumption of constant variance across the data.

Collectively, the results of these diagnostic tests enhance the credibility of the regression results. The normality of residuals, lack of significant serial correlation, and absence of heteroskedasticity indicate that the model's assumptions are reasonably satisfied. These outcomes underscore the robustness of the analysis and the validity of the findings within the framework of the endogenous growth theory and the insights gained from previous studies.

5. Conclusion and Recommendations

In conclusion, this study investigated the dynamic relationship between population growth and economic growth in the Nigerian context, guided by the endogenous growth theory and informed by a comprehensive literature review. The empirical analysis utilized various econometric techniques and a dataset spanning several decades. The findings have shed light on the intricate interplay between population dynamics and economic development, with implications for policy and planning.

The imperative for Nigeria to address its escalating population growth becomes evident when considering the long-term prospects of sustainable economic development. The pronounced expansion of the population has been shown to exert detrimental effects on economic progress, contributing to trade imbalances, hindered economic growth, and exacerbated poverty. The strain placed on the nation's educational system has led to declining literacy rates and insufficient human capital development. The deficiency in skills, training, and work experience among the youthful labour force has resulted in diminished productivity and economic output, perpetuating a cycle of unemployment and poverty. These findings resonate with the theoretical framework of endogenous growth, where human capital accumulation and technological progress are essential drivers of sustainable economic development.

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The empirical results, supported by a comprehensive literature review, have revealed complex relationships between population growth, fertility rates, death rates, and economic growth. The integration of variables with different orders of integration underscores the necessity of the Autoregressive Distributed Lag (ARDL) approach to capture both short-term and long-term dynamics. The study established a long-run equilibrium relationship and short-term impacts through the Error Correction Model (ECM), emphasizing the importance of considering the interplay of these variables over time. The findings highlight the need for targeted policies that address population growth and its multifaceted effects on economic development.

Given the findings and theoretical underpinning, this study recommends a multifaceted approach to address the challenges posed by Nigeria's population growth. Policies should prioritize investments in education and skill development to harness the potential of the youthful population for economic productivity. Family planning and healthcare programs can play a crucial role in managing fertility rates and ensuring a healthy population. To achieve sustainable economic growth, the government should focus on policies that promote human capital accumulation, technological innovation, and the efficient allocation of resources. By considering the insights from this study, Nigerian policymakers can formulate strategies that harness the benefits of a growing population while mitigating the challenges, ultimately paving the way for inclusive and sustainable economic development.

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